Relationship between the Desired Effect of Using ICT in Education and the University's Size in Japan

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Abstract: In order to perceive the real state of achievement of using ICT in university education, we conducted a questionnaire survey targeting higher education institutions throughout Japan in November 2015.

In this paper, we focused on the difference of responses of "the desired effect of using ICT in education" item in each university's size, which is based on the number of students. In the beginning, an exploratory factor analysis of "the desired effect of using ICT in education" was executed. As a result, we could find 4 factors, which were "increase the university's brand power", "educational effects", "improve educational methods", and "cost reduction". Moreover, in order to clarify differences in the university's size, we performed an analysis of variance and multiple comparisons of the scale scores of the 4 factors in each university size. As a result, there were significant differences of the "educational effects" and "improve educational methods" scale scores between large-scale universities and small-scale universities.

From these results, it can be concluded that the large-scale universities in Japan tend to have stronger senses of purposes for enhancing students' learning and students' willingness using ICT, and improving existing educational methods using active learning approach and flipped classroom approach and so on.

Keywords: ICT in education, e-learning, higher education, complete enumeration
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. 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, we conducted a questionnaire survey targeting higher education institutions throughout Japan in November 2015 (AXIES 2016). The result of the survey has revealed the actual conditions of ICT in education, including the presence or absence of organizations that promote the use of ICT in education, the rate of learning management system (LMS) introduction, ICT environments and services, the effects of introducing ICT in education, and the presence or absence of support systems. On the other hand, Sakai et al. (2016) noted that large-scale and medium-scale universities tended to be more promoting ICT utilization education and e-learning than small-scale universities as a feature of higher education in Japan, and pointed out that government support for small-scale universities is necessary.

Therefore, this paper focuses on the "the desired effect of using ICT in education" item in order to investigate the differences between university sizes in more detail. First, we extract common factors hidden behind the responses of "the desired effect of using ICT in education" items by using a factor analysis, and report on the differences of scale scores of the factors in each university’s size by an analysis of variance.

Survey Overview

In this section, an overview of this survey is explained. This questionnaire survey was conducted under the leadership of Academic eXchange for Information Environment and Strategy (AXIES) during the period from November 2015 to February 2016, and was targeting 1215 higher education institutions throughout Japan. Each institution responded using a web questionnaire system. The response rate was 65.2% (a total of 794 institutions, including 516 universities, 222 junior colleges and 54 technical colleges). This survey item consists of 57 questions in all five categories: "organization strategy", "open education", "implementation status of using ICT in education", "advantage and disadvantage of using ICT in education", and "support system". Based on the survey subjects, three types of questionnaires were prepared for universities, for junior colleges, for technical colleges, and for undergraduate/graduate courses.

Methodology

The analysis method is described in this section. As mentioned in the beginning section, the subject of analysis is "the desired effect of using ICT in education" item. This item is composed of 17 sub
items, including “Attract more applicants and international students”, “Enhance effectiveness of student learning” and so on. The responses in each sub item were marked along a four-level scale: “strongly agree”, “somewhat agree”, “somewhat disagree”, and “strongly disagree”.

First, we summarize the results of these responses. Subsequently, in order to extract common factors hidden behind sub items, we conduct an exploratory factor analysis by maximum likelihood method and promax rotation for university responses. Then, in order to investigate the difference in each university scale, the difference scales of each extracted factor scores are examined by analysis of variance.

Results and Discussion

Figure 1 shows the results of responses to "desired effect of using ICT in education". In Figure 1, the percentages of answers that sums "strongly agree" and "somewhat agree" to each sub item are shown by the type of institution. From these, the ratio of positive responses to sub items of "Provide a more convenient environment for students", "Enhance student motivation for learning", "Enhance effectiveness of student learning", and "Improve quality of education" was high at 80% or more in any institution type. In addition, the sub items that the percentage of positive answers was 80% or more were "Increase learning time outside of classes" (4-year institutions, technical college), "Improve working efficiency of teaching staff" (technical college), "Use in active-learning style courses" (4-year institutions, technical college), "Use in PBL style courses” (technical college). From this result, the sub item of "improve the quality of education" is considered as a common purpose in higher education institutions. On the other hand, however, there was a high percentage of positive responses to the "use in active learning style courses" and "PBL style courses” at technical colleges. The reason for this is because it is inferred that the technical college may also be affected by a promotion of active learning in the form of "subjective and collaborative learning towards discovering and solving tasks" under the leadership of the Ministry of Education, Culture, Sports, Science and Technology in primary and secondary education.

Subsequently, based on the answers from the four-year institutions in the sub items of "the desired effect of using ICT in education", we conducted an exploratory factor analysis using maximum likelihood method and promax rotation. The number of factors was determined to be four from the scree plot graph. In addition, factor analysis was carried out again excluding sub items which had factor loadings of 0.3 or more in multiple factors. As a result, 16 items out of 17 items were adopted. The final results are shown in Table 1.

In terms of the first factor, it was able to be named as "Increase the university’s brand power", because it is composed of sub items related to the management ability and appeal of the 4-year institutions such as "Attract more applicants and international students" and "Improve the competitiveness and publicity of universities". The second factor named "educational effect" because it consists of sub items related to educational effects such as motivation and academic ability of students, improvement of educational quality etc. In the third factor, we could name it "Improve educational methods" because it is
composed of sub items related to new educational methods such as active-learning type classes and use in PBL-type classes,

In the fourth factor, we could name it "cost reduction" because it is composed of sub items that mean reducing work costs and budget costs. When examining the α coefficient expressing the reliability for the sub items constituting each factor, it is considered that it is roughly an appropriate value.

![Figure 1 Desired Effects of Using ICT in Education](image-url)
Table 1 Extracted factors from responses of “the desired effect of using ICT in education” sub items

<table>
<thead>
<tr>
<th>Survey items</th>
<th>α coefficient</th>
<th>Increase the university’s brand power</th>
<th>Educational effects</th>
<th>Improve educational methods</th>
<th>Cost reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attract more applicants and international students</td>
<td>.88</td>
<td>.96</td>
<td>-.01</td>
<td>-.02</td>
<td>-.02</td>
</tr>
<tr>
<td>Expand range of target students</td>
<td></td>
<td>-.03</td>
<td>.05</td>
<td>.00</td>
<td>-.01</td>
</tr>
<tr>
<td>Improve the competitiveness and publicity of universities</td>
<td></td>
<td>.79</td>
<td>.13</td>
<td>-.04</td>
<td>-.07</td>
</tr>
<tr>
<td>Secure diverse teaching staff</td>
<td></td>
<td>.47</td>
<td>-.14</td>
<td>.22</td>
<td>.21</td>
</tr>
<tr>
<td>Enhance effectiveness of student learning</td>
<td></td>
<td>-.02</td>
<td>.87</td>
<td>.02</td>
<td>-.04</td>
</tr>
<tr>
<td>Enhance student motivation for learning</td>
<td></td>
<td>.03</td>
<td>.85</td>
<td>.02</td>
<td>-.06</td>
</tr>
<tr>
<td>Improve quality of education</td>
<td></td>
<td>.01</td>
<td>.56</td>
<td>.14</td>
<td>.09</td>
</tr>
<tr>
<td>Improve completion rate of students</td>
<td></td>
<td>.27</td>
<td>.31</td>
<td>.07</td>
<td>.10</td>
</tr>
<tr>
<td>Provide a more convenient environment for students</td>
<td></td>
<td>-.05</td>
<td>.44</td>
<td>.05</td>
<td>.10</td>
</tr>
</tbody>
</table>

Then, for each of these four factors, the scales score was obtained by adding and averaging the responses of the sub items constituting each factor. The results are shown in Table 2. From this, it was found that the four-year university in Japan emphasizes mainly the improvement of educational effectiveness and educational method as the purpose of introducing ICT. On the other hand, it was also found that Japanese four-year universities have different degree of management related objectives such as improvement of brand power of university and cost reduction.

In order to investigate the differences among the scale scores of the four factors obtained before, the one-way analysis of variance and multiple comparisons were conducted. The university scale was defined as 5 groups: Group A: The number of students is 10001 or more, Group B: 5001 to 10000 students, Group C: 3001 to 5000 students, Group D: 1001 to 3000 students, Group E: The number of students is 1000 or less, with reference to Sakai et al. (2016). The results are shown in Figure 2. From these results, significant differences could not be confirmed by “Increase the university’s brand power” and “cost reduction” factors. However, it was found that there were significant differences between the E group of the small institution and the other groups in the scale scores of the other two factors related to education.

Table 2 Scale Scores of Extracted Factors
In this proceeding, we focused on the difference of responses of "the desired effect of using ICT in education" item in each university's size, which is based on the number of students. An exploratory factor analysis of "the desired effect of using ICT in education" was executed. As a result, we could find 4 factors, which were "increase the university’s brand power", "educational effects", "improve educational methods", and "cost reduction".

Moreover, in order to clarify differences in the university’s size, we performed an analysis of variance and multiple comparisons of the scale scores of the 4 factors in each university size. As a result, there were significant differences of the "educational effects" and "improve educational methods" scale scores between large-scale universities and small-scale universities.

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### Conclusion

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