

A Secular Trend Analysis of the Effects of Using ICT in University Education

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Abstract: Promoting education through information and communication technology in universities is considered an important issue. So far, in order to gain an understanding of its actual conditions, institutions such as the Open University of Japan, Kyoto University, and Academic eXchange for Information Environment and Strategy have conducted questionnaire surveys targeting higher education institutions throughout Japan. This paper focuses on the effects of using ICT in education and compares results over time, while also attempting to extract comparable factors from each fiscal year with regard to the details of these effects. We reveal the characteristics of institutions that demonstrated improvement in their educational methods and effects in the 2015 fiscal year survey results.

Keywords: ICT in education, e-learning, higher education, complete enumeration

1. Introduction

Since globalization and open education are increasingly advocated and promoted within the Japanese higher education system, there is a growing demand for a qualitative change in university education to encourage self-directed learning by students, such as active learning. To realize such a transition, promoting education that uses information and communication technology (ICT) in universities is considered a key issue. So far, in order to gain an understanding of its actual conditions, institutions such as the Open University of Japan (2011), Kyoto University (2014), and Academic eXchange for Information Environment and Strategy (AXIES, 2016) have conducted questionnaire surveys targeting higher education institutions throughout Japan. The purpose of these surveys is to comprehensively show the spread of ICT utilization in higher education in Japan and to clarify the characteristics of our country in the world by comparing with similar overseas surveys such as Green (2016). Ultimately, these surveys aim to clarify the factors for promoting ICT utilization education and to propose measures for accelerating the spread of future ICT utilization education at each institution. On the other hand, a secular trend analysis, which involves investigating the differences in the actual conditions during each fiscal year, has not yet been conducted. Furthermore, its causality, that is, determining what factors bring about the effectiveness of ICT use in education, has not been made clear.

Therefore, this paper focuses on the “effects of using ICT” in education and compares their secular trends, while also attempting to extract comparable factors pertaining to the details of such effects by fiscal year (FY). Additionally, it reports on our investigation concerning the characteristics of institutions that demonstrated “improvement of educational methods” and “educational effects” in FY 2015 survey results.

2. Comparison of Secular Trends for the Effectiveness of ICT in Education

With regard to the effectiveness or ineffectiveness of introducing ICT in education, Figure 1 indicates the responses gained from the four surveys conducted between FYs 2009 and 2015. The four surveys used the same questions and responses were marked along a four-level scale with regard to its effectiveness/ineffectiveness or as “unsure.” Figure 1 shows that approximately half of the institutions considered ICT to be “effective” in all surveys. On the other hand, institutions that were “unsure” of its

effects increased from 37.8% in 2009 to 43.6% in 2015. This shows that while introducing and using ICT in education has certain positive effects, they have not been sufficiently tested.

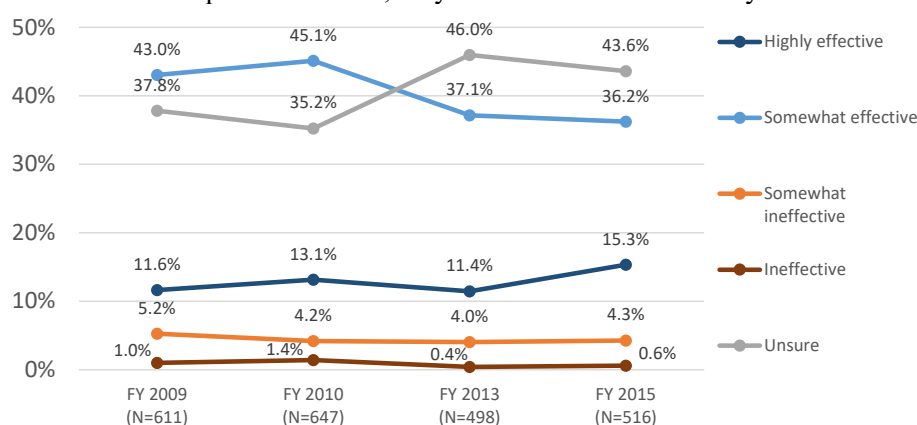


Figure 1. The Effectiveness of ICT Education.

3. Extraction of Common Factors based on the Comparison of Secular Trends

With regard to institutions that gave responses other than “ineffective” or “unsure,” we attempted to extract common factors based on the comparison of secular trends with specific data on their effectiveness. Furthermore, with regard to specific survey items, there were 13 items for FYs 2009 and 2010 and 17 items for FYs 2013 and 2015 because four items concerning advanced educational initiatives, such as active learning and problem-based learning (PBL), were added. We then conducted an exploratory factor analysis using maximum likelihood estimation and promax rotation for each response from the surveys of FYs 2013 and 2015 and compared the factors and lower-order items obtained. This resulted in finding the same factor structure in the response data for both FYs, excluding one item. Therefore, we eliminated two items with factor loadings under 0.30 in either of the FYs and one item that showed different factors with high loading that varied from year to year and then calculated the scale score for each factor. Table 1 indicates the common factor items extracted as a result. The factor loadings indicated in the table are based on the result of the exploratory factor analysis of FY 2015 responses. Similar to the study by Tsuji et al. (2016), which also conducted factor analysis of FY 2015 responses, we extracted four factors, including “increasing the university’s brand power,” “improving educational methods,” “educational effects,” and “cost reduction” and confirmed sufficient reliability for each factor using Cronbach’s α coefficient.

Table 1: Common factors based on the comparison of secular trends.

Survey items	α coefficient	Increasing the university's brand power	Improving educational methods	Educational effects	Cost reduction
Attracted more applicants and international students	.87	1.07	-.10	-.07	.00
Enhanced competitiveness and reputation		.78	.09	.03	-.05
Expanded range of target students		.74	.05	.05	-.07
Secured diverse teaching staff		.60	-.02	-.02	-.10
Increased active learning style courses	.80	-.02	1.01	-.04	-.10
Increased PBL style courses		.00	.89	-.05	-.04
Leveraged useful external teaching materials and contents		.13	.44	.03	.18
Improved access to learning resources for students outside of the university		-.06	.39	.06	.18
Enhanced effectiveness of student learning	.84	-.06	-.07	.97	-.04
Enhanced student motivation for learning		-.03	-.01	.93	-.06
Improved completion rate of students		.21	.00	.47	.09
Improved quality of education		.04	.29	.45	.12
Improved working efficiency of teaching staff	.70	-.07	.01	-.05	.81
Reduced budget costs		.06	-.02	.01	.69

4. Scale Scores for Factors “Improving Educational Methods” and “Educational Effects”

From Table 1, we considered “improving educational methods” and “educational effects” to be two factors related to the improvement of education and educational quality at universities. Therefore, for FY 2015 survey results (AXIES, 2016), we calculated subscale scores of the two factors by averaging and performed a t-test analysis to examine their correlation to other survey items and score the difference between the choices (yes, no). The results are indicated in Table 2 and Table 3. From these, we observe that universities working on “improving educational methods” tend to mention ICT in education-related initiatives in their action plans, obtain more competitive external funds, and make more progress in introducing and using LMS. Furthermore, they also tend to have university-wide organizations for its promotion as well as organizations that provide technological and educational support.

Table 2: Correlation between the two factors.

Survey items	Improving educational methods	Educational effects
ICT is mentioned in the university's vision and action plan	.312**	.138
Funding for ICT in education	.342**	.355**
Degree of awareness concerning OER	.400**	.232**
State of OER provision	.210**	.165**
State of OER use	.270**	.208*
State of MOOC provision	.266**	.162

** p<.01, * p<.05

Table 3: Subscale scores of other survey items

Survey items	Choice	Improving educational methods	Educational effects
Presence of a university-wide promotion organization	Yes	3.08**	3.16*
	No	2.48**	2.91*
Obtaining competitive external funds	Yes	2.93**	3.04
	No	2.61**	3.00
Measuring the effectiveness of ICT in education	Yes	2.44**	2.74***
	No	2.84**	3.10***
Introducing and using a university-wide LMS program	Yes	2.87***	3.07*
	No	2.31***	2.83*
Presence of a university-wide technical support organization	Yes	2.89***	3.04
	No	2.33***	2.95
Presence of a university-wide educational support organization	Yes	2.89***	3.09*
	No	2.53***	2.91*

*** p<.001, ** p<.01, * p<.05, + p<.1

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