Comparing e-learning outcome with face-to-face lecture in Korean agricultural high school

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Abstract

This study identified the effectiveness of e-learning by comparing learning outcome in conventional face-to-face lecture with the selected e-learning contents. The researchers developed two types of e-learning contents (animation based and video based) according to the rapid prototyping model and loaded onto the learning management system (LMS), which is http://www.enaged.co.kr. Fifty-four Korean agricultural high school students participated in a completely randomized design experiment. Each student was randomly assigned into three groups (face-to-face lecture, animation based e-learning, and video based e-learning group). All students took a pretest and posttest before and after learning under the direction of the subject teacher. The researcher conducted a one-way analysis of covariance to verify whether there was any difference between face-to-face lecture and e-learning in terms of students’ learning outcomes. Student’s pretest scores were controlled as covariate variable. No differences between animation based and video based e-learning as well as between face-to-face learning and e-learning were identified according to the results.

Keywords: e-learning, animation and video based content, analysis of covariance, agricultural high school teachers

Introduction

The use of distance learning is a major example of ICT in education (UNESCO, 2003). As a communication tool, internet technology has played great role in facilitating between teaching and learning (Roberts & Dyer, 2005). E-learning has become more and more popular not only in education but also in industry (Gunasekaran, McNeil, & Shaul, 2002). Korea takes full advantages of e-learning in education. Economist Intelligence Unit (2003) reported its e-learning readiness was ranked 5th in the world.

The use and application of e-learning in vocational education is low when it is compared with that of general education in Korea (Park, Lee, Yu, Seo, & Lee, 2005). There is also a lack of student centered instructional materials in vocational high schools and a need for the development of e-learning contents. Further, little research has been conducted to verify e-learning’s effect on learning outcomes in agricultural high schools in Korea (Park et al., 2006). In addition, there is very little data which identifies if various types of e-learning content produce a different learning achievement in agricultural education in Korea. This study examined the result of e-learning effects on learning outcome compared with a lecture format after two types of e-learning contents were developed in a food processing course of an agricultural high school in Korea.
E-learning contents and website

Contents

The content in this article mostly uses a media-based definition (Allen, 2003), because the information and knowledge to be learned were exactly the same for the experiment. “Food Processing Technology II” is a major course and is compulsory for students majoring in food processing technology at an agricultural high school in Korea. One lesson, “How to Make an Apple Jam” was selected as an experimental topic from the course. Animation based (Figure 1) e-learning content and video based (Figure 2) e-learning content were developed according to rapid prototyping model. Rapid prototyping model is a modified ADDIE model (analysis, design, development, implementation, and evaluation).

The rapid prototyping model introduces feedback from potential learners and reflects them onto making a prototype. Once a final prototype is completed and agreed among the content’s developing members, additional development works such as programming can proceed (Kruse, 2007). The researchers worked as instructional and web designers. An agricultural high school teacher in charge of teaching the course joined and co worked as subject specialist with the researcher for the development of e-learning. Three students participated in developing a prototype for feedback. Right after the final prototypes for both contents were made, the researcher created every story boards needed for actual content pages.

Finally, the animation based e-learning content was made by flash animation programming introducing a storytelling technique. The storytelling technique is often used motivate the students to engage in learning (Huffaker, & Calvert, 2003). Like other storytelling technique contents, this content contains animation, illustration, simulation, demonstration, and narration (Browaeys, & Wahyudi, 2006).

Figure 1: Example screen capture of animation based content
On the other hand, the video based content included the real teacher’ instruction video and the information to be learned at the same time. The information to be learned in both animation and video based contents were identical, but in a different format. Both contents were about 25 minutes long.

Figure 2: Example screen capture of video based content

**Method**

**Research design**

A pretest-posttest comparison group design was adopted for the study. The control group consisted of the students who received face-to-face lecture. Meanwhile, the experimental group was divided into two sub groups which were animation and video content groups. A one-way of analysis of covariance was introduced to test hypotheses. The pretest score was set as a covariate. Based on the design and the model, the following hypotheses were set.

H1: There is no significant difference in student posttest scores among the groups when their pretest scores as covariate were controlled.

H2: There is no significant difference in student posttest scores between animation and video based e-learning group.

**Experimental subjects and process**

Sixty third-grade agricultural high school students from two classes whose major is food processing technology participated in the experiment. The school is located in Kwangwon Province in Korea. Each class had 30 students, but only 54 students who attended both the pre and posttest were included in the experiment for the analyses. A completely randomized design (CRD) was introduced for the experiment. The students were assigned into each group according to their random numbers generated by the “RANUNI” command of statistical analysis system (SAS) software package (SAS Inc, 1999).
Table 1: The number of students in each experiment groups

<table>
<thead>
<tr>
<th>Method</th>
<th>Face-to-face (%)</th>
<th>Animation based (%)</th>
<th>Video based (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male students</td>
<td>10 (62.50)</td>
<td>7 (35.00)</td>
<td>4 (22.22)</td>
<td>21 (38.89)</td>
</tr>
<tr>
<td>Female students</td>
<td>6 (37.50)</td>
<td>13 (65.00)</td>
<td>14 (77.78)</td>
<td>33 (61.11)</td>
</tr>
<tr>
<td>Total</td>
<td>16 (100)</td>
<td>20 (100)</td>
<td>18 (100)</td>
<td>54 (100)</td>
</tr>
</tbody>
</table>

Instrument and statistical analysis

Two versions of test items, pre and posttest, were developed to assess students’ outcome of the course knowledge base. The questions of pretest were identically same as posttest questions, but different orders and sentences were used. Both were a four option multiple choice exam. Each test consisted of 10 questions which dealt with process and procedure of making apple jam. If one had all correct answers, then he or she got 10 points. The scores ranged between 0 to 10. The questions were developed by the teacher in charge of the course who taught in both the face-to-face lecture group and video based e-learning group. After administering the tests, data were coded into the SAS, and about 10% data were randomly checked for coding error. An analysis of covariance (ANCOVA) technique and two preplanned group comparison techniques with “contrast” options in SAS were carried out to test the hypotheses.

Results

Difference between pre and posttest scores

Before testing the hypotheses, three t-tests were implemented to see if a learning outcome took place in each group. Without the learning outcome, no significant mean differences between pre and posttest scores, it would not be worthy of testing hypotheses. A summary of t-test results is given in Table 2. According to the t statistics and p-values, every group had significant mean differences. Therefore, learning achievements occurred regardless of the group due to learning process, and the researchers could move ahead to test hypotheses. If there was no difference between pretest scores and posttest scores, then it may be useless to test group difference of posttest scores according to learning methods.

Table 2: T statistic results of pre and posttest scores

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean of pretest score (SD)</th>
<th>Mean of posttest score (SD)</th>
<th>Mean difference</th>
<th>t-value</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face</td>
<td>3.56 (1.26)</td>
<td>6.5 (1.31)</td>
<td>2.9</td>
<td>-6.44</td>
<td>30</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td>Animation based e-learning</td>
<td>4.05 (2.01)</td>
<td>6.75 (1.59)</td>
<td>2.7</td>
<td>-4.71</td>
<td>38</td>
<td>&lt;.0001***</td>
</tr>
<tr>
<td>Video based e-learning</td>
<td>4.17 (1.20)</td>
<td>7.22 (1.06)</td>
<td>3.1</td>
<td>-8.09</td>
<td>34</td>
<td>&lt;.0001***</td>
</tr>
</tbody>
</table>

Note: Score range 0-10; ***p<.001 level (two-tailed)
Hypothesis 1

Hypothesis 1 “There is no significant difference in student posttest scores among the groups when their pretest scores as covariate were controlled” was set to see if group mean differences exist after removing previous knowledge effect. According to the statistics in upper Table 2, posttest score of face-to-face group (mean=6.5) was lower than both the animation based e-learning group (mean=6.75) and the video based e-learning group (mean=7.22). The video based e-learning group has the highest posttest score. However, the result of ANCOVA showed no difference among the groups. A summary of ANCOVA statistics is included in Table 3. Based on the results (F=1.02, p-value=.6799), the hypothesis was not rejected and should be adopted. In other words, there was no overall effect of learning method on learning outcome after controlling previous knowledge. In addition, it was further identified that the pretest score as covariate was not linearly related to their posttest score. This is interesting result because it is generally known that students’ previous knowledge is related to their future knowledge. This may be because all pretest scores had almost the same centering on 4, which could not differentiate each group. Another possible reason may be the lack of the number of experimental subjects since this study included only 54 students.

Table 3: Statistics of ANCOVA

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>df</th>
<th>Type III SS</th>
<th>MS</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group (treatment)</td>
<td>2</td>
<td>4.64</td>
<td>1.82</td>
<td>1.02</td>
<td>.6799</td>
</tr>
<tr>
<td>Pretest score (regression)</td>
<td>1</td>
<td>3.38</td>
<td>3.38</td>
<td>1.89</td>
<td>.1752</td>
</tr>
<tr>
<td>Residual (error)</td>
<td>50</td>
<td>89.48</td>
<td>1.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
<td>97.50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hypothesis 2

The “contrast” statements in general linear model (GLM) procedure in Statistical Analysis System (SAS) were used for preplanned comparisons, which test hypothesis 2. The hypothesis could not be rejected either. That means there was no difference between e-learning methods in terms of learning outcomes of the students. The mean of animation based e-learning group posttest was 6.75 and the mean of video based e-learning group was 7.22. This produces just about .5 difference in the range between 0-10 scores. This difference was not enough to differentiate one or another in terms of learning outcome.

Table 4: Contrast preplanned comparison results

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>df</th>
<th>Contrast SS</th>
<th>MS</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animation vs. Video</td>
<td>1</td>
<td>3.33</td>
<td>3.33</td>
<td>1.86</td>
<td>.1787</td>
</tr>
<tr>
<td>Error</td>
<td>50</td>
<td>89.48</td>
<td>1.79</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discussions and conclusions

Both the e-learning group and the face-to-face lecture group increased their knowledge about the selected academic topic from the course. Their posttest scores were significantly higher then pretest scores. After identifying the students’ learning, that is to say, changes in terms of knowledge, the researchers tried to determine whether each learning method are different from one another in terms of learning outcome. Overall, e-learning turned out to be at least
as effective as the face-to-face lecture learning. The results of hypotheses tests showed no significant differences not only between the e-learning and face-to-face group, but also between e-learning groups themselves.

Generally, animation based e-learning contents are considered nice-looking and provide a fancy interface, but expensive cost. Animation based e-learning contents are more preferred and used in web-based training of industry in Korea because of its fancy type of design and flexibility of learning. Dix, Finlay, Abowd, & Beale (2004) identified interface characteristics as a major component of effective man-computer interaction. Meanwhile, this study showed no difference between the selected e-learning methods, animation based contents and video based contents. The result confirms differently Chens’ findings (2005) that display interfaces had significant impact on students’ elementary knowledge such as facts and concepts regardless of students’ levels of prior knowledge.

It is recently often understood that learners want to see their instructors in e-learning mode. Especially, school students tend to like to watch their teachers’ instruction in e-learning. Thus, video based e-learning contents for young students are mostly used in both formal and private education in Korea. Further, the researchers identified agricultural high school students as preferring study by e-learning which contains their real teacher after additional interviews with some students.

References


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