The Knowledge Circulated-Organisational Management for Accomplishing E-Learning

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Abstract: Nowadays, e-Learning has been used in many kinds of educational institutes as a regular learning/teaching system. In the real practices, Educational knowledge management among the relevant organizations is quite important. This means "knowledge in universities circulated-systematic process" of finding, selecting, organising, distilling and presenting information in a way that improves a learner's competency and/or ability to fulfil his or her necessary learning objectives. In order to construct such educational management systems, the fundamental processing modules are required, such as a distributed file system, synchronous data communications, etc. If any applications and tools related to e-Learning can be plugged into the core framework, we can build an integrated e-Learning environment where learners/teachers can share/operate this software/data in real time. Universities also have many organisations to perform educational activities and researches. In order to operate and manage an e-Learning system, the information/knowledge occurring in each of organisations must be connected seamlessly and integrated under the standardised data format and the procedure of job-processing. In this paper, we mention the conceptual framework of Knowledge Circulated-Organizational Management according to our experiences of UEC-GP project. Moreover, we introduce how to construct & analyze the content-frames of e-Learning as technological knowledge on Instructional Design.

Keywords: Knowledge management e-learning Instructional Design Contents-Construction Integrated LMS e-KARTE

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1. The Organisational Knowledge Management in Educational Contexts

According to Davenport (1997), knowledge management can be defined as "the systematic process of finding, selecting, organising, distilling and presenting information in a way that improves an employee's comprehension in a specific area of interest."

Nonaka arranged the process of Knowledge Management as "a Socialisation / Externalisation / Combination / Internalisation (SECI) model" (Nonaka, 1995). This SECI model is expressed as a conversion cycle between tacit and expressive knowledge. The former has a non-linguistic representation form, while the latter is a result of putting tacit knowledge into linguistic form. Tacit knowledge is shared with others by converting it into expressive knowledge.

Knowledge management in an educational context can be defined as follows: "the systematic process of finding, selecting, organising, distilling and presenting information in a way that improves a learner's comprehension and/or ability to fulfil his or her current learning objectives." Our e-Learning practice in the university aims to support learners' activities in combination with various types of knowledge. The information of a learning entity includes both expressed/overt and tacit/covert knowledge.

The overt knowledge can be represented by natural language as verbal information. In general, we can regard this knowledge as that which would be elicited from the learner's tacit knowledge. It is important to determine how best to convert from covert to overt knowledge using new technologies, such as web mining, text mining, etc.

2. Design of e-Learning Environment

When people build their e-Learning environment, three issues should be considered (Okamoto, 2000): the pedagogical goal representing the ability /knowledge as learning objectives, the subject contents and the learning modes. The learning modes are defined by seven learning environments:

(1) Distance individual learning environment for mastery learning. This environment provides courseware for knowledge/skills acquisition, i.e., typical e-Learning courses, such as WBT/VOD (Video on Demand) systems (Hui, 2000).

(2) Distance individual learning environment for discovery learning using various search engines (VOD search and navigation mechanism).

(3) Distance individual learning environment for problem-solving learning using simulations, ILE (Interactive Learning Environment), etc.

(4) Videoconference systems in the classroom environment for discussion, instructional presentation, question-answer sessions and telecommunications (Chen, 2001; Nieminen, 2001).

(5) Collaborative learning environment for small groups/pairs using videoconferencing, various types of communication tools, various applications accompanied by shared-screen viewing and learning log tracking mechanisms.

(6) Collaborative simulation learning environment for learners of different learning performance, different functions in team-work learning patterns to form special skills in the learner's own domain, e.g., a collaborative activity within the cockpit of a jet airplane.

(7) Linkage/Coordination among different organisations and/or areas, e.g., access to an online school library, online museum, etc.

The most important issue in the establishment of e-Learning environments is to start by defining the educational objectives (instructional/learning goals), and then to develop/classify the learning contents that are best equipped to build the required learning environment (Chrysostomou & Papadopoulos, 2008). Moreover, research into appropriate methods is required to build the asynchronous collaborative learning contents. Further research should be devoted to the study of learning environments with the virtues of individualised learning and collaborative learning. In this case, the transmission of real images and voice data is required. The fundamental environment components for e-Learning systems include the whole information system related to e-Learning environments should consist of several management functions, such as curriculum/learning materials management, learners' profile/log-data management, learning support as the core framework, LMS (Learning Management System) and LCMS (Learning Contents Management System). To construct such educational management systems, several data/file processing modules are required, such as a distributed file system, synchronous data communications, etc. If any applications and tools related to e-Learning can be plugged into the core framework, we can build an integrated e-Learning environment where learners can share/operate this software/data in

real time (Okamoto et al., 2008). In addition, the total management system of e-Learning is required for implementation in a real educational project/practice, which means a requirement for research project management, learning schedule management, courseware development, etc.

3. Case Study: UEC GP-Project

From 2004 to 2008, our university ran a three-year national support project named "Selected Efforts of the Distinctive University Education Support Program (Good Practice Project, abbreviated as GP Project)"(ALIC, 2003). The theme of the project is "The Practice of e-Learning with mutual interaction for the advanced courses". The project involves all faculties and the UEC office. The Center for Developing e-Learning (CDEL) takes initiative in this project.

In this project, we focus on the use of a Digital Portfolio, which stores essays, credits, grades, past mentoring reports and report submission history. It is used for mentoring and coaching for questions, course recommendations and advice on proceeding with e-Learning.

3.1. Basic & Theoretical System Concept

An efficient e-Learning system provides learners with a learning environment that has a high degree of freedom (Collins, 1999), allowing learners to choose appropriate contents. RAPSODY is based on this model. On the other hand, teachers wish to check access status, which will allow them to improve their course. To realise this, the LMS must handle information, such as user identity, curricula, learning contents, learning history, communication among learners, questions and answers.

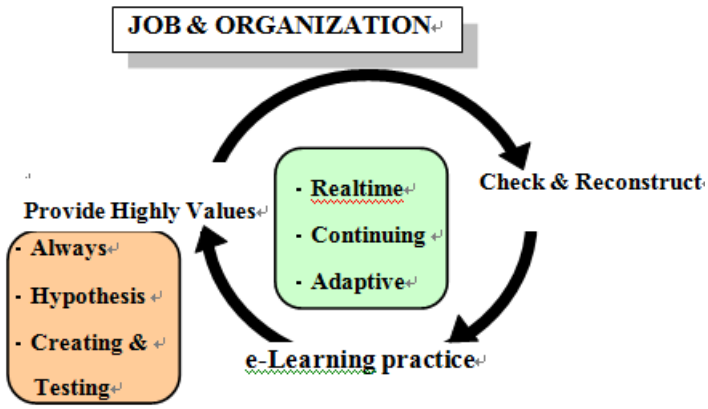


Figure1. Framework of Learning Organization & Knowledge Management

We have already executed the official practices of e-Learning in the curriculum of our university for 5 years. Our basic concept is based on the model of Learning Organization & Knowledge Management as shown in Figure. 1. This model is composed of 3 phases of "provide highly value", "check & reconstruct" and "e-learning practice". Every jobs (activities) related to e-Learning practice are referred to this model. The activities are as follows: the need analysis for learning, the setting of learning objectives, the design of learning environment, the construction of e-Learning content, the practicing (monitoring & mentoring), the achievement evaluation, the revising. In RAPSODY,

learners and teachers can utilise various functions, such as computer-supported collaborative learning (CSCL), authoring, curriculum planning, evaluation and reporting.

3.2. The Architecture of RAPSODY-LMS

Figure.2 shows the whole e-Learning system architecture based on the framework of Learning Organization & Knowledge Management. The several organizations such as the computer center, the faculty, the administrative office and e-Learning center are virtually integrated by sharing data / information / knowledge.

Administration

When registering learners, teachers can choose from the already registered partition imported from the Educational Affairs Section database. The partition has a standard tree structure such that a learner can be specified by status as regular/irregular course student, entrance year, faculty and department. Importing course grade information is available from 2006 in the XML format, including student ID, name, entrance year, faculty, department, e-mail address, current courses, past courses with grades, course teacher ID and teacher name. Using this information, the student will receive various suggestions suitable for their learning history.

Authoring

A problem frequently encountered by teachers is the reduced variety of question formats at the end of each unit. We added an n-to-m mapping question style and ordering question style of response items. The authors must follow the structure of the Course-Unit-Description/Question. The authoring form supports the construction of this structure.

Communication

One of our primary focuses is the support of mentoring activity. We call the support framework the Digital Portfolio. This can be an asset for a learner to reflect on their progress in a course and on a weekly schedule. Necessary information for the Digital Portfolio for a learner includes the one-week course schedule, progress and ranking in a specified course, history of progress (progress curve) , including attendance, submission of essays(reports), past mentoring comments and submitted reports. In addition, the mailing list and discussion board can be used in mentoring/coaching.

Analysis

Teachers wish to analyse their course during the e-Learning period. In WebClass-RAPSODY, teachers can obtain basic statistics, such as the sum, average, maximum, minimum, and standard deviation of access time and score. Using this information, teachers can analyse both their learners and courses. This GP Project began in UEC in April 2004. In the first year, we developed 13 courses from various faculties. The project included a variety of course topics and content styles, not only using HTML, but also with video streaming and simulation plug-ins.

Nowadays, we have more than 110 courses. The modes of contents are text/video based tutorial, drill & practice, simulation & gaming, data analysis package for experiments, collaborative contents. Figure 3 shows more concrete system configuration according to Figure 2. Especially, the authoring system which supports contents-construction has many functions such as streaming VOD, Flash contents, JAVA movies, Word-texts/figures/photos etc. Moreover, this system is easily connected from mobile phones and PDAs.

This system provides the intelligent mentoring function with e-KARTE (e-portfolio) in order to diagnose and evaluate timely the degree of students' achievement based on all of learning log data and their profile data.

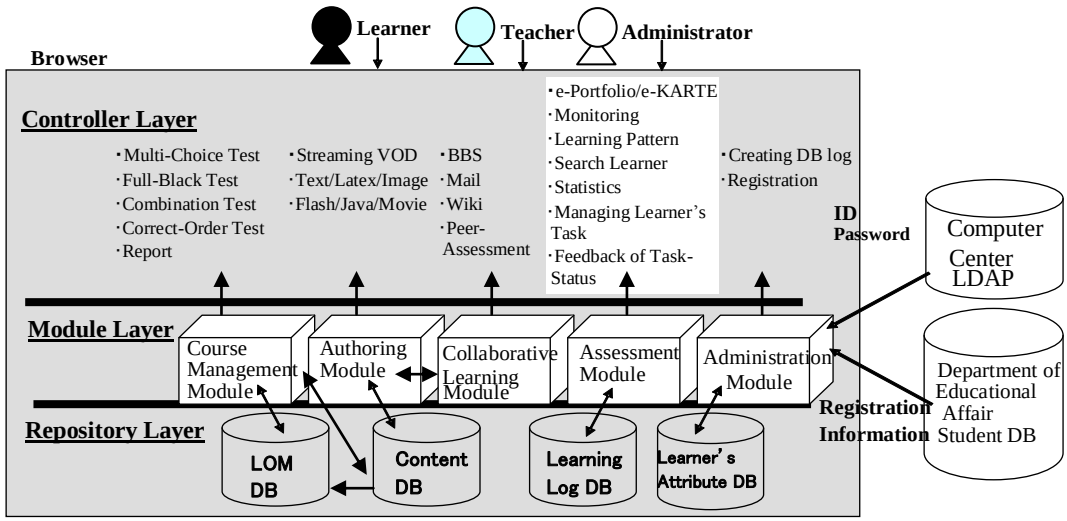


Figure2. WebClass-RAPSODY

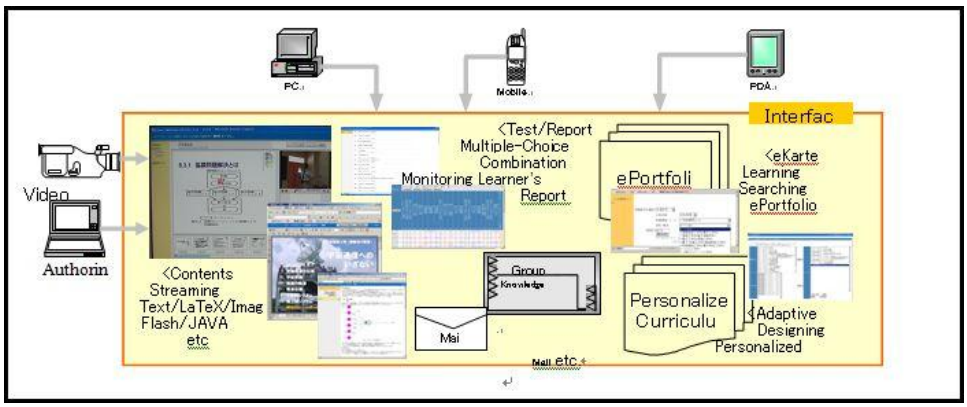


Figure3. The specified system configuration for authoring and learning supports

3.3. The Student's e-KARTE and Mentoring Functions

The main theme of our research & development is to provide "e-Learning services with mutual interaction between students' learning activities and RAPSODY". We emphasize the mentoring functions in order to guarantee students' learning sustainability and support the achievement of specified learning goal on line–real time. So, we provide e-KARTE with the functions of formative/summative evaluation for an individual learner. By this e-KARTE, the students can check and confirm their learning status/progress (understanding level) as self evaluation from the subjective/objective points of statistical data analysis.

As mentioned the above, the center provides students and teachers with e-Learning services such as information related to formative/summative evaluation with the diagnosing information on line-real time. In this project, we focus on followings especially:

Use of Digital Portfolio (e-KARTE): This is related directly to our theme. We integrated grade information currently stored in the Instruction Section database with learner information stored in LMS. This enables teachers to give students appropriate suggestions. We currently include:

- subjects of reports and submitted reports
- status of submission and its date
- status of credits
- grades
- past history of mentoring with summaries
- degree of achievement for goal and teachers comments

Figure 4 shows e-KARTE including the mentoring function. Each student can see and check his/her learning status/achievement in order to prompt a learning plan of progress again. In e-KARTE, there are learning time, times of lesson access, degree of achievement per section/chapter in a course and diagnosed messages. The students' learning log data are also analyzed by some statistical methods, then those results are shown to students.

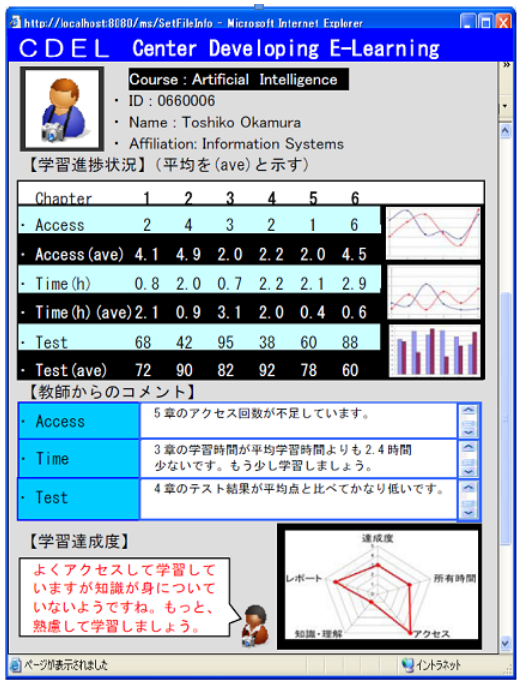


Figure4. A case of display for mentoring

Mentoring and Coaching: Only preparing the digital portfolio is not sufficient to assure a student's learning progress. It is necessary to provide the function of mentoring / coaching like Figure 4. In addition, we prepared several tutorial classes for teachers.

Mentoring/Coaching items are about:

- questions about contents
- recommendation of courses for students
- know-how of proceeding learning
- providing curriculum suitable for students
- advices for learning progress

These comments are made by teachers with reference to the learner's digital portfolio. By supporting learners in mentoring/coaching appropriately, we believe that even the advanced courses can be learned by e-Learning.

4. Contents Analysis & Design Method

For the purpose of assuring learning quality, we have wrestled with the construction method of e-Learning contents based on instructional theory. Especially, we address the task of compound "semantic relationship" as multimedia among "figures & tables", "explanatory sentences" and "voice instructions" in a frame as well as the task of frame sequences. This research for frames-construction tasks and testing of learning effectiveness are cyclically based on "the framework of learning organization and knowledge management" of Figure1.

For conducting e-Learning, the idea of instructional design is quite important for the purpose of assuring quality on learning effectiveness. In general, the method of instructional design covers the areas as followings (Bruner, 1997) (William, 2003):

(1) Need & Task Analysis (2) Objectives Hierarchy (3) Performance Standards (4) Instructional Strategies (5) Lesson Specification (6) Lesson Development (7) Student Evaluation (8) Lesson Validation

In consideration of those steps, we propose the method to design and analyze the frames and its sequence on e-Learning contents construction. In general, e-Learning contents are composed of some represent media such as sentence / figure & table / video/sound-narration/animation/simulation. In this research, we take up the problem of the frame construction based on combination of sentences (with narration) and figures & tables. Then, we try to explore how to construct frames/contents from the point of semantic relationship among those media for the purpose of enhance learning effect. We set up the elaborative learning environment and produce e-Learning contents under several theoretical hypotheses in consideration of Bruner's represent theory of thinking. Our theory on content-construction of e-Learning is based on Bruner's represent model (Briggs, 1977) which consist of enactive, iconic and symbolic learning media.

Instructional Design is the systematic process of applying general principles of learning and conducting plans for instructional learner/materials (Dick, 2001). Instructional Design as a Process is the systematic development of instructional specifications using learning and instructional theory to ensure the quality of instruction. Instructional Design as a Science is the science of creating detailed specifications for the

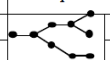
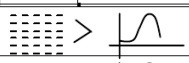
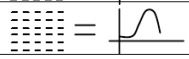
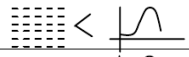
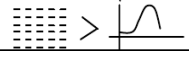
development, implementation, evaluation, and maintenance of situations that facilitate the learning of units of subject matter at all levels of complexity (Gagne, 2005). However there are not so much specific researches about contents construction-method on e-Learning.

In our project, we emphasize this authoring activity under the system building of Organizational Knowledge Management. This study is intended to specify e-Learning contents-features/characteristics in consideration of the semantic relationship between figures & sentences. In order to specify those features /characteristics, we propose the method of contents analysis for "characteristics of a frame" and "frame sequence". By this analysis, we try to propose the constructional method of contents. The problem of the content construction is related to the technology of Instructional Design. We also propose the methodology of Instructional Design to compose effective & adaptive contents from the points of educational psychology and linguistics in consideration of individual differences.

4.1. Semantic Relationship between Figures and Sentences

In general, a frame of e-Learning contents consists of some figures and sentences (Keiko, 2000). We focus on the semantic relationship between figures and sentences for a frame-construction. In this study, a table is regarded as a kind of figures. We try to analyze the semantic relationship between figures and sentences, moreover extract a meaningful pattern of frame sequences.

Table1. Chart of contents-analysis

			Item	Relation	Example		Standard	F1	F2	F3	F4	F5	F6
Frames-characteristics	Characteristics of a figure	1	Link	Procedure Causal		Flow chart System onfiguration	Showing a relation connecting groups of components.		☑		☑	☑	☑
		2	Array	Compare Up-down		Correlation table Matrix table	Showing a relation by arranging.						
		3	Area	Inclusion Adjacent		Venn diagram	Showing a relation by enclosing groups of component.						
		4	Coordinates	Positional		Bar graph Distribution map	Showing by cartesian coordinate.						
	Semantic relationship between figures & sentences	1	Exemplification	Exemplification			Expressing contents of sentences by examples.				☑		
		2	Copy	Copy			Expressing contents of sentences by copy.		☑		☑		
		3	Supplement	Supplement			Expressing missing parts of sentences by replenishment.					☑	☑
		4	Condensation	Condensation			Expressing concrete ideas by condensation.						

We designed the elaborated chart for contents-analysis. If a certain frame has any "characteristics of a figure"/"semantic relationship between figures & sentences" /"logical-story features on frame-sequence", an evaluator checks (☑) in the chart. The figures were classified into four groups of "Link", "Array", "Area", "Coordinates". The semantic relationship between figures & sentences were classified into four groups of "Exemplification", "Copy", "Supplement", "Condensation". We executed the preliminary researches in order to assure/guarantee *ordinability* for the degree of a intuitive-understanding (without deep understanding) about "Semantic characteristics of a figure" and "Semantic relationship between figures & sentences".

As a result of that, we set up *ordinability* which makes an ordering scale from high to low.

Ordinability for figures:

Link> Array > Area > Coordinates (p<.01).

Ordinability of the semantic relationship between figures & sentences:

Exemplification >Copy > Supplement > Condensation (p<.01).

4.2. Extraction of Features/Characteristics on Frames

Procedure

We tried to find out the semantic relationship between figure & sentences in a frame according to the given frame sequences.

X-axis consists of 4 categories which are Link, Array, Area, Coordinates as values of *ordinability*, Y-axis consists of 4 categories which are Exemplification, Copy, Supplement, Condensation as the same way. In the plane of 2-dimention, we can show the profile of an e-Learning content. If a certain frame has a figure, then we decide each position for X-axis and Y-axis. We repeat this procedure for all frames in the topic. We try to link between two nodes according to the give frame sequences. By this procedure, we can extract a peculiar pattern from a frame-sequence. By this method, features /characteristics of the extracting content is evaluated for the degree of understanding .

We extracted three patterns from this analysis as followings (see Figure 5, 6 and 7).

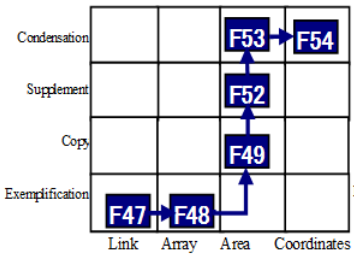


Figure5..Pattern of progressive

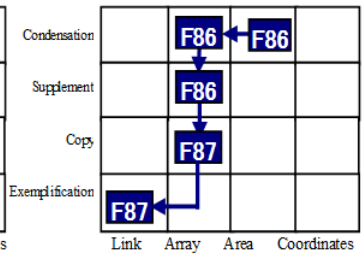


Figure6. Pattern of regressive

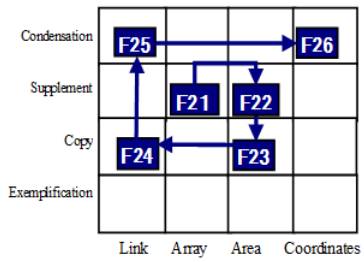


Figure7. Pattern of spiral

(1) Pattern1: Progressive-pattern (11patterns)

(2) Pattern2: Regressive-pattern (8 patterns)

(3) Pattern3: Spiral-pattern (7 patterns)

Analysis

We examined each test-result for Progressive-pattern, Regressive-pattern and Spiral-pattern.

In order with the average values for three patterns: Progressive-pattern>Regressive-pattern >Spiral-pattern.

From the result of variance analysis, significant difference was found between Progressive-pattern and Regressive-pattern. Moreover statistical significant difference was found between Regressive-pattern and Spiral-pattern ($F(1,15) = 7.40$, $p < .05$）.That is to say, *ordinability* for the degree of a intuitive-understanding of content is Progressive-pattern ＞Regressive-pattern ＞Spiral-pattern.

5. The Framework of Knowledge Sharing and The Flow of Job Agencies

Universities have many organisations to perform educational activities and researches. In order to operate and manage an e-Learning system, the information / knowledge occurring in each of organisations must be connected seamlessly and integrated under the standardised data format and the procedure of job-processing. From the viewpoint of the e-Learning management system, we set up the model of an e-Learning management architecture as shown in Figure8. There are six functional job-agencies which are for each event of community, context, content, personalisation, infrastructure and behaviour-usage-analysis. Among those job-agencies, various kinds of information/knowledge must be transmitted, exchanged and reused for daily educational activities (especially e-Learning services). In this context, Know-How of the contents production as one of Instructional Design Technologies must be accumulated and reused in organisational knowledge management system. Efforts to build an effective methodology of organisational knowledge management lead to the issue of quality assurance to improve the daily e-Learning practices in the organisation.

Those organizational activities of e-Learning practices are also related to the new way for faculty development and quality assurance of teaching power (or learning power for students). Especially, the agencies of Context, Personalization and Behaviour-Usage-Analysis in Figure8 have the quite close relationship for developing effective content production to realize personalized e-Learning. We study the construction methodology of frames/contents as one important issue of instructional design in this framework.

6. Conclusions

In this paper, we introduced the UEC GP Project and Center for developing e-Learning (CDEL), which aims at systematic management and organisation of e-Learning resources/activities in the different organisations (departments) of our university. For this purpose, we developed WebClass-RAPSODY LMS. The system supports registration, authoring and importing information from different sections of Educational Affairs. This enables effective pedagogical activities, including mentoring /coaching through utilisation of Digital Portfolio (e-KARTE).

We have now challenged to build the method of e-Learning contents construction as one technology related to Instructional design. Under this environment, it

will be necessary to establish new e-Pedagogy to create effective/significant systems for future university education. We proposed the method of contents analysis for "characteristics of a frame". By this analysis, we tried to propose the constructional method of contents. Moreover, contents were evaluated for the degree of understanding extracting semantic characteristics of frames. We proposed the methodology of Instructional Design to compose effective & adaptive contents from the points of educational psychology and linguistics in consideration of individual differences.

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