# Web-based Learning Material Development with less experienced staffs' Participation

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**Abstract:** In this paper, we report the way in which we have developed the high quality and elaborately designed learning material contents with less experienced staffs' participation. Basically we have followed to the instructional design models. In addition, we have prepared a "contents outline", which is clearly separated from a "class outline" to design each class of the Java programming course. We are able to make the part which less experienced staffs can participate clear and develop a high quality learning material contents systematically. We have carried out the Java programming course in 2006 and 2007 successfully using the learning materials developed following our method.

**Keywords:** Learning material contents development, WBL, student assistant, CMS, Java programming, class outline, contents outline

## Introduction

We have been practicing the programming course in the self-learning style using Course Management System (CMS). It is very difficult to start up a self-learning style course that uses web-based learning materials because teachers need to spend much time and make efforts to prepare it. At the universities in Japan, teachers normally act as both a designer and instructor, and they are taking charges of a lot of classes. Therefore teachers cannot take enough time to prepare learning materials. To reduce teacher's load, another staffs' participation is strongly hoped for. It is necessary not only to follow the procedure of the instructional design model but also to design the learning material contents so that even less experienced staffs are able to participate and develop a high-quality learning material efficiently. To deal with it, we have introduced a "contents outline". A contents outline is the design that focuses on learning material contents. Using a contents outline, we could successfully develop the learning material contents with less experienced staffs' participation.

## 1. Background of the development of learning materials with less experienced staffs' participation

We have been trying the development of learning materials by less experienced staffs' participation. We tried in the learning material development of the makeup class of C++ programming [1] and the distance course of Java programming with students' participation. The teachers in charge of the related classes, including authors, designed these classes

following the procedure defined in instructional design models and wrote a “class outline”. The students made the learning material contents based on the design.

However, those contents did not have the qualities that were able to be actually used in the classes. We think that though they might have enough abilities to develop individual contents, the students are immature to summarize a whole composition. We think that a class outline was not suitable for this use. To make use of abilities effectively, we thought that we had to make a more detailed design in which attention to contents themselves should be paid.

## 2. Learning material development for a web-based self-learning style class based on instructional design concepts

In a self-learning style class, it is very important to develop learning materials so that learners can surely understand. To design such learning materials, instructional design concepts and systematic models are very valuable and helpful. A lot of systematic instructional design models have been proposed. Many of them follow the basic instructional design model that contains core five steps: Analysis, Design, Development, Implementation and Evaluation. This model is called the ADDIE model. Gagné et al. uses the ADDIE model as a basis of the framework of their model [2]. Dick and Carey’s model [3] consists of ten steps that are based on the ADDIE concept. Dick and Carey’s model defines detailed systematic procedures. However, sometimes it is very hard and time consuming to follow all the steps in Dick and Carey’s model in real situations. Gustafson et al. classified instructional design models into three types, which are Classroom Orientation, Product Orientation and System Orientation [4]. Our current study which focuses on the learning material development for a self-learning style course seems to have both Classroom Orientation and Product Orientation characters. Morrison, Ross and Kemp’s model [5] also consists of nine elements. However, the order in which you address the individual elements is not predetermined. You may not require treating all nine elements in their model. This model seems useful when you utilize instructional design models in a real situation.

Among the books written about the concrete procedures for designing and developing learning materials along systematic approach, there are “Learning material Design Manual” [6] and “e-Learning Handbook” [7]. Learning material Design Manual describes the process of making learning materials, especially for the use in self-studies. It describes what you should plan and what you should prepare in each step of the systematic approach comprehensively. E-Learning Handbook describes procedures of the development of learning materials for e-Learning classes at universities concisely. Although this model is based on Dick and Carey’s model, it has been adopted so that it can be used in learning materials development at university lectures. We design and develop our Web-based learning materials along the procedures in e-Learning Handbook.

## 3. Development of a “class outline”

The instructional design steps can be divided into two phases: design of the whole course and design of each class. Our main interest in this study is the design and the development of the learning materials of each class rather than the design of a whole course. In Dick and Carey’s model, the learning objectives of the course are divided into clusters in “develop instructional strategy” step. This cluster corresponds to one class in university lecture

courses. We have designed a whole course and each class following to the steps proposed in e-Learning Handbook [7].

A typical flow of a class described in e-Learning Handbook is shown in Figure 1. These elements are referred from Dick and Carey's five learning components [3] which are based on Gagné's nine events of instruction [8]. One of the roles of the introduction step in Figure 1, which corresponds to pre-instructional activities step in Dick and Carey's five learning components, is gaining motivation. Keller's ARCS model of motivation [9] which consists of four elements: attention, relevance, confidence and satisfaction, should be taken into account in this step.

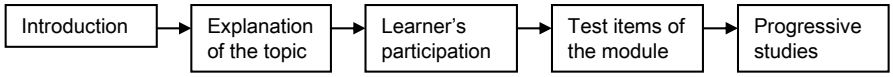


Figure 1. Typical flow of a class [7]

We design a flow and learning activities in each class and develop learning material contents used in the class. We have developed a "class outline" following the procedures proposed in e-Learning Handbook [7]. The composition of a class outline is listed below.

- Objectives of the class
- Test items of the class
- List of the items that should be explained to achieve the objectives
- A flow of the module
  - Introduction
  - Contents of the learning material
  - Learner's activities
  - Test items of the class
  - Progressive studies

We prepare a class outline by filling items listed above. In a class outline, we design a composition and a flow of the whole class which includes learners' activities. You need to choose information which is necessary for the learning material contents development from a class outline. Therefore, we have designed the composition of the learning materials in detail based on a class outline.

## 4. Development of a "contents outline"

A class outline is the output of a design process in which a structure and a flow of a class are designed to make instructions effective. We think that there is the gap between the class design written in a class outline and the learning materials for the class. Therefore the design which focuses on the learning material contents is necessary. The development of the learning material contents are mentioned in some instructional design models. For example, it is explained in "develop / select instructional materials" step in Dick and Carey's model [3]. However, though these instructional models help us when we design a structure, a flow and an activity of a class, it is not clearly mentioned how we develop the contents of the learning materials.

We need to specify the details of the contents if we ask less experienced staffs to participate in the learning material contents development. Normally, it might be assumed that content development specialists develop the learning material contents, and it seems that the contents making after designing the learning materials is out of the concern of the

instructional design concepts. We found in our past work that it is difficult to design a whole learning material contents for less experienced staffs. However, they seem to have enough abilities to write explanations of a simple matter. We outlined the structure of the pages of the learning material contents and the details of each page so that less experienced staffs can develop a segment of the learning material contents. We call it as a “contents outline”. The structure of a contents outline is shown below.

- Objectives of the class
- Introduction
- Explanation of topic 1.
- Examples of topic 1.
- Self tests of topic 1.
- Explanation of topic 2.

  :
- Test items of the class
- Progressive studies 1.

  :

The items in the highest level correspond to each page. In each item in a contents outline, what should be explained in the page is described as in detail as possible. The detailed descriptions will reduce the part that less experienced staffs need to design by themselves.

## 5. Development of the learning material contents with less experienced staffs’ participation

We have developed the learning materials in cooperation with Learning Technology Laboratory (LT Lab) in our University. The teachers who are taking charge of the subject, including authors, and the student assistants of LT Lab (LT Assistant, LTA) develop the contents of the learning material. We asked the postgraduate students to participate the learning material development as LTA.

## 6. Results of the practice

We have developed the learning material contents of each class for the Java programming courses following to these procedures. We put the Java programming classes into practice using the learning materials in 2006 and 2007. Each Java programming course consists of fifteen of 90 minute classes.

It is very difficult to evaluate how the quality of the developed learning material contents is. The teachers who participated in the course think that the quality of these contents has been kept in high level.

We carried out the survey by asking students to fill in a questionnaire after the last lecture in the Java Programming 1 course. We asked three questions. The first question was “(1) How is the usability of the learning materials?” The second question was “(2) Have you understood the whole contents?” The third question was “(3) Is the quality of the learning materials different among the classes?” In the answer to the question (1), 81 % students answered that the usability is good. In the answer to the question (2), 91 % students answered that they could understand the contents to some extent. In the answer to the question (3), 71 % students answered that they did not find any differences in a quality of the learning materials.

From these results, the learning material contents developed by LTA seem to have been as comprehensible as the learning materials that teachers have developed.

## 7. Discussion

We think that we could develop the learning material contents with very high quality through the whole course. Teachers, including authors, and LTAs could share a very detailed image of the learning material contents by developing not only a class outline but also a contents outline. The finish of the learning material contents developed by LTAs is satisfactory because it is not far from what teachers had imaged. By developing a contents outline, the part of which the teacher had to take charge and the part of which LTAs can take charge were able to be divided clearly. We could avoid making LTAs take charge of the part which they can not develop. This is the one of the reason that we could keep the quality of the learning materials high.

We need to mention that it is a considerable load to design not only a class outline but also a contents outline. In the development of the learning material contents based on a contents outline proposed by this research, we can design and develop the learning material contents using a class outline, and we can also estimate the amount of the work of the learning material contents development. And because the part which LTAs can develop became clear, the teachers' work has been reduced as much as possible. By preparing a contents outline, the process of the learning material contents development become systematic, and we have been able to distribute our resources effectively.

## 8. Conclusion

In this study, we have developed the learning material contents after preparing a class outline and a contents outline with less experienced staffs' participation. Although we could not reduce teachers' work dramatically, we could make the part which LTAs can develop clear. The most important result of this study is that we can develop a high quality learning material contents systematically by preparing a contents outline.

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