

Development of an instructional material and deliver system based on Instructional Transaction Theory

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Abstract: In this study, there was two case of developing the instructional system based on ITT. First, we developed and evaluated the instructional material for sushi restaurant. The system was implemented Execute transaction without knowledge objects. Second, we developed the prototype of delivery system separated algorithm (strategy) and data using knowledge objects.

Introduction

In recent years, e-learning material has increased in Japan or in the world. In order to be a sharable (search) and reusable of e-learning, learning objects were standardized such a LOM (Learning Object Metadata) added meta-data for searching and SCORM (Shareable Content Object Reference Model) separated LMS (Learning Management System) and contents for reusable. On the other hand, as SCORM can't sequence the learning contents (object) by adapting learners before SCORM2004, learning objects is weak in the part of a learning support.

There is the instructional design theory that treats learning objects from the view point of learning support. It is Instructional Transaction Theory (ITT) by Merrill(1999). Wiley(2001) points out the various definitions of the term "learning object" confuse us and he introduced the knowledge objects in ITT is one of the learning objects. More over, he tells instructional design theory must be incorporated with any learning object implementation. ITT is instructional design theory and it uses learning objects.

The purpose of ITT is an effective instruction based on instructional design and efficient instructional development by automating instructional design process. ITT is the theory for a shell construction and aimed automating instructional design, delivered effective learning environment by incorporated strategies of instructional transactions based on an instructional design as algorithms into the system beforehand and registered instructional contents (components and these relationships) as the knowledge representation (data / knowledge objects). The term "shell" means the system can be replaced the data (and has interface for a replacement).

There has been a few study of ITT(Merrill 1998, 1999, 2001) since then and nothing to use actually . ITT has

been still on the way to study, so we consider that a realization of the system is meaningful. Furthermore, we consider that the study about learning objects in the future can refer the concrete ITT system (if realize) by way of presentation and combination of learning objects from the view point of learning support.

In this study, the development and evaluation of the instructional material implemented one strategy of ITT (but knowledge objects didn't be implemented). We, furthermore, developed the prototype of delivery system separated algorithm (strategy) and data using knowledge objects as a basic study of shell system.

What is ITT

ITT is an instructional design theory expanded component display theory (Merrill 1983). This expand search the model of constructing the learning environment automated determining the characteristics of the learning task and analyzing in detail effective conditions for each learning tasks.

Instructional Transaction is defined as all of the learning interactions necessary for a student to acquire a particular kind of knowledge or skill (learning goal), and thirteen classification of instructional transaction is specified.

ITT expresses the knowledge as a knowledge objects. Knowledge objects are defined as containers consisting of compartments (slots) for different related elements of knowledge. Four types of knowledge objects have been identified, entities, properties, activities, and processes.

For example, there is an entity of a switch of a light, the entity has on and off properties, and causes the process if a switch is on then off by the activity of turning off the light.

Merrill(1999) explains three transactions in detail and learning environment to teach the learner how to install or remove a double-seat valve as an example of development . They are Identify, Execute and Interpret transaction of Component transaction class.

An instructional material for work of sushi restaurant based on ITT

Purpose

Some sushi restaurant (rotation sushi) employs daily or temporary part-time worker on holiday and the last day of the year because it has many customers. Though properly the restaurant expects to reduce busyness properly, the works of sushi are stopped in the short time for teaching to him by on the job training. Daily part-time workers are taught by a staff each time when he gives new work content to them. The staff can't do own work while teaching them. They, that is, don't need to be employed. The instructional material are require an effectiveness and efficiency such a performance support system.

So, we developed the instructional material of sushi based on ITT to understand the work contents in the short time before beginning work on the computer for daily part-time workers. The work contents of sushi mainly are the procedure of making sushi or washing dishes. ITT has a strategy for learning procedure (execute transaction).

Analysis of work

First, we investigated the work contents of daily employment. As the result of it, we identify seven kinds of

contents, “washing dishes”, “washing up except the type of dishes”, “a rolled omelette”, “a fishhead soup”, “a fish soup”, “thick white noodles” and “broth”. Next, we investigated the procedure of each kind of contents. For example, the procedure of “washing up except the type of dishes” shows figure 1.

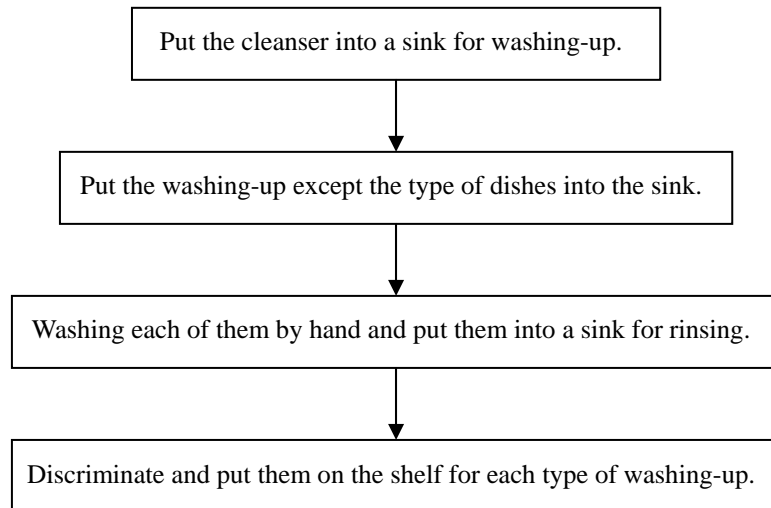


Figure 1. The example of procedure (washing up except the type of dishes)

Design

In the instructional material, identify transaction was considered to understand already, we designed and implemented execute transaction. Interpret transaction wasn't needed to daily part-time workers (only remember and do steps of work). Execute transaction by Merrill(1999) actually consists of 4 level strategies, but our system has 3 level strategies because learners are daily employment and it has limited time for them to learn how to work. The comparison of ITT and this instructional material shows Table 1. It integrates level 3 and 4 strategies so the differences between them are only timing of feedbacks.

Implementation

In this study, Interface of screen of this instructional material was made as similar as possible with actually the place of work (Figure 2). It uses the animation and sound of washing. It displays what level (correspondence to Table.1) does learners progress above the right of screen and has to do as the next step on the right. It developed by Adobe Flash MX (Action Script).

Evaluation

We evaluated at the phase of implementing the contents of “washing up except the type of dishes”, one of the seven contents. This evaluation aimed to see that learners can understand the contents at short time, there is the lack of a series of steps in instructional material, learners can learn without getting stuck. We evaluated it to three university students when a few number of customers is in the restaurant on weekday so that having only a slight influence on the actual business. Pre-test was that they stood actually on a work place at sushi restaurant and

checked to be not understood the work contents of washing up. Post-test was that they work actually. And then, questionnaire and interview did.

From the result of this evaluation, all of them answered they did not understand the work in the pre-test and all of them worked well without failure in the post-test. Consequently they understood the work and this instructional material instructed well.

On the other hand, we observed they took much time to wash carefully. The washing up was very clean but they worked very slowly, and they could not treat the leftover. In this instructional material, therefore, some advices were needed by staff just in time.

The current instruction for daily part-time worker takes about 5 minutes to only teach and about 15 minutes to scaffold or fade based on our experience. Using instructional material, it takes average 5.6 minutes to learn by it at staff room and more 5minutes to instruction by staff at work place. Accordingly, it suggested the instructional time was reduced by this instructional material.

Table 1. The strategy of execute transaction in this instructional material

Level	ITT (Merill 1999)	This instructional material (washing up except the type of dishes)
1	“hands-off” demonstration. The guide performs each of the steps in turn.	The demonstration of the washing-up is shown to learners. It plays by the “next” button and plays back by the “again” button for a review.
2	“Simon Says” demonstration. The guide tells a learner the step to perform. If a learner attempts to do a different step, the guide presents a feedback that the step is incorrect.	The directions from instructional material show what the next step such as “Next, put into the cleanser”.
3	“Do the next step” simulation. The guide only presents the message “Do the next step”. If a learner has mistakes, the guide shows the same level 2 feedback.	The directions are only shown “Do the next step”. Learners only progress by themselves without advice. If they have mistakes such as putting something into a sink to wash before putting into a cleanser., the system tells that they have mistakes and go back to first step without feedback to collect steps.
4	“Performance” or “You-do-it” simulation. A learner can perform any of the steps until a learner decide to finish. The feedbacks are shown by comparing correct path and learner’s path.	



Figure 2. Screen of this instructional material

Development of a delivery environment using knowledge objects based on ITT

System overview

This prototype system was implemented a learning environment, Identify, Execute and Interpret transaction by Merrill (1999) . This system consists of the delivering and authoring environment, but not included the authoring environment this time. The system structure is shown Figure 3. The delivering environment allows learners to explore some devise or settings, in other words a simulation or open-ended learning environment. From the menu, the system allows learners to select the guide of Identify, Execute and Interpret options. The knowledge is expressed by knowledge objects, and the environment was shown based on them. The system consists of a delivering environment for interacting learners, each part of processing transactions and the part of reading data when the system begins. The data consists of XML data of knowledge objects and resource files such images. Furthermore, the menu can be customized such as only the guide of Identify transaction shows because the XML data includes the information of menu structure. The goal information is also included. The Web page is simply a HTML file embedded Flash. We prepare the provisional contents. One of them is canal lock referred to Merrill(2001) and another is Japanese geography referred to Merrill(1998)'s European geography.

Knowledge objects

Knowledge objects are implemented as same as possible with Merrill(1999). The consistent of knowledge objects are shown Table 2.

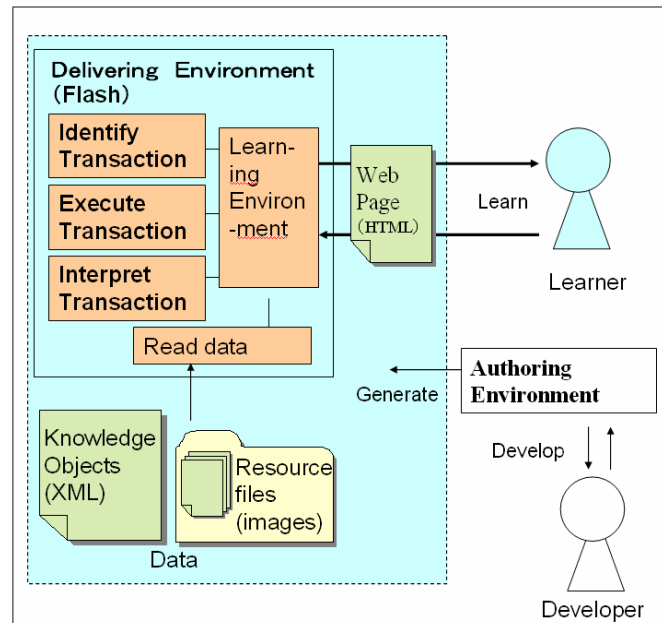


Figure 3. System structure

Table 2. Knowledge Objects

Type	Slots
Entity	name, description, portrayal(resource), properties(pointer), location, parts-of(pointer), has-part(pointer), activity(pointer)
Property	name, description, value, value portrayal(pointer to each portrayal associated value)
Activity	name, description, trigger(pointer to process)
Process	name, description, conditions(go result if true), results(changes of some property value), trigger(pointer to other process)

Transactions

Transactions are implemented as same as possible with Merrill(1999).

Identify transaction strategies displays the name of parts under the cursor, the explanation about the function of parts by clicking the parts. As the practice of Identify, the system shows the name of the part and makes learners select the part corresponding to the name, and shows the list of parts name and highlight the part then makes learners select the item of list. If selected, the system provide right/wrong with correct answer feedback.

Execute transaction strategies is shown Table 1 (left column). The system was implemented from level 1 to 4. Figure 4 shows level 2 of Execute transaction.

Interpret transaction strategies have three levels of the guides to allow learners to predict when given some conditions and explanation the reason why the unexpected result causes (trouble-shooting). Level 1 guide allows the learner to request an explanation after any action during free explanation of the system. The explanation

provides what just happened and why it happened. Level 2 is a “predict” practice. The system gives the learner some situation (action), learner select the correspondence item from the list of properties (conditions and results) predicting after the action. Level 3 is a “trouble-shoot” practice. The system configures a fault of a procedure, makes the learner perform the next step, select the list of properties about what and why happened and change the value of properties if needed. After that, the learner sees the results of perform the step again and the system gives the feedback whether correct or incorrect of its changes.

Conclusions and future work

In this study, there was two case of developing the instructional system based on ITT. We developed and evaluated the instructional material for sushi restaurant. The system was implemented Execute transaction without knowledge objects. On the other hand, we developed the prototype of delivery system separated algorithm (strategy) and data using knowledge objects.

We will evaluate usability of this delivery system and develop the authoring environment. Furthermore, we will design about the remains of ten transactions.

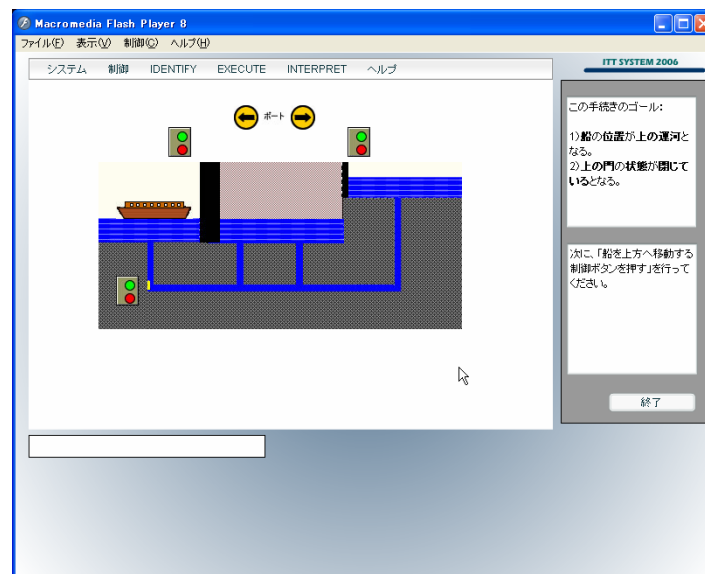


Figure 4. Level 2 of Execute transaction

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