The Study on the Efficacy of E-Learning Application in Industrial Technology of South Korea

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Abstract —**After four years of expansion efforts for industrial technology of South Korea using E-learning since 2005, the need to identify its application and ways to improvement has been surfaced recently. The purpose of this study is to examine how direct effects the e-learning contents has brought to industrial technology field and how such an effort has acted effectively on the industrial aspects. For this reason, the efficiency of the e-learning operation was focused on the application to actual tasks. General contentment, academic accomplishments, application level, and requirements about industrial technology e-learning program were examined. Several suggestions regarding the improvement of work application were also made. To proceed this study, survey analysis and FGI(Focus Group Interview) were used as primary means.**

Index Terms—**E-learning, FGI(Focus Group Interview), Transformation of training**

I. INTRODUCTION

A. Research background and purpose

After four years of expansion efforts for industrial technology using E-learning since 2005, the need to identify its application and ways to improvement has been surfaced recently. In 2007, there was an incidence where general examination including recipient contentment, academic accomplishment, applicability to actual work, and cost effects were tested for each field specific area. Although this research covered almost all the material, a more specific and detailed explanation regarding the effects of e-learning application was required.

The purpose of this study is to examine, closely and specifically, how direct effects the e-learning contents has brought to industrial technology field and how such an effort has acted effectively on the industrial aspects. For this reason, the efficiency of the e-learning operation was focused on the application to actual tasks. Also, it was proposed to understand the level of application in each industrial field, analyze great examples of such applications, and make a proper suggestion to enhance the application.

B. Major contents and Methods of the Research

Generally, in testing the effects and influence of e-learning program, Kirtkpatrick's 4-level standards system is applied.

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Kirtkpatrick's 4-level standards system consists of 1-level test in which the learners' reactions are assessed, 2-level test in which the learners' academic achievements are assessed, 3-level test in which the learners' behaviors are assessed, and 4-level test in which the learners' impacts on an entire organization are assessed[1].

In this study, the 3-level behavior test was performed in order to identify the learning application and used surveys and FGI. General contentment, academic accomplishments, application level, and requirements about industrial technology e-learning program were examined.

To proceed this study, survey analysis and FGI(Focus Group Interview) were used as primary means to collect data. The samples were composed of learner, bosses, and their colleagues. Qualitative technical statistic analysis and statistical analysis were used to grasp the degree of work application for each field. Using FGI, further analysis on the procedures of e-learning program and the actual application level was practiced.

II. THEORETICAL BACKGROUND

The change in the market scale of E-learning from 2005 to 2008 is as follows. Generally, domestic E-learning market has grown for the last 5 years and the demand of corporate E-learning market has constantly grown as well. The initial scale of corporate E-learning market was smaller than that of individual E-learning, but the two markets now has similar sizes.

TABLE 1. RESEARCH ON THE ACTUAL CONDITION OF E-LEARNING INDUSTRY IN SOUTH KOREA

Category (year)/	2005	2006	2007	2008
Corporation	668.169	752.286	759.603	812.052
Individual	671.509	697.227	735.108	816.765
Government/ Public Organization	94.418	137.574	163.366	167.207
Education Center	18.424	26.220	69.555	70.804
Total	1.452.520	1.613.307	1.727.632	1.866828

(Unit: one million won, Source: [2]-[5])

Assessment of Transformation of Training is to measure the transfer of training, in which the educated are examined if they can properly apply their knowledge, skills, and attitude under the actual conditions[6]. Transformation of Training is to measure and assess how the educated students are applying the received instruction to the actual working environment.

However, since current assessment of Transformation of Training is isolated from training programs and actual application, it is not easy to precisely measure it and the working processes are becoming more and more complex[7][8][9]. Thus, there is a need to collect enough databases regarding assessment procedures and approaching strategies.

According to the study of Cheng and Ho[10], Transformation of Training contains not only efficient learning but also the concept of transfer and they claimed that the studies about transfer training are the most important and influential ones. As a concept incorporated into Transformation of Training, trainability was suggested as a new word to represent the ability and motivation in training. Baldwin and Ford [11] stated that trainability has a functional relationship with ability, motivation and environmental favorability. Recent studies pointed out individual variables, attitudinal variables, and environmental variables as factors that affect the results of training transfer.

Cheng and Ho [10] categorized transfer-related factors discovered for the last 10 years into 9 variables and these 9 variables were classified into 3 different groups.

Transformation of Training discussed so far goes further than just measuring the effects of education. It analyzes detailed and accurate educational effects for each working environment and differentiates the tools according to degrees of correlation and time gap. Thus, when we try to develop a Transformation of Training model, it is necessary to identify various factors and their relationship to each other, as well as define the measurable effects before identifying them.

III. SURVEY RESULTS

A. Overview of survey

1) Methods and Procedures

In order to understand the degrees of E-learning in industrial technology fields, a survey was performed to 2,466 students who attended 34 classes of 6 professions in 2008. The survey was practiced from January 5th of 2009 to 28th. Retrieved surveys had 79 participants, indicating 3.2% of response rate. Students were 55 (69.6%) people and their colleagues were 24 (30.4%) people.

2) Participants

The specifics of students who participated in the survey are represented in <Table 2>.

TABLE 2. SURVEY OF PARTICIPANTS IN E-LEARNING TRAINING

Type of business	Operation	Course title	Number of Students (in 2008)
Robot	Korea Polytechnic University	Basic Embedded system, Sensor-based robot autonomics, Service robot sensor and Actuator interface, Multimedia system, etc. (8 courses)	295
Mobile Telecommunication	Korea Association of Material Industry	PCB course, RF course, Soc+Chip course, Display course, etc (6 courses)	155
Internet communications equipment	Korea Polytechnic University	IPv6 protocol technology and applications, Wireless sensor network setup and applied technologies, etc (5 courses)	318
Display equipment material	Korea Display Industry Association/Tech Ville committed operation	Introduction to display industry, PDP/OLED manufacture procedures, TFT-LCD manufacture overview, etc (5 courses)	1,000
Semiconductor Industry	Korea Polytechnic University	Pre semiconductor procedures, Post semiconductor procedures, Introduction to semiconductor industry, etc (5 courses)	441
Material industry	Korea Association of Material Industry	Copper procedures, Magnesium procedures, Powder procedures, etc (5 courses)	257
total			**2,466**

B. Respondent qualities

The category averages and standard deviation of 79 people who responded to this survey are represented in <Table 3>.

TABLE 3. THE ENTIRE DESCRIPTIVE STATISTICS

Category	N	Minimum value	Maximum value	Average	Standard deviation
Type of business	79	1	6	3.41	1.75
Gender	79	1	2	1.13	0.33
Age	79	20	50	28.85	7.89
Position	79	1	9	3.04	2.60
Education	79	1	4	3.19	0.72
E-learning experience	79	1	2	1.21	0.41
Tuition	79	1	2	1.56	0.50
Motivation	79	1	6	2.14	1.33

C. Results of survey by category

The technology statistics results for each category are represented in <Table 4>.

To a question that asked, 'Did you actually apply the obtained content in this course?', 31.6% of the respondents answered 'yes', 30.4% 'normal', and 24.1% 'no', indicating that it is not likely to apply the obtained content. However, 13.9% of 'strongly agree' shows that actual and specific application instances in working environments are not rare.

TABLE 5. ACTUAL APPLICATION OF LEARNING CONTENTS

Category	Frequency	Percentage	Cumulative percentage
No	19	24.1	24.1
Normal	25	31.6	55.7
Yes	24	30.4	86.1
Strongly agree	11	13.9	100.0
Total	79	100.0	

D. Interpretation of the Results and Implications

3) Interpretation of respondents' answers

With respect of age, 87.3% of the respondents were male, showing significant participation rate. The highest age group was 30s, followed by 20s and 40s. For position category, staff took up the largest proportion followed by deputy and chiefs. There was also a lot of participation from researchers due to the nature of the fields. Majority of the respondents had bachelor's degrees, and many had master's degree. Most of the respondents attended the courses voluntarily.

4) Interpretation of the Contentment

Most of the content categories including 'Clarity of the learning objectives(M=4.1, SD=0.7)', 'suitability of the learning content(M=4.0, SD=0.7)' appeared to be satisfied, while 'professionalism of learning content(M=3.4, SD=0.8)' seemed dissatisfied. Under system categories, 'stability of the system(M=3.9, SD=1.2)' showed the highest contentment, whereas 'encouragement and support for the system(M=3.3, SD=0.9)' showed the lowest contentment.

5) Interpretation of Transformation of Training

Content comprehension(M=3.7), achievement enhancement(M=3.7), and ability improvement(M=3.75) showed high level of Transformation of Training, whereas organization support(M=3.5), work application(M=3.45),

and propagation(M=3.55) showed relatively low level of Transformation of Training. These results prove that although E-learning lacks the ability to relate learning contents to the actual work application, it could be helpful in comprehending and maintaining and the content, improving personal ability and relating it to the entire organization's achievement.

IV. FGI RESULTS

A. FGI Overview

1) FGI Purpose

In order to study business specific examples through qualitative analysis of E-learning's Transformation of Training, we performed FGI(focus group interview). This FGI can complement the survey results by revealing the other factors that might have been overlooked in quantitative analysis, and help understand the level of work application and the real condition of each working environment.

2) FGI Prime questions

Selected questions for FGI test on industrial technology E-learning Transformation Training are represented in <Table 6>. Important interviews were composed of background of course taking, conditions of course, work application, expansion of industrial technology E-learning, and the other suggestions. As for the factors related to Transformation Training, questions were asked about content comprehension, work application, ability improvement, achievement improvement, propagation, organization support, and way to apply obtained learning contents.

TABLE 6. CONTENTS OF FGI

Category	Content	Explanation
Background	Background and motivation	Routes towards E-learning, Personal motivations, Organization policies
Conditions	E-learning conditions	The number of courses, time table, tuition, etc.
Transformation of training	Content comprehension	Comprehension and maintenance towards learning content
	Work application	Review about the content if it was helpful to the actual tasks or not
	Ability improvement	Instances where content was helpful for task performance
	Achievement improvement	Instnaces where content helped organization's achievements and their results
	Propagation	Propagation of the content, E-learning propagation
E-learning	Development and	Prerequisites for

expansion	expansion	expansion of E-learning
Other suggestions	Wishes towards universities and corporations	Unlimited suggestions for E-learning development

B. FGI Results Analysis and Implications

FGI Results analysis and implications of industrial technology E-learning are as follows.

1) Actual work application

□ General analysis

- The course was more of introductory contents rather than being professional and detailed.

- There were a lot of demands for specific examples addressing industrial trends and actual application to work.

- There was an opinion that claimed an up-to date trends due to the rapid change in industry.

□ Implications

- We learned that basic concepts and theories are also important just like specific instances of actual application methods.

- There needs to be various levels of courses, and actual application courses and basic introductory courses should be differentiated in order to develop and operate the courses according to the students' needs.

2) Ways to application to actual work

□ General analysis

- The contents should be complemented with recent trends and methods.

- Requirements in the working environment and instances are necessary.

- More specific course construct such as development of advanced course, intermediate course, or high level course.

- Papers, or pdf files that are immediately available at the working environments.

- Information or functions that can interact with members or perform actual networks.

□ Implications

- In order to improve the application to actual work, course material contains practical examples and trends and their active application onto the work. This indicates that there is urgent need to develop a content that reflects the requirements of the work place even if this could raise the development cost.

- More specified levels in the courses should be made so that learner can maximize the efficiency of the learning.

- Operating system should be combined into a unit, improving active exchange of information and knowledge in the field of industrial technology and extent of network

V. RESULTS OF E-LEARNING EFFECTS AND SUGGESTIONS

A. Results of E-learning effects

Based on the results of survey, following conclusions were made. It is inferred that primary beneficiaries of E-learning are the highly educated people who are in charge of important tasks. The purpose of taking E-learning is mainly to nourish their own techniques in the related fields rather than to apply the obtained information to the actual works.

And this result implies that the foremost goal of E-learning experience is to improve personal professionalism.

Overall, the contentment for operation was lower than that of contents. E-learning contents are said to be in a proper shape in terms of content and methodological aspects, and the students also find it interesting.

An important quality related with E-learning process is that even though the application level was not very high, the students perceive the effort positively in that they can improve the achievement of their organizations. They felt that the course material was pretty relevant to their actual work, and such experience could enhance their own performance ability.

Based on the FGI results, following conclusions were induced. With regards to E-learning, support from organization is not enough, and to complement such a shortcoming, there needs an effort to propagate the benefits of E-learning as well as expand the initiatives of it.

There were a lot of opinions that addressed the course material was too theoretical and that starters wanted easier explanation while the intermediates wanted more professional ones. To increase the understanding of the contents, the program needs to provide various levels of courses so that the contents match well with the students' ability to understand it.

It appeared that comprehension of overall task was improved. The participants increased understanding not only for their own field of work but also the related fields of work, enhancing the communication skills with customers and achieving great deals.

B. Suggestions for promoting E-learning applications

In this study, there were a lot of cases in which people took courses not about their own field but other related fields. The participants in these cases perceive very positively the fact that they could apply a new technique obtained from other categories to their fields.

One of E-learning's qualities is great availability of upgrade. However, it is practically not easy to upgrade the course material too often. Many participants in this study felt that they couldn't get enough up-to-date information from E-learning courses. This means that their expectations for E-learning as well as new technologies have been increased a lot.

Also, it appeared that the participants didn't share the contents with professionals from various parts through diverse interactions in an organization. It is not enough to participate in training to improve the techniques relevant to a field, and dependency on the contents indicates that they are not able to utilize the Internet as actively as possible. Therefore, it is required to promote interactions and networks among participants and professionals, rather than just focus on the content development and operation for technology propagation.

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TABLE 4. DESCRIPTIVE STATISTICS AND STATE OF THE ENTIRE BUSINESS TYPES

Prime area	Sub area	Category	Category contents	N	Minimum Value	Maximum Value	Average	Standard Deviation
Contentment	Contents	Learning objectives	Clarity of the learning objectives	55	2	5	4.1	0.7
		Content suitability	Suitability of the content	55	2	5	4.0	0.7
		Content professionalism	Professionalism of the content	55	1	5	3.4	0.8
	System	Guide for operation	Suitability of operation guide	55	1	5	3.6	0.8
		Learning support	Appropriate learning support and encouragement	55	1	5	3.3	0.9
		Tutor support	Suitability of instructors and tutors	55	2	5	3.5	0.8
		Stability	Stability of the system	55	1	5	3.9	0.7
Transformation of Training	Content comprehension	Goal recognition	Recognization of the goal	79	2	5	3.7	0.7
		Content comprehension	Level of content comprehension	79	2	5	3.7	0.7
	Work application	Application opportunity	Opportunity to apply the obtained information	79	2	5	3.6	1.0
		Degree of application	Level of actual application	79	2	5	3.3	1.0
	Ability improvement	Task-related	Relevance of individual performance	79	1	5	3.9	0.6
		Performance improvement	Improvement in performance	79	2	5	3.6	0.7
	Achievement enhancement	Achievement-related	Relevancy of content and the achievement of organization	79	2	5	3.3	0.8
		E-learning continuance	Positivity of e-learning improvement	79	2	5	3.9	0.7

	Propagation	Application interest	Level of interest in actual application	79	2	5	3.7	0.7
		E-learning propagation	Positivity of E-learning propagation	79	1	5	3.4	1.0
	Organization support	Colleague support	Level of support for application	79	1	5	3.2	0.9
		Organization atmosphere	Overall atmosphere of an organization towards new technologies	79	2	5	3.8	0.9
Lectures overall	Contentment		Contentment for the overall courses	79	30	100	78.1	15.2
	Comprehension		Comprehension for the overall courses	79	20	100	75.7	17.0
	Transformation of training		Training transfer for the overall courses	79	20	100	61.3	21.7
	E-learning continuance		Development and continuance of E-learning	79	3	5	4.4	0.6