Learner-centered Design in Higher Education by ICT with IDT

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ABSTRACT

This keynote introduces current trends in the long-lasting traditions of instructional design and technology (IDT) and their applications to ICT-based higher education. Learner-centered design has been the key issue in reforming practices of higher education. Such IDT theories and models as First Principles of Instructional Design, Goal-based Scenarios, and Layer Model for e-Learning Design will be introduced, in reference to current practice of a 100% online master program for e-Learning Professionals at Kumamoto University. Application of IDT and transformation by ICT, not integration of ICT, are argued to be our central focus.

INTRODUCTION

Instructional design and technology (IDT) models and theories, which have been one of the major areas of research in the field of educational methodology for more than 40 years, have been utilized more extensively in business and military training, compared to higher education, because they are suitable in goal-driven settings with specific challenges to overcome. Demands for higher education to be more effective, efficient, and engaging have also become higher and more critical by its increased diversity, universalization, mobilization, and the need for differentiation. Students require more, with less effort, and we need to do a better job, with fewer resources. We all know that changes are needed, but we may not know how to change ourselves. Learner-centered design has been the key issue in reforming practices of higher education through the use of information and communication technology (ICT). If one wishes such reforms to be firmly grounded in evidence-based rationales, rather than stemmed merely from experiences of best practices, IDT can be a solution as the knowledge base with practical applicability. This keynote introduces some IDT theories and models, as a knowledge base to achieve the goals of ICT utilization in higher education settings.

GRADUATE SCHOOL OF INSTRUCTIONAL SYSTEMS[1]

As the Japan's first 100% online program for e-Learning specialists focused in corporate and higher education, Master of Science program in Instructional Systems started in April 2006 at Kumamoto University. As the first attempt to add a 100% online program to an on-campus university of more than 100 years of its history, it is to train e-Learning professionals emphasizing four areas of expertise. The four Is, representing our program's emphasis, are the followings: Instructional Design (ID), Information Technology (IT), Instructional Management (IM), and Intellectual Property (IP). It is a regular master program that requires two years of study, taking courses up to a minimum of 30 credit hours. Twelve courses are required to complete the Master's program, whereas 16 elective courses are offered from which four or more courses to be taken as a part of the requirement.

It was planed to be a 100% online course for some reasons: (1) The program is targeted for working professionals who require flexibility for them to enrol while working full-time. (2) Kumamoto University is located in the south-most island, whereas the demands for such a program are in major cities such as Tokyo or Osaka, not in Kumamoto. For an institute located far from major cities, online was the only chance to get enough students. (3) Japanese government regulation had been changed to allow a 100% online graduate program, not as a correspondence program, but as a regular program that is equivalent of an on-campus program through the advanced uses of technology to make interactions possible on a regular basis. (4) e-Learning professionals should be able to be trained via using an e-Leaning system to show them how each of the e-Learning components can be used to its maximum potential.

The program (Graduate School of Instructional Systems, or GSIS) was launched in April of 2006 with 15 first year master's students, after being selected through rigorous admission process from 37 candidates. All of them are working professionals in their 30-40's, working full-time in various locations:

10 living in Tokyo, 2 in Osaka, and the rest in Kyushu Island where Kumamoto University is located.

A quick audience analysis revealed that they are mature students, studying alone at home or offices, capable of conducting independent study via Internet. Minimal faculty support would be required, and encouraging collaboration and learning from each other would be an effective instructional strategy, since they have diverse professional backgrounds to share among themselves. Time management may be an issue, since they are working full time: Asynchronous mode of learning seemed to the most flexible learning environment for the busy professionals.

OVERALL DESIGN OF GSIS PROGRAM

Figure 1 describes the overall design of GSIS program created based on ID methodologies. Inputs are listed on the top of Figure 1, which included the 4 I's concept, list of courses, and governmental requirements for implementation to be regarded as equivalent of on-campus program (15 interactive synchronous/asynchronous sessions). Case studies, indicated on the bottom of Figure 1, were conducted to locate and examine advanced online programs, including instructional systems program of Florida State University, Open University of U.K., and Carnegie Mellon University's West Campus. Also taken into consideration was a movement of Japan's e-Learning Consortium to establish e-Learning Professional Certificate Program (eLP). An early draft version of eLP's competencies for seven kinds of professionals were obtained so our program could be aligned with what Japan's prominent professional alliance in the field of e-Learning had to offer to certify their professionals.

Based on these inputs and consideration of future trends for our prospective graduates, a list of GSIS competencies was created and made public in January

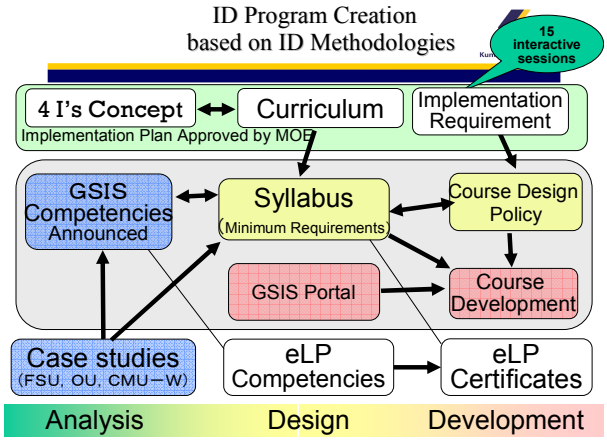

Figure 1. Overall design of GSIS program

2006. Course design policy was agreed upon among core members of the program, on which each of the course syllabi was drafted and coordinated through workshops among the core members. A learning portal was then designed and created to link the University's single sign-on user identification to the learning management system (LMS, in particular, WebCT CE6), as well as to provide learning assistance for GSIS students. Each of the course contents was then created based on the course design policy, before the implementation of GSIS program. Each of the outputs is to be described in the following sections.

GSIS COMPETENCIES

Table 1 shows GSIS core competencies, whereas Table 2 shows GSIS optional competencies. The GSIS core competencies list 12 capabilities that would be developed by taking required courses of the program. They cover the basic capabilities in the field of ID, IT, IP and IM, the four I's emphasized in the GSIS program. All the assignments in the required courses are mapped with one of the 12 competencies, which represent basic knowledge and skills of e-Learning professionals. When each of the assignments is accomplished by a student, a mark indicating the assignment will reverse the color, showing accumulating status of a competency by completing the assignment.

Table 1. GSIS core competencies

By completing this program, you will acquire a basic level of the following competencies:

1. To analyze the status quo of education and training practices, by referring to the fundamentals of instructional systems research.
2. To describe and interpret e-Learning success and failure cases in various domains and areas.
3. To create a course development plan and conduct a persuasive proposal based on various viewpoints of stakeholders.
4. To design effective, efficient, and appealing learning contents by utilizing functions provided by an LMS.
5. To develop a prototype of active contents executable on a Web browser.
6. To implement a course development project as a team leader.
7. To evaluate and suggest improvements for an implemented project or a developed course.
8. To propose strategies for educational services and businesses based on HRD strategies or market needs.
9. To recognize and solve regal and ethical issues in networked environment.
10. To watch latest advancements in instructional systems field and apply them in professional activities.
11. To disseminate findings from own practices through professional activities thus contribute to society.
12. To contribute to improvements and advancements of the GSIS program as an alumnus.

Note: Announced in Jan. 2006 at http://www.gsis.kumamoto-u.ac.jp/outline/

Table 2. GSIS optional competencies

By taking optional courses in this program, you will acquire a basic level of the following competencies:

1. To set up, manage and utilize a server for e-Learning and to develop a prototype of active course contents by utilizing server-side applications.
2. To develop courses and manage systems that meet requirements of e-Learning standardization and inter-operatability.
3. To create a safe e-Learning environment in terms of network security.
4. To propose management resolutions from the viewpoints of knowledge, information, and learning.
5. To discuss with subject matter expert in a specific area based on its own instructional characteristics.
6. To propose and support implementation of educational services and products as a consultant.
7. To propose establishment, implovement, and change in e-Learning policies for own organization and customers.

Note: Announced in Jan. 2006 at http://www.gsis.kumamoto-u.ac.jp/outline/

By showing in the form of competencies, the students, current and prospective, will be notified with our expectations for the students. It shows the boundaries of our expectations: for example, for IT related competencies, all the graduates are expected to become able to design effective, efficient, and appealing learning contents by utilizing functions provided by an LMS (Core Competency 4), and to develop a prototype of active contents executable on a Web browser (Core Competency 5). However, to become able to develop a prototype of active course contents by utilizing server-side applications, one need to take one or more elective courses (Optional Competency 1).

It was our thought that all of our graduates should have experiences of actually developing a course segment, so they will have acquired an ability to talk with developers of e-Learning contents, although not many of our graduates would actually engage in the development of contents as programmers. The term "prototype" is thus used in the statement of the competencies, representing the minimum requirement for the skill related to development.

GSIS COURSE DESIGN POLICY

Based on our audience analysis, governmental regulations, and general grading policy of the University, a set of course design policy was established as shown in Table 3. Asynchronous mode was introduced as the main method of interaction though the use of WebCT's quiz function, report submission function, and Bulletin Board System (BBS). Instead of having deadlines once a week, our policy states the 15 required interactions to be clustered to have two or more tasks due on the same date (Policy 4). This was introduced by taking account the fact that each of the students would be taking about 5 courses each semester. If due dates are set for every weeks, then he or she would need to handle tasks for five different courses each week. By having them clustered, a student would be allowed to finish several tasks of one course, before moving to tasks of a different course.

Table 3. GSIS course design policy

1. Fifteen (15) interactive sessions in each course with evidences, e.g., quiz, mini-report, answer to practice exercises.
2. Course grades based on multiple reports/products with the record from 15 sessions, each requiring the minimum of 60% for a passing grade.
3. Direct connection of course assignments to the GSIS competencies.
4. Due dates of 15 session tasks to be clustered into 3-5 blocks to enable learner's intensive study.
5. Limited synchronous whole class activities (maximum of twice a semester per course).
6. Students commenting each other's reports/products for improvements before final submissions.
7. Introductory video message in all courses or all blocks of a course as a motivator, not as a primary mode of information provision.

To encourage interactions among our students, Policy 6 was introduced (Table 3). By using BBS's functionality for threaded discussions, a student would be asked to post a message with his/her draft proposal as an attachment. Other students, after posting their own drafts, are encouraged to review the classmates' drafts, then make any comments as a reply to the original messages. It is after these interactions among the students, their final proposal would be turned in by using WebCT's report submission function. Points are to be allocated to the contributions of making comments to other's drafts, indicating that the interactions among peers are regarded to be of high value.

GSIS LEARNING PORTAL

GSIS Learning Portal was designed and developed as our original products serving for the need of our prospective students. It was designed to connect the University's sign-on site to our LMS (WebCT), in such a way that the portal would serve for time management of our students, as well as a portal to various resources including University's digital library and registration.

Figure 4 shows a screen that provides monitoring function for all the courses a student is currently taking. In particular, this student was taking five

courses, after finishing an orientation shown on the bottom. Each course has direct links to 15 tasks in the upper portion, and several assignments in the lower portion of a horizontal scale. By moving mouse over to each of the buttons, due date and starting conditions are indicated as a mouse pop-up. Each entry is marked its due date by colors: overdue in red, due within a week in pink, being accepted in yellow, available tasks in green, and not yet available tasks in gray. Evaluation status is also shown as either passed (yellow), resubmission required (orange), or grading in progress (blue). It is our wish that by providing such an overview for each of the students, he or she would have a better control in managing time for study without human help.

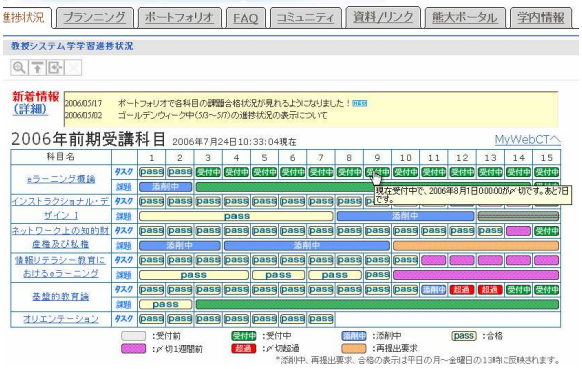

Figure 4. Monitoring Progress in All Courses (GSIS portal)

TOWARD GSIS 2.0

Initial design process and outputs for GSIS at Kumamoto University are as described so far. It was our intention to utilize what we know about instructional design to create our own learning environment for the 100% online master course for working professions. The first year has passed and we are collecting data from both students and faculty members to examine how successful we have been, and to start improving our portal, course contents, to better meet the needs of our own students.

There have been many Instructional Design Models proposed as of today, some of which will be introduced in the remaining part of this paper. We are in the process of renovating our program, toward the next version of our program, or GSIS 2.0, by incorporating suggestions from the ID models.

First Principles of Instructional Design

First Principles of Instructional Design is proposed by Merrill[2] to include the following five features, if any forms of instruction are to be effective, efficient, and engaging (See Figure 5):

Principle 1: Real World Task (Problem) Centered

- Learning is facilitated when learners are engaged in solving real-world problems.

Principle 2: Activation

- Learning is facilitated when existing knowledge is activated as a foundation for new knowledge.

Principle 3: Demonstration
(Don't Tell me, but Show me)

- Learning is facilitated when new knowledge is demonstrated to the learner.

Principle 4: Application (Let me do it)

- Learning is facilitated when new knowledge is applied by the learner.

Principle 5: Integration

- Learning is facilitated when new knowledge is integrated into the learner's world.

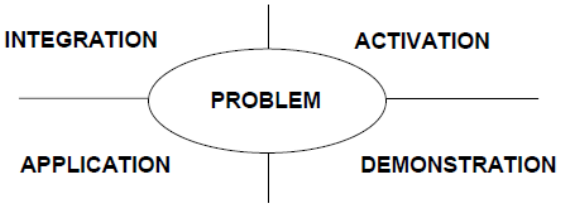

Figure 5. First Principles of Instruction Diagram (Merrill, 2002)

Merrill proposed that major ID theories and models available today follows the above five principles, but not all of the five are included in any of ID theories. Thus he considers these to be the First Principles. He see the current situation of Web-based materials to be not instructional, but informational, lacking adequate support for learning based on current findings of related research. He advocates the use of the Principles to avoid "*enervative, endless, or empty* e_3-learning (3 sub-three learning) and replace it with *effective, efficient, and engaging* e^3- learning (e to the third power learning)." [3]

Looking back our GSIS program, even if we specify competencies and make all the assignments aligned with the competencies, it does not necessary means that the contents of our courses start with *real-world* authentic *tasks* to provoke the students' desire to learn. Graduate curriculum tends to be "telling, not showing (*demonstrating*)" the new contents, with limited opportunities for the students to *apply* or *integrate* what they learned. In this respect, the design guidelines provided with First Principles may well serve as a checklist to version up the GSIS program to better fit what contemporary ID theories advocate.

Goal-Based Scenarios and Story-Centered Curriculum

Goal-Based Scenarios Theory (GBS) is an instructional design model proposed by Schank[4] that

focuses on how to make learning-by-doing simulations. The aim of GBS is let the learner practice decision-making processes in an authentic, but risk-free setting, and learning by making mistakes and reflecting on his/her mistakes. It has made a major impact on corporate training first in 1990's, then adapted to higher education curriculum design and development projects by the name of Story-Centered Curriculum (SCC)[5]. Computer Science Program at Carnegie-Mellon University West Campus is one of the successful direct applications of SCC [6].

There are seven essential components of a GBS: *Leaning Goals, Mission, Cover Story, Role, Scenario Operations, Resources,* and *Feedback*. Figure 6 illustrates relationships among the seven components of GBS[7]. Learning is to be taken place by scenario operations that let the learner decide based on available information as resources, during the course of authentic decision-making processes. Before going into the scenario, the learner is given a role to play, mission to fulfil, and a cover story to place the scenario in a realistic and plausible setting. Mistakes are welcomed so that the learning can be facilitated by reflecting upon the consequences by themselves and through the messages of experts.

Looking back again to GSIS program, or undergraduate and graduate programs in general, correct answers are usually given to the students via lectures with few opportunities to make any kind of mistakes, except for not being able to fill out the given correct answers on the tests. GBS and SCC question our traditional ways of providing education and suggest a new way to restructure the program entirely at a curriculum level. All the courses offered in GSIS can be clustered into one or some central themes so that the students can acquire practical knowledge and skills in a real-life scenario, instead of taking 5 unrelated courses per a semester. Especially those who work fulltime, bits and pieces of information in multiple courses can be better

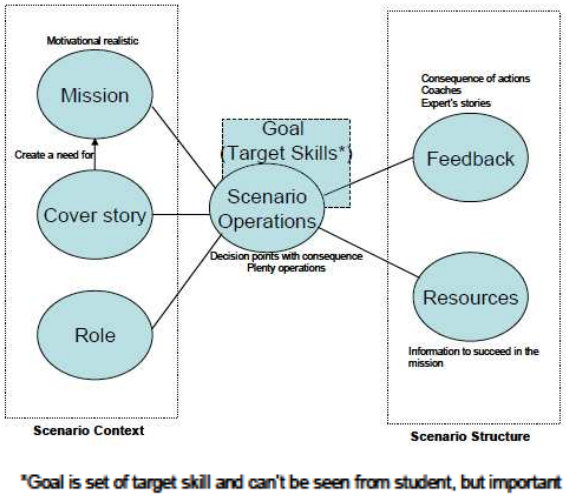

Figure 6. Seven Components of GBS Theory (Nemoto & Suzuki, 2004)

comprehended if there is a way to organize all pieces together.

Layer Model for e-Learning Design

The design and development of e-Learning contents and systems is a complex process and there are many different models, or processes, that are used to build effective and engaging e-Learning courses. The layered model[8] [9] (Table 3) has been proposed as a frame of reference for clarifying the purposes of various instructional design techniques and models and to illustrate how they can be meaningfully organized in terms of purpose and impact. This organizational structure has several benefits: it clarifies the relationships among the various design activities in e-Learning development, it can provide guidance to e-Learning designers, and it can help managers of e-Learning development who must coordinate a team of designers.

Table 3. A Layer Model of e-Learning Design (Suzuki & Keller, 2007)

Quality of e-Learning	Achievement Index	Major ID Techniques
Level 3: Willing to Learn (Appeal)	Continuing motivation, engagement, Did I do this many without noticing? Link to future self, Self-selected, self-responsible, individual taste and persistency, Brand, Pride	Motivation Design (ARCS Model) Principles of Andragogy
Level 2: Easy to Learn (Effectiveness)	Learning environment matching nature of the task, learning support elements matching learner needs, interaction effects of collaborative members, self-regulated learning, responsive environment	Learning facilitation Design (9 Events of Instruction) Structuring & Sequencing
Level 1: Easy to Use (Information Design)	Operatability, Usability, Navigation and Layout, Technical writing	Prototyping, Formative evaluation
Level 0: No Deception (SME)	Content accuracy, Validity of Learning Scope, Validity of interpretation, Indication of equivocality, Freshness of Information, Rational and reliable, Intellectual Property Handling	Needs Analysis Task Analysis Content Analysis
Level -1: No Pain (Hygiene)	Access environment, Adequate network speed, Substitute alternatives for different IT environment, Stability of service, Feeling of security	Learning Environment Analysis Media Selection

In this model there are five levels. Layer 1: *Information Design*, which can be considered to be the baseline level, is actually at the midpoint of the five levels. There are two layers below it and two above. This organization is guided by the concepts of Herzberg's[10] "motivator–hygiene" theory. He postulates that certain activities, called hygiene factors, help avoid discontent or annoyance and keep people happy, while other kinds of factors, called motivators, contribute to meaningful work experiences and stimulate people to achieve. This theoretical foundation is reflected in the layer descriptions, in which both Layer 0: *No Deception* and Layer -1: *No Pain* should be satisfied first as hygiene factors, whereas Layer 2: *Easy to Learn* and Layer 3: *Willing to Learn* can be built only after all other levels below would be satisfied.

CONCLUSION

John B. Carroll proposed his model of school learning in 1963[11] that all students can learn everything in school, if provided enough time for learning for him/her. Carroll suggested a paradigm shift to think of the difference in degree of learning (DL) in terms of time in the following formula:

DL = f (time spent learning/ time needed to learn)

This was a start of learner-centered education, which lead to the movement of mastery learning that all the students have right to stay in class until they master the basic education. Outcome based design, such as GSIS's competency, has been grounded on the premise that all students can reach the level of mastery, if we give enough time and support for each of the students.

Equivalency theory proposed by Simonson[13] points out the importance of designing new format of education for distance learning, which may look different from traditional classroom instruction, but whose value is equivalent of the traditional education. Being on campus or at distance, we can utilize ICT to better serve students of various needs. The format may not be the same, but the value should be equivalent or better, if we say we utitlize ICT.

Reigeluth (2005) stressed the importance of ICT, not to be integrated into current practices of education, but to trigger a transformation of education to fit the need of learners. He stated that learner-centered approach is the key for any instructional design models to focus on[12]. Learner-centered learning environment has long been awaited since the area of Carroll's model of school learning. It is by the advancement of ICT, now available for all institutions of higher education, combined with proper application of IDT models and techniques that the vision of learner-centered education may come true. For that end, not trying to integrate ICT to the current traditional education, but trying to transform our education should be our central focus.

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