IMPROVEMENT OF AN E-LEARNING COURSE WITH QFD ANALYSIS

YOSHIDA Masami (Chiba University, Faculty of Education)

1-33 Yayoi Inage, Chiba 263-8522, Japan,

yoshida-m@faculty.chiba-u.jp

ABSTRACT

An investigational study was done through a blended PhD course; "Distance education and international co-operation in education" of Chiba University. Here, e-learning with LMS was used to provide lesson content, mentoring, discussion, assignment and learning activities using both Japanese and English to cover overall period of the course. And, the author introduced Quality Function Deployment (QFD) analysis to clarify proper measures for improvement of the course. QFD is a systematic process that helps us quickly understand and integrate our unintentional needs into the course. QFD enables to introduce integrated "tacit knowledge" into "procedural measures" by using decision making method, and also provides a transferable document that covers comprehension areas to related staff members. As result, one of extracted elements by QFD was to concern the installation of communication software that could not be perceived during data collection period. Difference between pre-perceived elements and QFD elements was 10% of weight in improvement actions.

1. INTRODUCTION

While a systems view of distance education (DE) is a good conceptual tool that helps us understanding and is essential to its successful practice (Moore & Kearsley,1996). Even when we do not use the term; systems approach (SA), our thinking is influenced by a systems perspective. A DE system consists of all the component processes that make up DE, including indispensable subsystems; management, faculty and technology (Yoshida, 2002). The systems view helps us not only recognize issues that separate DE from conventional F2F, but also distinguish good DE from bad. Lack of integration of the system, limited interaction among sections frequently induced fatal stagnation of effects ofDE. It must have a transducer that can exchange opinions of a section practitioner to be recognized by all other section members and should have a chance to discuss near future improvement of DE system among staff members of different expertise. Quality Function Deployment; QFD is a comprehensive group decision technique that enables experiences of practitioners into a transferable deployment. Thus, QFD forces to reveal hidden tacit knowledge to the style of explicit knowledge with putting a scale and priority in it (Figure 1).
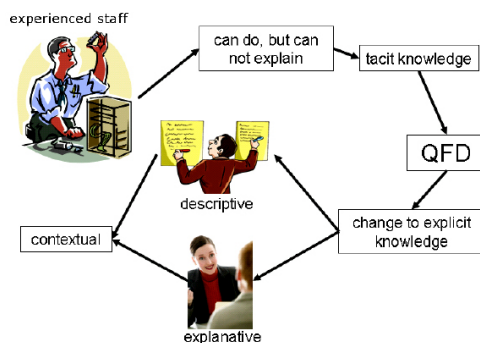

Figure 1: Tacit Knowledge to Explicit Knowledge

2. QFD

QFD was initially developed in Japan in the late 1960s for manufacturing and service sectors, and then it was rapidly spreading to the variety of US sectors in the 1980s. Later, many industries and service sectors in the world used QFD to know appropriate technical requirements for each stage of the system. The results of QFD, called House of Quality (HOQ), yield transparent and visible matrices that can be used for a system improvement. Recently, QFD evolved from a number of different initiatives, but still original purpose was involved (Hill, 1994),

1) To improve the "quality of design"
2) To provide staff deployment before the this

initial production run Academic organization is a special one that has evidence of QFD application to conduct quality education and research (Chan & Wu, 2002). QFD had

been made slow distribution during 1980s in educational institutions, and many studies are appeared from late 1990. Although there were few chances for educational institutions to conduct a systematical educational project that went beyond pedagogical designing in a classroom, ICT innovation introduced new mode of learning. SA into education and QFD was immediately used powerful potential into quality improvement of DE project in terms of course design, training design and service (Murgatroyd, 1993). This movement convinces us if we look at matured total quality control (TQC) and practical use of QFD in content improvement of me dia production houses and ETV stations. On the other hand, recent QFD software tool enhance to process integrating know-how and to focus on the essentials proactively.

3. PERCEIVED CUSTOMER

QFD was initially designed to attain higher levels of customer delight. This customer integrated decision making (CIDM) was already reconsidered for the educational project. Kushner et al. (1994) clarifies customers of educational institutions by internal and external functions.

In a school setting, customers could include students, faculty, staff, volunteer, parents, the community, business and industry, government, and various levels of post-secondary education and training.

Clearly, only opinions of students are not compatible to CIMD in educational system. Murgatroyd (1993) also showed nine components of DE process to be basics of an excellent course, those were includes view points of many DE functions in addition to students' opinions. Here, we need to consider SA as components of CIMD to illustrate the project. Then, in our experimental study, the author organized a team for QFD that could propose outcome quality in all subsystems of DE.

4. METHOD

The subject of this study is an e-learning lesson that occupies 2/3 in a blended education

of a PhD course. There are following three characteristics of our PhD courses.
1) Small sized class
2) Requiring integrated and authentic activities of students outside the country
3) Provision of novel information
1) is the same situation across the world, and 2) and 3) are the special condition of difference in Ph.D. courses among the world.
Then, QFD was vest suite for improvement of this up-grading course.

4.1 E-LEARNING LESSON.

Course title : "Distance education and interna tional cooperation in educa tion" of graduate school of social science and humanities, Chiba University
LMS : Chula e-learning system, English menu version (course contents, streaming audio/video, self-check examination, message board, chat function equipped)
Content : Instructional content was described in Japanese and English.
Fieldwork assignments in e-learning: open questions; investigation of foreign DE project, develop Gantt and Part charts of the DE project, Cost calculation of the DE project, describe a cartogram and a conceptual group
Learning period: from October 2006 to February 2007

4.2 A STUDY TEAM

A study team was organized by three PhD course students and a professor in charge. All the members were involved in the target e-learning course, and here, the team could cover versatile areas of specialties; Distance Education, Educational Technology, Psychology, Science & Technology, and Public Communication. The team gathered empirical cases for improving e-learning execution as well as learned about subject area of the course. It was similar concept in the triangulation technique of the action research, by joint work of different experts, confirmed

validity of each item. Students: One Japanese and two Asian students (One needs to learn in Japanese and another needs to learn in English.)

4.3 PERCEIVED PROBLEMS

The perceived problems by the team before QFD analysis are as follows.

1) Communication difficulties among students of different language speakers
2) Difficulties to expand interests and lead spontaneous applied activities of students

4.4 STUDENT ACCESSES

Access distribution
All the students had own computers with broadband connection in their home, and also they had chances to
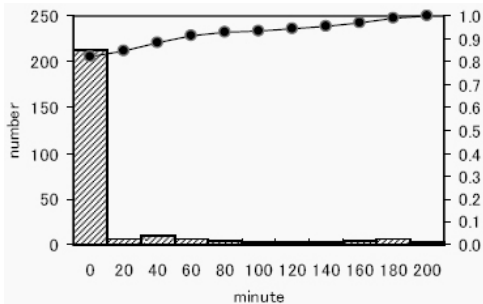

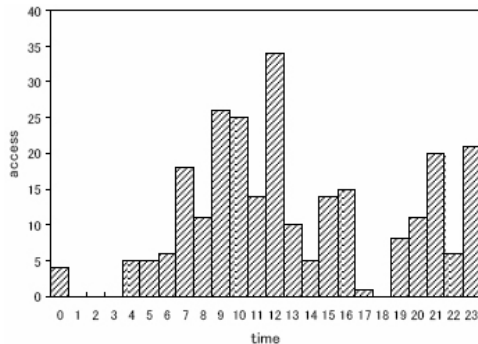Figure 3 : Frequency Distribution and Cumulative Frequency Graph of Students' Accesses

Figure 2: Access Time

use computer service inside the campus without any difficulties. Figure 3 is a frequency distribution and cumulative frequency graph of students' accesses. Finally, 260 accesses were automatically recorded in the LMS. 82% of total accesses were short learning time, within 20 minutes, and they saved information, or moved to

recommending links and processed their activities. Surprisingly, 17% of accesses were within 5 minutes, but they said it was enough time to get information under broadband connection. Access time There were two peaks of access time in day and night except midnight and evening (Figure 2). Day time was more preferred by them. Maximum accesses were seen in lunch time.

4.5 ANALYSIS

In this study, QFD software; Visio QFD Tool v1.2 developed by xknowledge was used to analyze data (xKnowledge, 2007).

4.6 PROCEDURE

Gathered cases were discussed in F2F session where the team chose cases that could transform to output qualities for improving e-learning. Analysis procedure was as follows,

1) Describing output quality items that define required target quality from considerations of confirmed cases
2) Using KJ (Kawakita Jiro)-method and making groups of output quality items in three hierarchical levels
3) Using paired-comparison method among output quality items and relative rating (1-9) between items
4) Conducting an analytic hierarchy process (AHP) sheet
5) Quality planning by putting number in target quality with benchmark scaling (1-5)
6) Listing up connotation elements of each output quality item
7) Using KJ-method and making groups of connotation element items in three hierarchical levels 8) Valuing and rating (1-4) cells of matrix in HOQ

Table 1 shows the arranged output quality items in three hierarchical levels. Following analysis to AHP was processed based on second level, and also second level of connotation elements were used (Table 2) in the continuing analysis to HOQ. AHP was developed by Satty, T.L. (1980), and provides to deal with complex decision making by a mathematical mechanism for checking the consistency of evaluation measures and minimizing common pitfalls of decision

Table 1: Grouped Output Quality

FIRST LABEL	SECOND LABEL	THIRD LABEL (ORIGINAL)
learners' competencies	communication skills	student can search relating expert
		a student can do professional interview in the field study
		students can communicate one another through cyber space
	creativity	assignment products include more creativity than an example
		a student can expand interest to the world
		students can make linkage with their own dissertation
	attitudes	students are punctual for F2F session
		students can keep time limit of assignments
		students can finish reading before F2F
		a student accomplish field study to the sufficient level
		students can conduct steady access to e-learning
		students spend enough time to read through content
		students do not send duplicate e-mail
		proper course selection by students
		students can follow the directions of an assignment
computer literacy	functional e-mail	a teacher can forward personal mail reply to all students
		easy to modify a name list of mailing list
		easy to sort e-mails into lots
		prepared measures against no reply to e-mail
	computer skills	students have enough graphics skills to conduct assignments
		students can select proper tools for documentation
online administration	monitoring function	teacher can monitor the progress of field work of students
		teacher can confirm that all students mastered prerequisite of the course
		students' product show what they did for
		teacher can monitor students' activities in cyberspace
		a teacher know existence of students in e-learning
	online service	easy to introduce a student's product into e-learning
		fast uploading files
		system has a link to external learning tools
		easy to develop multi languages pages
		student can manage ID and PASS
		there are links to teach how to use application software
		easy to replace proposed assignment to new one

Table 2: Grouped Connotation Elements

FIRST LEVEL	SECOND LEVEL	THIRD LEVEL
skills	Getting Things Done	self control
		responsibility
		time securing
		scheduling
		motivation
		sincerity
		involvement
	academism	subject area knowledge
		creative power
		interdisciplinary approach
		flexibility
	sociability	story telling
		collaboration skill
		intercultural mind
	LifeHack	IT knowledge
		searcher skill
		graphics technique
		documentation technique
strategies of design	field work	open question
		portfolio
		mentoring
technical specification	software	sophistication of mailer soft
		functional mailing list
		instant messaging
	LMS function	RSS
		asp
		mobility
		up-dating Web
		multi lingual
reliability of system	online management	technical guide
		security knowledge
		personal data management
		data management

making process by the team for reducing bias. In the calculation of this study, geometric mean method was used for rating each paired outcome quality items. This was the process that transfers qualitative data into quantitative data. For calculations of absolute weight in HOQ, benchmark technique was used by comparison of the following projects.

Thailand TCU: It provides nationwide e-learning courses developed by leading universities organized by MOE, Thailand. (users; 31,064, teachers; 2,175, courses; 402, Oct. 2007)

Chula Online: It offers more than 300 courses which cover from secondary education level to continuing education managed by the dominant university in Thailand. They use same LMS system of this study.

Figure 4 is the HOQ that shows output qualities in rows and connotation elements in columns. As results, student attitudes toward learning in the course has highest weight for quality planning; 43%, and following monitoring function of online system improvement has 25%. For scaling target quality, "Thailand TCU" and "Chula Online" were selected for benchmarking, because these projects use LMS of same origin. Both project are well organized nationwide e-learning project with large size, and have developed services. However, content development is frequently based on outsourcing. Although our e-learning is small sized laboratory based project, assignments are designed as open questions, where students required their distributing self-initiated investigation during periods. Therefore, even low grade-up rate (1.5) in monitoring function of quality planning; but it was marked as higher weight. In the matrix, ◎, ○, and △ show rated as 4, 2, and 1 respectively. Connotation elements in columns could be categorized into three subcategories (shown in Table2). The most elements are also in "learning and instructional (*faculty*)" area, and

occupies 69% in weight. The second enhancement area could be seen in *technology* area, 24%. An element of *management* area contributes only 7%. Within extracted connotation elements, *fieldwork* which is closely related to open question assignments has the most multiple links to outcome qualities. However, in the quality planning of connotation elements, GTD is selected as highest weight; 25%. The second enhancement element is *fieldwork* and *software*, both 17%.

6. DISCUSSION

Blended education was accepted by students. The course gave a conceptualization chance to foreign students during F2F session and active field work during e-learning lesson. A professor could provide learning contents in Japanese and English without difficulties. And, students could learn about their selected foreign country by their preferable linguistic background. Nevertheless, communication among students was quite limited, and each student worked independently and did not have so much interest in information developed by other students. Therefore, the author introduces discussion between perceived problems (described in sec 4.4 above) and QFD results, in addition to appeared successful course work of students. About the first perceived problem, it must increase collaborative and communicative assignments and also provide assistance for multi-linguistic environment. In HOQ, the setting of fieldwork by a professor in the front, and also sociability of students in the back (28% in total) would enhance the quality of communication. The next, perspective view and profound recognition are crucial in PhD courses. Then, the second perceived

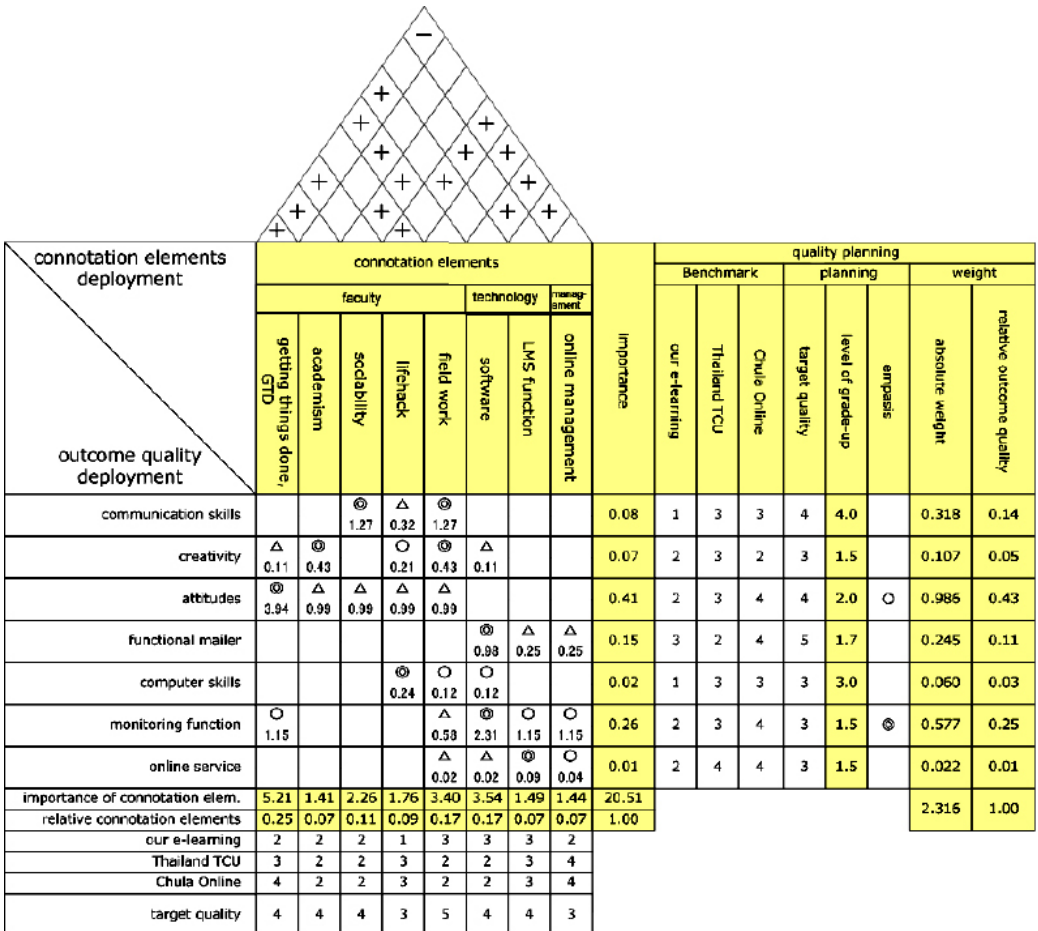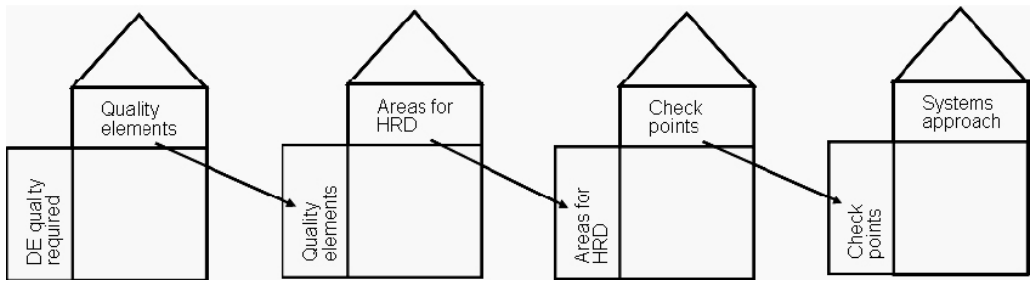| outcome quality deployment	GTD	academism	sociability	lifehack	field work	software	LMS function	online management	importance	our e-learning	Thailand TCU	Chula Online	target quality	level of grade-up	emphasis	absolute weight	relative outcome quality
communication skills			◎ 1.27	△ 0.32	◎ 1.27				0.08	1	3	3	4	4.0		0.318	0.14
creativity	△ 0.11	◎ 0.43		○ 0.21	◎ 0.43	△ 0.11			0.07	2	3	2	3	1.5		0.107	0.05
attitudes	◎ 3.94	△ 0.99	△ 0.99	△ 0.99	△ 0.99				0.41	2	3	4	4	2.0	○	0.985	0.43
functional mailer						◎ 0.98	△ 0.25	△ 0.25	0.15	3	2	4	5	1.7		0.245	0.11
computer skills				◎ 0.24	○ 0.12	○ 0.12			0.02	1	3	3	3	3.0		0.060	0.03
monitoring function	○ 1.15				△ 0.58	◎ 2.31	○ 1.15	○ 1.15	0.26	2	3	4	3	1.5	◎	0.577	0.25
online service					△ 0.02	△ 0.02	◎ 0.09	○ 0.04	0.01	2	4	4	3	1.5		0.022	0.01
importance of connotation elem.	5.21	1.41	2.26	1.76	3.40	3.54	1.49	1.44	20.51							2.316	1.00
relative connotation elements	0.25	0.07	0.11	0.09	0.17	0.17	0.07	0.07	1.00								
our e-learning	2	2	2	1	3	3	3	2									
Thailand TCU	3	2	2	3	2	2	3	4									
Chula Online	4	2	2	3	2	2	3	4									
target quality	4	4	4	3	5	4	4	3									

Figure 4: House of Quality

Figure 5: Four Phase Model for DE Project

problem is related with academism (7%) and GTD (25%). Both elements occupied 32% in total. As a result, perceived problems and those measures were concerned 60% of analyzed connotation elements. On the other side, GTD, field work, software and sociability were scored as higher priorities in QFD results (70%), and could conclude as immediate measures of improvement from this analysis. It was also clarified weight difference between before analysis and after analysis as 10% (software > academism). Thus, QFD could cover comprehension area of DE project, and reveal potential importance from different field. As a countermeasure, the author modified LMS to be able to connect communicative Wedget programs. If a DE project is managed by a large number of people, it is better to process continuous QFD analysis to show particular units within connotation elements to staff members. Now continuous phase analysis by QFD is general procedure (King, 1989), and the author also indicated an example of implementation phase of QFD for large DE project improvement (see Figure 5, cited from Yoshida, 2007).

7. ACKNOWLEDGEMENTS

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