CLASS DEVELOPMENT OF MANAGEMENT INFORMATION SYSTEM USING SYSTEM OPERATION E-LEARNING BY COMPIERE ERP

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Abstract: ERP (Enterprise Resource Planning) systems are necessary in order to help enterprise managers by providing performance information of the company. By the growing of learning technology, some of ERP training have introduced simulators to learn ERP system. The benefit of simulators enable learners to operate the ERP system and confirm the learning degree. A system of operation e-learning has been developed by Xu et al. (2016) to help learners learn without limitation of times and locations, and a demonstration lesson is conducted for graduate students in mechanical engineering. However, regular lessons are not applied and developed. This study introduces class development by using operation e-learning materials with Compiere ERP for a graduate level class in management information system.


1. Introduction

As management at enterprises have become complex and diverse, it is difficult to conduct all business activities only by human beings [1]. Management information systems such as ERP (Enterprise Resource Planning) systems are necessary in order to help enterprise managers by providing performance information of the company [2]. These systems have not only enabled organizations to achieve cross-functional business process integration across internal business operations, but they have also facilitated collaboration among business partners through the use of various e-business technologies [3]. However, not only the package fee but also initial, maintenance and operating costs are still high for ERP systems [4]. Though an open source ERP called Compiere now exists at lower costs [5], human resources required to use this system are still insufficient which has become an urgent issue in Japan.

Besides the costs, the complexity of ERP system also make the implementation difficult [6]. Sun et al. (2015) [7] introduces an ERP report by Panorama consulting solutions. A survey in 2013 shows that 54% of ERP projects are reported to be cost overrun, 72% are time overrun and 66% of the enterprise implementing ERP software initiatives receive less than 50% of the anticipated measurable benefits.”. Also, Koh et al. (2009) [8] point out that an increasing number of small and medium sized enterprises (SMEs) have attempted to implement and operate the ERP systems but improper training brings failures of ERP projects. Hence, the paper investigates training model employed by a case company. Furthermore, Dalvener [9] mentioned that “it is known that employee acceptance and familiarity play an important role for ERP effectiveness”.

About all, as a successful solution of implementation, the first step is to give a training for employees and students to understanding of the linkages among the various part of the organization and the business [10]. Due to the spread of the Internet and information communication networks, e-learning systems have become important and more suitable for learning operations of software compared with the traditional passive educational methods. E-learning for industrial engineering has been introduced as a regular class in universities, such as content for a “Production System Design” class [11], a collaborative learning exercise for a “Production System Design” class [12], and business process and class curriculum for a Product Lifecycle Management (PLM) class [13].

By the growing of learning technology, some of ERP training have introduced simulators to learn ERP system. The benefit of simulators enable learners to operate the ERP system and confirm the learning degree.

The simulators for learning ERP can be divided into two type: the specialized education simulator and the real system simulator. The Management Interactive Case Study Simulator (MICSS) is one of the specialized education simulators [10]. This education business game allows learners to experience managing a small manufacturing company with a small integrative information system. However, the finally aim of learning ERP system is also to master the
real ERP system.

Sun et al. (2011) [14] have developed an ERP education program for business Re-engineering project. This education program is administered at Aoyamagakuin University. This class give an example of a virtual company named eLPCO automation Inc., and explain sales management, demand forecast and so on. Most of the classes are administered by description lectures and calculation exercises only, and at the last class students have one time to do production management operation on the SCAW ERP system.

Dalveren [9] introduces an e-learning model with SAPgui and Application Service Provider (ASP) at Victoria University in Australia. Magal and Word (2009) [15] have designed essentials of business processes and information systems to reflect how real-world business processes are managed and executed in a practical and accessible way by using a SAP simulation. By comparing to the specialized education simulator MICSS, the SAP simulation enable learners to remember the system operation and obtain the necessary knowledge from the system which have minimized the learning time. However, the SAP simulation only has two study modes with the guided exercise and the self-exercise. In the guided exercise, there will be several windows with details and explanations of each step but without the voice guidance. In the self-exercise, learners will complete the exercise on their own without any help or hints. This self-exercise seems difficult for the beginning learners.

Thus, a system operation e-learning for Compiere ERP system have been developed by Xu et al. (2016) [16] with both words and voice guidance. According to learners’ study degree, four study modes can be selected by themselves. Before the system operation e-learning system been developed, Compiere has carried out training using textbooks, videos on CD-ROM, other teaching materials as well as a 5-day face-to-face workshop [5]. These training methods are limited in terms of study times and locations. Also, it is not easy for the learners to have an actual experience of operating the ERP system. Therefore, it is difficult to remember all the operational procedures without actually operating the ERP system on the screen. Hence, an operation e-learning system has been developed by us which can be used without the limitation of learning times and locations, and a demonstration lesson has been conducted for mechanical engineering graduate students in Meiji University [16]. However, these e-learning materials have not been introduced a regular class to learn management information systems.

This study introduces a class development by using the operation e-learning materials with Compiere ERP for graduate students management information system. First, the developed operation e-learning materials are installed on the learning management system (LMS) for a graduate school class. Next, a class schedule is planned, and some of the system operation e-learning materials are set for the class. Also, multiple tests and questionnaires are designed for measuring learning effects and satisfaction. Finally, the tests and questionnaires are analyzed and discussed.

2. Literature Review

This section introduces both the class development and the developed operation e-learning materials process with Compiere ERP.

2.1 Overview of class implementation with operation e-learning materials for Compiere ERP

Figure 1 shows the class development process with an operation e-learning for Compiere ERP. In this class implementation, the first step is the preparation work to install e-learning materials, tests and questionnaires online by the LMS. The second step considers the class structure and makes a timetable to manage class time and progress. The class is actually carried out at the third step. After the class is implemented, the tests and questionnaires are analyzed at the forth step. Also, from the result of that, some changes will be done to improve the class at the fifth step so that the plan of the next class is organized to the second step.

![Fig. 1 Class development process with operation e-learning for Compiere ERP](image)

2.2 ERP Development process of system operation e-learning for Compiere ERP

Before developing the management information systems class, operation e-learning materials for each lecture should be developed [16] by adopting the instructional design. This is one of the systematic processes by which instructional materials are analyzed, designed, developed, implemented and evaluated [17].

As the developing tool, the manual creation software Dojo which is provided by TENDA Inc.[18] was adopted. Dojo enables the creation of operation e-learning materials using the simulation and voice guidance of the operation procedure. Additionally, it enables output of operation e-learning materials in several formats, for example, HTML, SCORM, and so on, which helps the installation on the LMS. Each of the formats can be generated into four types of content modes as shown in Table 1.

3. Class education in e-learning

The class has been implemented as a graduate class of management information system at the University of Electro-Communications (UEC) in Tokyo, Japan. This class has 18 students consisting of 5 graduates and 13 undergraduates as well as one professor and one teaching assistant. Additionally, the user must sign up for an agreement of the e-learning terms and conditions in this class.
Table 1  Dojo [18] contents learning mode

<table>
<thead>
<tr>
<th>Mode</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto demo</td>
<td>A series of operation methods are displayed in a balloon on the screen, and the flow is automatic regeneration described by the automatic voice.</td>
</tr>
<tr>
<td>Lecture</td>
<td>The total number of daily female guests</td>
</tr>
<tr>
<td>Pretest</td>
<td>There is no input operation guidance. If some mistakes occur a certain number of times, users can review the lecture in order to overcome discovered weakness in the drill format.</td>
</tr>
<tr>
<td>Exercise</td>
<td>This is a self-test format, which can check the proficiency degree of the learner. If the input by users is wrong, an operation method of help will be displayed.</td>
</tr>
</tbody>
</table>

3.1 Educational method

In order to help students enhance understanding of the business process, lessons consist of lectures, online business games and ERP e-learning. The planned time schedule is adjusted and managed by the professor on site, thus it is synchronous and face-to-face e-learning. Table 2 shows a class structure of the management information system with online business game and ERP operation practice. This class is divided into 3 parts. The Part 1 is the introduction of the management information system. Part 2 includes playing an online business game. The last part involves ERP operation practice. This part is the most important part and is why the class is implemented.

In lesson 1 some information about management information systems is introduced. In addition, from lesson 2 to 4, students use computers to play the online business game provided by Yokohama National University [20]. Ev-
ery student team one to three consisted of students has its own bakery shop to administer and become a manager of the shop. The students develop thinking skills to determine ordering, manufacturing and pricing to increase surplus funds as a competition among the student teams. After the management information system lecture and business game, the concept of the business process should be understood by students.

Lessons 5 to 7 are about learning the Compiere ERP operation. This part consists of a lecture by the professor and an exercise of the system operation e-learning by a teaching assistant. At first, the professor explains the purpose of the operation and business process, and the teaching assistant explains how to use the system operation e-learning. The remaining time is for practice of carrying out the operation on the e-learning materials for Compiere ERP.

Table 2 Class structure of management information system with online business game and ERP operation practice

<table>
<thead>
<tr>
<th>Part</th>
<th>Lesson</th>
<th>Class content</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part1</td>
<td>1</td>
<td>Management information system slide</td>
<td>Introduce management information system knowledge</td>
</tr>
<tr>
<td>Part2</td>
<td>2~4</td>
<td>Online business game</td>
<td>Enhance understanding of business process</td>
</tr>
<tr>
<td>Part3</td>
<td>5~7</td>
<td>ERP practice e-learning</td>
<td>Master Compiere operation</td>
</tr>
</tbody>
</table>

3.2 Class content for ERP operation practice at Part 3

Table 3 shows the operation practice part using the operation e-learning materials. As previously mentioned in section 3.1, Part 3 is the most important part of the class. For students to be able to learn the wide range of management functions of the Compiere ERP, Part 3 has 3 components from lesson 5 to 7 as practice lessons. Each lesson has one practice. Each practice lesson is divided into the first and latter half. The e-learning materials and the purpose are selected as shown in Table 3.

Practice 1 in the first half is the lecture about knowledge of ERP and the Compiere system. Practice 1 in the latter half is for section 5.1.1 customer registration. Practice 2 in the first half deals with section 5.1.2 address registration, and the latter half is for section 5.4.1 order received. Practice 3 deals with 5.5.1 section inventory displacement in the first half, and addresses section 5.7.3 performance measurement dashboard in the latter half.

3.3 Teaching tool

The operation of ERP e-learning is carried out as an online practice. Every student has to sign up to participate in the operation on the learning management system (LMS) called WebClass. A list of attention points for the operation e-learning is made, distributed to the students, and shown on the document camera in a classroom to explain it to the students. The existing operation procedure using training manual textbooks [5] and the operation flowchart which uses a Compiere ERP book [21] for each practice part is also distributed to help the students understandings.

Furthermore, tests and questionnaires are designed for measuring learning effects and satisfaction in a lecture format and e-learning materials. Table 4 shows what the list of the tests and questionnaires are conducted based on [12]. A test using a fill-in-the-blank form both for the first half and the latter half as the pre/post-test is administered by the teaching assistant at the beginning and end of the lesson. The total points of the pre/post-test is 10 points, it consists of 5 points for the first half and another 5 points for the latter half. According to Table 3, the first half at practice 1 is carried out by lecture, thus at this part the quiz is used instead of a fill-in-the-blank form test. In addition, a self-evaluation questionnaire about the operation learning degree is carried out at the beginning and end of the lesson.

The pre/post-self-evaluation questionnaire is divided into 5 stages, high, moderately high, medium, moderately low, and low as shown in Table 5. High indicates that the student learned very well the e-learning training and lecture description. Moderately high means that the e-learning training and lecture description are understood by the student but knowledge of the class is somewhat lack-
ing. Medium indicates that the student is able to understand the significance of the e-learning training and lecture description. Moderately low means that the student can understand the lecture description but cannot understand the e-learning training. Low indicates that both e-learning training and lecture description cannot be understood.

With regard to measurement of learners’ satisfaction, the satisfaction of the lecture structure and the e-learning materials are measured with the 5-stage satisfaction evaluation questionnaire, and a free description questionnaire is administered at the end of class. All of these tests and questionnaires are installed on the learning management system WebClass as the e-learning materials.

Table 4 List of tests and questionnaires

<table>
<thead>
<tr>
<th>Measurement purpose</th>
<th>Types of test and questionnaire</th>
<th>Pre-test/ questionnaire</th>
<th>Post-test/ questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class learning effect</td>
<td>Fill-in-the-blank</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td>Multiple choice question</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Class satisfaction</td>
<td>Multiple choice question</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td>Writing task</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Table 5 Five stages of concrete content of pre/post-self-evaluation questionnaire

<table>
<thead>
<tr>
<th>Five stage</th>
<th>Concrete content</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Student can learn very well the operation e-learning materials and lecture description.</td>
</tr>
<tr>
<td>Moderately high</td>
<td>E-learning training and lecture description were understood by the student but knowledge of the class is somewhat lacking.</td>
</tr>
<tr>
<td>Medium</td>
<td>Student is able to understand the significance of the e-learning training and lecture description.</td>
</tr>
<tr>
<td>Moderately low</td>
<td>Student can understand the lecture description but cannot understand the e-learning training.</td>
</tr>
<tr>
<td>Low</td>
<td>Student cannot understand both e-learning training and lecture description.</td>
</tr>
</tbody>
</table>

4. Class implementation result

The learning management system of the WebClass automatically summarizes the test and questionnaire data from the students. In this section, the pre/post-test, pre/post questionnaire, 5-stage satisfaction questionnaire and free description questionnaire are analyzed. Additionally, each test and questionnaire result is compared with the demonstration lesson at Meiji University [16] and discussed.

With respect to a difference of the evaluation method from Meiji University, at the end of UEC class, a final report is also given for students to evaluate the business game and to give their opinion of how the management information system should be connected to the e-learning materials that have been used in the class or other topics that have been referred to in the class.

Also, at the end of the class, the class evaluation questionnaire is also administered which is prepared by the UEC for all of the classes. The result is analyzed and compared with the previous year in 2015 class evaluation. In addition to the management information system class, the e-learning material is also provided in another production management class for undergraduate students at the 3rd year. Each student who has experienced the e-learning material is required to write his or her own impression of it.

This section 4 discusses the results of each class test, questionnaire and report in UEC, and compares the results with those of the Meiji university class or with the previous year’s management information system class in UEC in terms of 3 research questions:

i. How has the students' level of understanding and the feeling about their operation of Compiere ERP changed through the class? From the test and questionnaire result what differences have been found between the two universities at UEC and Meiji?

ii. How does the student evaluate the class including the lecture slides, pre/post-test and four modes of e-learning (Auto demo, lecture, pretest and exercise). From the test and questionnaire result, what differences have been found between the two universities at UEC and Meiji?

iii. How does the student think the management information system class should be changed for this and the previous years in UEC? Has the learning impression of management information system class been improved than before?

4.1 Measurement of class learning effect

a. Pre/post-test analysis

Figure 3 shows the pre/post-score average and deviation of the 3 practice lessons. The first and the latter half of each practice test has a maximum 5 points in total. The horizontal axis shows the results of the pre/post-test for each class, while the vertical axis represents the pre/post-test scores.

Overall, compared with the pre-test, the average score of post-test tended to increase 3 times higher than that of the practice lessons. The first and latter half of practice 1 and the first half of practice 2 have almost the same gap of about 0.58 between the pre/post-test. In the latter half of practice 2 and 3, the points clearly increased at the post-test. The former results increased by 2.12 points, and the latter ones are also increased by 0.88 points. However, the points in the first half of practice 3 increased by only 0.24 points. Therefore, some improvements should be made for the pre/post-test contents, especially to the first half of practice 3 in order to observe the score point changed more clearly before and after the operation practice. Another reason why some pre/post-test’s scores changed obviously but the others are not improved is that there was a difference degree of difficulty for each test.
Additionally, the gap of deviation between the pre/post-test is not found except in the latter half of practice 1 and 3. At the latter half of practice 1, it can be considered that although students have learned about some knowledge of the management information system and Compiere ERP, it is still difficult for them to understand section 5.1.1 customer registration. This result is reflected on the pre-test, and the deviation became smaller through the e-learning operation. On the other hand, at the latter half of practice 3, the post-test score deviation is higher than that of the pre-test. According to the learning times recorded in minutes, the operation time for the e-learning in the latter half of practice 3 is shorter than that of the others. This may have been because the limited less operation time causes the high deviation compared to that of the pre-test.

In the learning data of Meiji University [16], the score in the first half of practice 1 increased by 2.2 points which was higher than that of this UEC class by 0.58 points. One of the reasons for this increase is that the students at Meiji University have no previous knowledge of industrial engineering and management since their major is mechanical engineering. After the lecture, students absorbed the knowledge and obtained higher score in the Meiji University class. Additionally, the latter half score of practice 1 in the Meiji University class increased by 0.6 points, which was close to that of the UEC class by 0.58 points. With regard to practices 2 and 3, the increased scores in the Meiji class were lower than those in the UEC class. However, at the latter half of practices 1, 2 and 3, the trend of the changes for the scores between the pre/post-test was similar for both the Meiji University and the UEC classes. It is thought that the students at Meiji University began to use the operation materials immediately starting from practice 2 without any lecture.

b. Pre/post-self-evaluation questionnaire analysis

In order to confirm the level of understanding from the practice of the e-learning materials, the pre/post-test was carried out. Furthermore, a learning feeling level was also surveyed by each student for the five stages as high, moderately high, medium, moderately low and low.

In Figure 4, the horizontal axis shows the percentage score of the pre/post-evaluation questionnaire in each practice class, while the vertical axis means the pre/post-score of each practice for operation content. In other words, Q1 in practice 1 is for the section 5.5.1 customer registration, while Q1 and Q2 in practice 2, respectively, is for section 5.1.2 address registration and section 5.4.1 orders received. Finally, Q1 and Q2 in practice 3 respectively is for section 5.5.1 inventory displacement and for section 5.7.3 performance measurement dashboard.

Through all the practice lessons, the percentages of the medium, moderately high and high levels of pre-questionnaire reached over 70%, which means more than 70% of students were able to understand the e-learning training and lecture description. One of the reasons is that the lecture slides for introducing the management information system of part 1 and the business game of part 2 seemed to help students understand well. By comparing the results of the pre-questionnaire to the post-questionnaire, the total percentage of high and moderately high apparently increased. Regarding the percentages of high and moderately high total, Q1 (section 5.1.1 customer registration) in practice 1 became 48%, and Q1 (section 5.1.2 address registration) and Q2 (section 5.4.1 order received) in practice 2 were 81%. However, Q1 (section 5.5.1 inventory displacement) and Q2 (section 5.7.3 performance measurement dashboard) in practice 3 were slightly decreased and became about 71%. A possible reason for this is that the operation process of both Q1 and Q2 is more complicated than that of other practice lessons.

The latter half of practice 1 and the first half of practice 2 are all about the registration, the latter half of practice 2 is about the product order which uses the registration information. The first half of practice 3 is about inventory
displacement. Once the inventory shortage happens in a store warehouse, the product will be moved from other warehouses to this warehouse. The latter half of practice 3 is about making the performance measurement dashboard by setting the standard number, the colour and so on. Both parts are new areas for students.

The result in Meiji University also showed the same trends [16]. The total percentages for high and moderately high in practice 1 are 25%. It then became 50% and increased by 25% in practice 2, but the percentage became 33% and decreased by 17% in practice 3. However, the total percentages of high and moderately high became obviously lower than those in the UEC class where the respective percentages in practice 1, 2 and 3 were 48%, 81% and 71%. One possible reason for this is that the UEC class was implemented not only with the operation practice but also with the lecture description and online business games in the previous lectures. Therefore, the UEC students can use the e-learning materials more masterfully due to understanding the intent of the operation.

4.2 Measurement of class learning satisfaction

c. Analysis of 5-stage satisfaction evaluation questionnaire for teaching materials

In the 5-stage satisfaction evaluation questionnaire, the four modes of the operation e-learning (auto demo, lecture, pretest and exercise), the lecture slides and pre/post-tests are also evaluated quantitatively as extremely satisfied, moderately satisfied, neither satisfied nor dissatisfied, moderately dissatisfied and extremely dissatisfied.

Figure 5 shows the result of the 5-stage satisfaction questionnaire teaching materials. The horizontal axis indicates the percentage of the 5-stage satisfaction, while the vertical axis shows the teaching materials. Through all of the practice lessons, the satisfaction above moderately high is over 50% Except the lecture slides for class, the satisfaction of the four modes of the e-learning materials and pre/post-test shows the growing trend from practice 1 to 2. However, when it comes to practice 3, the satisfaction is slightly decreased.

According to the pre/post-test and pre/post-self-evaluation questionnaire, the test score and operation level of practice 3 are lower than that of practice 2. On the other hand, it is considered that the former part of practice 2 is similar with practice 1, and the operation step at the latter part of practice 2 is longer. The operation at
practice 2 is not complex and easy to understand. Furthermore, as mentioned in the free description questionnaire of practice 2, the operating purpose of each operation part and the reason why student’s operation predicated to be a mistake even if they do the correct operation while taking the e-learning material’s pretest or exercise mode at practice 1 lesson are discussed and described. In practice 3, the complex operation may be the main reason for the result of lower satisfaction. On the other hand, from the free description questionnaire, students can efficiently use the exercise mode practice, and the operation process can be remembered naturally. However, the free description questionnaire in practice 3 also shows that some students are tired using e-learning materials after practicing three times. Additionally, some students seem to begin to feel that the e-learning practice is boring. These feeling are also one of the reasons for the lower satisfaction.

Since the data at Meiji University is collected from only 5 students, it is not easy to compare the results between the Meiji and UEC classes. However, the overall satisfaction in the UEC class seems better than that in the Meiji class because the satisfaction level above moderately satisfied of all the parts is over 50% throughout practice 1, 2 and 3. However, the respective pretest mode percentage of the satisfaction level above moderately satisfied is just 25% and 16.7% at Meiji University for practices 1 and 3, while the satisfaction level above moderately satisfied of pre/post-test is 0% for practice 2.

d. Analysis of free description questionnaire

The free description questionnaire is carried out at the end of the class. It is provided for each student to describe their opinions about the e-learning materials, the Compiere ERP system and other things such as class structure and description including both the advantages and disadvantages.

Table 6 shows the results of the free description questionnaire from practices 1 to 3. In practice 1, many students are satisfied with the system operation e-learning because it enabled them to explain the operation method on an actual screen with voice comments (#1). Also, the students can study at their own pace using the individual e-learning on the LMS (#2). Therefore, it is considered that this skill practice lesson results in better understanding by comparing it with the class which only has a description (#4). However, the practice lesson also had some disadvantages. For example, even if users click or input on the correct place, it is judged as a mistake which is called a positioning bug. This happens frequently while doing the input operation (#5), and the purpose of the operation cannot be understood well by students (#6).

In addition, the students have some requests which require more operation time (#8), and more detailed information about why the positioning bug happens. Therefore, the teaching assistant explained the operation purpose of this part and the correct input operation method to prevent the positioning bug from happening in practice 2 lesson. As the free description of practice 2, the students can use the e-learning materials more efficiently by understanding the operation purpose (#11). Also, when a student’s input operation is judged as a mistake by the pretest mode, the student is able to distinguish it from his mistake input operations or the mistake input contents (#10). However, some students begin to feel that the voice comment guidance of the e-learning mode is unnecessary (#14). Since the speaking speed is slow, it is slower than a user’s reading speed. Therefore, for the operation e-
### Table 6  The result of the free description questionnaire

<table>
<thead>
<tr>
<th>Practice 1</th>
<th>Advantages</th>
<th>E-learning material</th>
<th>Compiere ERP</th>
<th>Others (class structure, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>#1 With voice commands and the learning operation method on the actual screen, it is a meaningful study.</td>
<td>#3 I think it is a convenient tool that can collectively manage a variety of information.</td>
<td>#4 This class has lectures and skill practices, and is easier to understand in contrast to the lecture lesson.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>#2 Progressing at an individual pace, proceeding after firmly understanding. There is no need to worry about not keeping up with other students.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disadvantages</td>
<td>#5 Some bugs occur while doing the input operation (especially Kana and Kanji input).</td>
<td>#7 Multiple kits of information is present at one screen which is difficult for beginners. It is better to change the information quantity according to the user’s proficiency.</td>
<td>#8 The operation practice time is not sufficient. #9 Operation method is hard to understand. Maybe it is better to explain it by practice.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#6 I cannot get the whole picture of the operation and also cannot understand the purpose of each operation step well.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practice 2</td>
<td>Advantages</td>
<td>#10 The reason for operation mistakes has been explained. So when judged as a mistake in the pretest mode, I can distinguish it from my mistake input operation or the mistake input contents.</td>
<td>#12 I think this system is very functional that an address can be find by inputting the post code.</td>
<td>#13 It is good that a part of the practice operation time is long.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>#11 Operation purposes are explained at the beginning of the class so I can use the e-learning material more efficiently.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disadvantages</td>
<td>#14 Words commands are enough, and voice is not necessary.</td>
<td>#16 It is difficult to image how the actual Compiere ERP system works when users learn without touching the real ERP system.</td>
<td>#17 There are too many paper documents. If this information can be confirmed by the software, it is easy to be used.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#15 If users can control the speaking speed, it perhaps can meet a lot of needs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practice 3</td>
<td>Advantages</td>
<td>#18 When beginning the study without voice guidance mode, I find it more difficult than I expected.</td>
<td>#20 Achievements can be understood well from the dashboard function by a visual sense.</td>
<td>#21 The Compiere ERP system demo explaining how it works is shown.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>#19 The complex operation can also be mastered doing it many times.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disadvantages</td>
<td>#22 I can study with this e-learning material but cannot solve the fill-in-the-blank form test. Maybe it is just my personal problem.</td>
<td>#23 The operation step at this time is particularly difficult.</td>
<td>#24 Doing the operation practice just feels like a paper work. #25 I feel bored doing the e-learning material’ operation after three times of practice.</td>
<td></td>
</tr>
</tbody>
</table>

learning materials, the word commands which explain the operation method displayed in a balloon on the screen is enough for some students.

Also, the other students request to see the actual Compiere ERP system (#16). Hence, from the practice 3 lesson, the Compiere ERP system demo is performed to help students understand Compiere ERP well. Finally, the free description shows that the students have already mastered the operation method and can do complex operations (#19).

In addition to that, as mentioned about practice 2, some students feel that the voice guidance is unnecessary (#14). Thus, in practice 3 students begin to study without using the auto demo or lecture mode which has voice guidance. However, some of them find the study more difficult (#18). On the other hand, when the practice is done for the third time, some students began to feel bored about the operation practice (#25). It seems for them to just be a paper
work (#24).

4.3 The final evaluation

e. Analysis of management information final report

At the end of the lesson of this lecture, students prepare a final report by writing an evaluation about the business game and giving their opinion of how the management information system should be managed by connecting with the e-learning materials or other topics that have been referred to in the class. Based on the final reports of students, most of the students answered that the management information system is easy to use. In addition, the management information should not only be limited to the enterprise fields but also widely used in education, health care and others fields to make society more productive. On the other hand, students pointed out that the huge and complex business processes in the management information system make it difficult for users. As a solution to this problem, students agree that the e-learning materials used in the class can solve the difficult operation problems. It can help users to master the operation of management information systems more effectively.

f. Analysis of class evaluation questionnaire carried out by UEC

At the end of the class, we also conducted the class evaluation questionnaire which was prepared by UEC for all of the classes. The questionnaire content is shown as at Table 7. This year’s questionnaire result is compared with the last year’s one in 2015. The number of respondents was 9 people and the response rate was 56.3% in 2015. In 2016, the number of respondents was 17, and the response rate was 85%. The figure shows the deviation value for each class evaluation questionnaire in 2015 and 2016. From the figure, it can be seen that the deviation value of 2016 is higher than that in 2015, especially for Question 1, 3 and 4.

Based on the answers to Question 1 (How often did you attend this class?), it seems that it was effective to conduct a quiz at the beginning of the class. The results of Question 3 (Did you compensate by asking questions or seeking out the answers yourself regarding the points that you did not understand during the class?) and Question 4 (Do you think you have acquired knowledge, thinking ability, skill, etc. according to the purpose of the class?) were also much higher than that of the last year. By implementing a business game and e-learning operation materials, students became deeply interested in the lessons, and it is thought that they also acquired skills. However, the result of Question 11 (Was the class conducted according to the syllabus?) was lower than that of last year’s evaluation. The reason for this result is due to the part of the practice lesson which used e-learning materials and was not written obviously in the syllabus and was not updated because the e-learning materials were under development. Also, the evaluation of Question 12 (Overall, was this class beneficial to you?) was decreased. However, the number of respondents this year was double compared to that of the last year, and the response rate was also higher.

<table>
<thead>
<tr>
<th>Question</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>How often did you attend this class?</td>
</tr>
<tr>
<td>Q2</td>
<td>How much time did you devote to this class for prep, review, reporting, etc. on average per week?</td>
</tr>
<tr>
<td>Q3</td>
<td>Did you compensate by asking questions or seeking out the answers yourself regarding the points that you did not understand during the class?</td>
</tr>
<tr>
<td>Q4</td>
<td>Do you think you have acquired knowledge, thinking ability, skill, etc. according to the purpose of the class?</td>
</tr>
<tr>
<td>Q5</td>
<td>Was each lesson well prepared and organized?</td>
</tr>
<tr>
<td>Q6</td>
<td>Were the explanations easy to understand?</td>
</tr>
<tr>
<td>Q7</td>
<td>Could you hear the professor’s voice well?</td>
</tr>
<tr>
<td>Q8</td>
<td>Was the writing on the blackboard or slides easier to read?</td>
</tr>
<tr>
<td>Q9</td>
<td>Were the teaching materials (textbooks, prints, quizzes, web materials etc.) appropriate?</td>
</tr>
<tr>
<td>Q10</td>
<td>How was the speed of the class? (not about superior or inferior)</td>
</tr>
<tr>
<td>Q11</td>
<td>Was the class conducted according to the syllabus?</td>
</tr>
<tr>
<td>Q12</td>
<td>Overall, was this class beneficial to you?</td>
</tr>
</tbody>
</table>

Fig. 6 Deviation value for each class evaluation questionnaire

g. Analysis of free description from production management class

In addition to using the e-learning materials in a management information system class, it also is used in the last lesson of the production management class for undergraduate students. E-learning materials could not be run on WebClass due to environments of a computer room. Instead, we used one laptop with the e-learning materials loaded. Also, as the class time was limited, students had just a few minutes to use and review the e-learning materials. Additionally, students gave some opinions about the e-learning materials through the operation experience. Most
of their opinions were similar to the opinions of students from the management information system class. However, they were also some new viewpoints. For example, one student pointed out that the study of the e-learning materials was just like playing a game which makes the study interesting and easy to remember for young people.

5. Conclusions and future research directions

The aim of this paper is class implementation of a system operation e-learning for Compiere ERP. Tests and questionnaires are carried out for operation of a practice lesson. The result of the tests and questionnaires are also compared to those of a class at Meiji University (Xu et al., 2016) [16]. Also, the implemented management information system class is compared with last year in 2015. The main conclusions drawn are as follows:

- The class with the system operation e-learning by Compiere ERP was implemented as planned. The e-learning materials, tests and questionnaires were installed to the LMS WebClass successfully. Additionally, the students cooperated in completing the tests and questionnaires.

- The tests and questionnaires showed that the student’s understandings for management information systems were improved. The learning effect at the regular class in UEC was more obvious than one at demonstration lesson in Meiji University at the experimental class.

- The evaluation from students to management information system class this year was better than one the last year (2015).

In the terms of future research directions, firstly, the pre/post-test should be considered and developed into an easy observation test. The management information system class should be developed diversity, not only the traditional lecture or just the practice lecture to improve student’s curiosity about this class. Additionally, other kinds of e-learning for the Compiere ERP study should be developed for company employees.

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