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Sustainable Development and Maintenance of e-Learning Materials

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Abstract: This paper discusses sustainability in Web-based education from the viewpoint of both development and maintenance of e-Learning materials. Based on the examination on the conversional model in our e-Learning system, we proposed a new project-based learning model for sustainable contents development and maintenance, where two types of student functions cooperate under a hierarchical organizational structure. This 4-year case study explores the effectiveness of our approach.

Keywords: development and maintenance of materials, project–based learning, e-Learning

Introduction

Recently, lack of manpower for development and maintenance of web-based educational systems and/or their contents has become an issue in most Japanese universities. For effective deployment of web-based educational systems, a management system, which enables sustainable development and maintenance of the contents, is indispensable. From the educational point of view, a project-based management system based on the collaboration between students, highly-skilled staff and teachers is the most effective. In Japan, however, there have been little case studies on this topic. This paper describes our proposal for project-based learning by means of contents making and maintenance as a solution for desirable sustainable management system of web-based educational systems. Our approach has been experimentally introduced into several of our undergraduate subjects. Results of an evaluation through 4-years of operation are also described.

1. Overview of our e-Learning

This chapter describes the outline of the learning management system (LMS) and materials of the e-Learning system in CIST (Chitose Institute of Science and Technology). Our e-Learning system has been used in various educational situations such as for homework and blended learning both in lectures and exercises. Over 5,000 textbooks and 13,000 exercises are introduced in the e-Learning system. All materials are created by staff and students in our university. Most contents are developed using the Adobe Shock Wave Flash (SWF) format. The exercise material consists of 3 frames: a problem description, hints, and an answer box as shown in Fig. 1. The hints frame allows users to view 3 hints, which appear step by step at the user's request. The textbook material has 2 frames: an animation and an explanation related to the context of the animation appearing step by step at the user's request. The LMS was constructed under the original specification of CIST. The LMS has as its key function the management of the learner's detailed learning records including hint information.

2. Conventional model of contents making

2.1 Contents making processes

Figure 2 illustrates the use case for the project-based contents making process, which represents our conventional management system introduced from the beginning of our e-Learning system. We designate 4 roles in the use cases: A teacher making the draft for materials, a staff member providing templates for materials, a developer making the contents of the material by using the template along with the teacher's draft or scenario, and learners using the materials for their study in the e-Learning system. Note that, in our use case, the developer is appointed from among the students who specialize in information technology.

A draft image of the material is provided by the teacher to explain the e-Learning course in his/her lecture. The draft image is drawn either on paper or in electronic format. On the other hand, templates are provided by the staff to maintain the uniformity and the quality of materials. We define 19 different kinds of templates in accordance with the instruction design. Figure 3 shows an example of the exercise template. It has components of a question text, answer boxes (textbox, drop-down list, etc), and some hints. Student developers can make materials by simply editing those components. For a student with basic skills of SWF, it is estimated about 6 hours to make 12 exercises, compared to 18 hours to make similar exercises without templates.

2.2 Problems in the conversional model

To maintain a sufficient level of education, it is very important to guarantee a supply of new and/or updated versions of content materials to all users in a timely manner. Therefore, sustainable development and maintenance systems must inevitably keep the web-based education system effective. However, our conventional model has two major problems in this sense. One is the skill development of the contents developer. The other is the maintenance of the contents. Even though the developers have specialized in information technology, they are not trained to work with customers to satisfy their needs. Furthermore, since the developers change every year, it is difficult to make modification to the originals later. This leads to the materials becoming obsolete and insufficient.

3. Proposed model of contents making and maintenance

3.1 Approach to Sustainable Model based on Project-Based Learning.

This chapter describes our proposal for a model of sustainable development and maintenance of the content materials. Figure 4 shows the use case of the proposed model. The main feature of the use case is project-based learning that is introduced in the course of a career development program for sophomores at CIST in the information science area. A learner who joins the project-based learning is referred to as "project members". Project members are divided into several teams. The average number of the students in a team is 5. Throughout the material development process, project members learn skills not only in software technology but also in dealing with customers' demands from senior students called "media consultants". The media consultants act as advisors to the project members,

and simultaneously they are part-time workers for the maintenance of the material. They are appointed from among students who have experience as a project member. Media consultants not only give training in SWF skills but also encourage the project members to communicate with the teacher, who is the customer of the output from the project. All projects are supervised by a teacher specializing in information and communication technology. He takes responsibility of the whole project-based learning. The teacher, media consultants, and project members work together to fulfill their objective. Continuing this activity helps the progress of students' knowledge and software skills, and consequently leads to successful construction of the system for sustainable maintenance and development of the e-Leaning materials.

3.2 Case study

The proposed model has realized the organization of over 90 members in project-based learning every year. The hierarchical training structure explained in the previous section has been well managed to develop and maintain the materials. We evaluated the degree of sustainability on the basis of the number of developed and maintained materials from 2005 to 2008, as shown in Fig. 5. Developed materials are over 2,000 every year from 2005 to 2007. Our project was selected as a Good Practice of Learning in Japan supported by the Ministry of Education, Culture, Sports, Science and Technology for the 3-year term from 2005 to 2007. In this period, since the teachers participating in the project actively used the e-Learning system in their lectures, demands for new materials were quite high. After the project was completed, the number of revised materials increased. These results indicate that the hierarchical organizational structure, namely the project manager, media consultants and project members, works quite effectively for the sustainability of the contents development and maintenance.

4. Conclusions

We have proposed a project-based learning model for the sustainable development and maintenance of e-Learning materials. From the case-study for 4 years from 2005 to 2008, it was shown hierarchical organizational structure (project manager, media consultants and project members) in the proposed model worked quite effective for the sustainability.

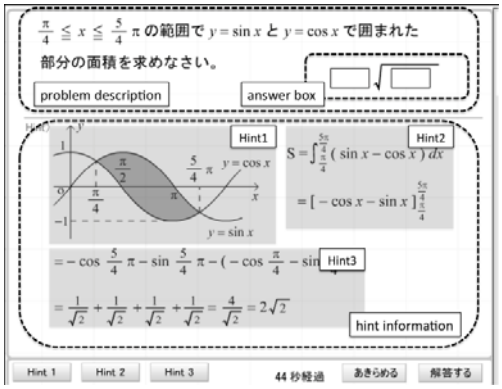

Figure 1: Screen image of exercise

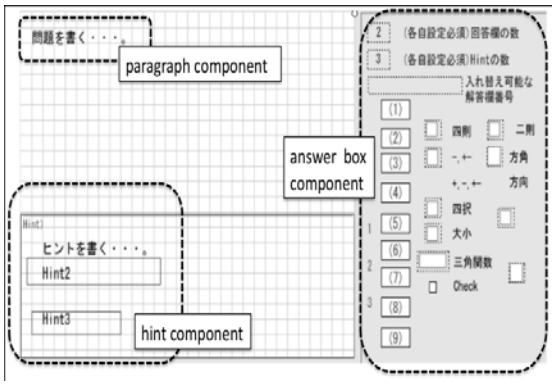

Figure 3: Example of exercise template

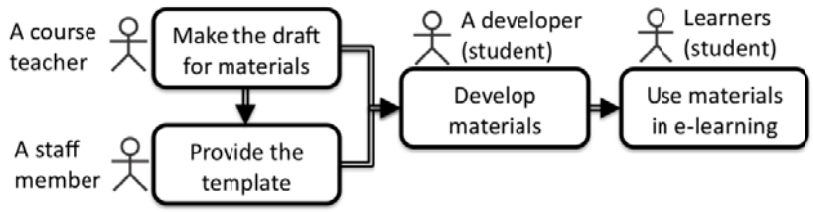

Figure 2: Use case in conventional model.

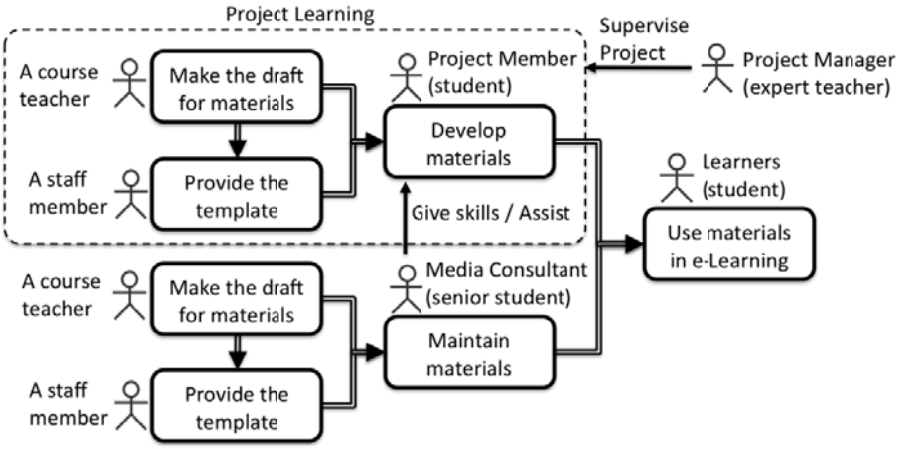

Figure 4: Use case of proposed model.

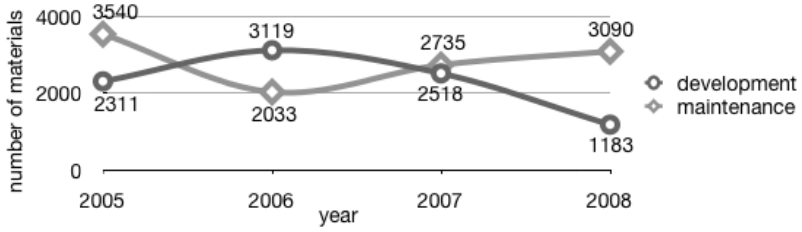

Figure 5: Number of developed and maintained materials from 2005 to 2008

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References

[1] National Institute of Multimedia Education (2008). Inquest Repot of ICT Based Learning that Using e-Learning Systems In Japan vol. 2008. 18-23.

[2] S, Tsuneo et al. (eds.) (2006). Development of Teaching Materials and the Initiative of Education by e-Learning. *Journal of Multimedia Aided Education Research 2006*, *2*(2), 11-17.

[3] H, Shigeru et al. (eds.) (2007). Production of e-Learning Contents and Their Utilization in Many Fields. *Journal of Multimedia Aided Education Research 2007*, *3*(2), 85-94.

[4] K, Hiroshi. (2005). Experimental Study of e-Learning To Realize Knowledge Sharing For Science and Technology. *Journal of Multimedia Aided Education Research 2005*, *1*(2), 11-22.