Designing Ubiquitous and Universal Learning Situations Integrating Textbooks and Mobile Devices

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Developing learning with textbooks and mobile devices for large classes

We will introduce a procedure for developing instructional materials which are used in the conventional full-time teaching environment and can be implemented further in the correspondence course of Bukkyo University, which has a fifty year long history in distance textbook-based learning. In spite of the rapid development of ICT, textbooks and printed materials are still the most effective and economic media for disseminating distance education on a large scale, for reaching remote areas as well as economically deprived populations. Our attempt to develop this learning system will be useful in those situations where large groups of students in a course are moving on and off campus with a poor availability of PCs, but affluent with mobile devices such as mobile phones and PDA.

Instruction for large a number of students in universities is still in the form of lectures which students attend passively, especially in our Japanese culture. Students are presumed to be knowledge consumers, not knowledge producers. Among the critical and urgent issues to be solved in higher education is the one that will result in the students' active involvement in learning and creative participation, on as well as off campus. The first solution to this issue is to provide students with opportunities to participate in active discussions and collaborative team working. Undergraduate students in the introductory 'Instructional Technology' course are requested to create one imaginary school per team with the intention of introducing innovative lessons instead of the present passive and monotonous lectures. They review the structure and system of present school education from a holistic viewpoint and submit final reports showing what they have created and proposed during the team work as well as through individual learning. From the very beginning of formulating imaginary schools in the team working stage to the final individual report writing, students follow the instruction provided by textbooks, respond to questions through mobile devices and discuss issues with their peers in the bulletin boards implemented in their mobile phones. A large number of students, one to two hundred, in the above mentioned course have to express new ideas in their teams of five to six members each, discuss issues and elaborate on them with their peers,

produce a series of PowerPoint slides and instructional materials collaboratively using a limited numbers of PCs, and finalize their personal reports by the end of the half-year course. This learning process is managed with workbooks and reference materials, communication tools such as mobile devices synchronized with the printed materials, and with a collaborative platform of a limited number of PCs.

Theoretical background of instructional development

Article 26 of the Japanese National Constitution and UNESCO's 1985 Declaration of the Right to Learn provide a philosophical background for realizing a ubiquitous and universal learning, or u-Learning. Our national constitution maintains that 'All people have the right to learn corresponding to their ability'. In spite of this declaration for the equity of national education, the Japanese school education has developed more based on the national interests and less on individual abilities. The theoretical background of this solely textbook-based instruction helps to focus our view critically on the design technology for students' creative and active involvement in learning. A recent technology for distance learning tends to depend heavily on sophisticated ICT, especially multimedia and broadband. Adaptation of a simple hardware technology, however, reveals the essential and appropriate technology for critically effective and economic distance instruction. The authors presumed that active learning can be realized by integrating the structural and procedural components of instruction rationally. Our instructional strategy for producing textbooks is to follow the modeling procedures of 'Structure model MACETO' and 'Process model ITISCA'.

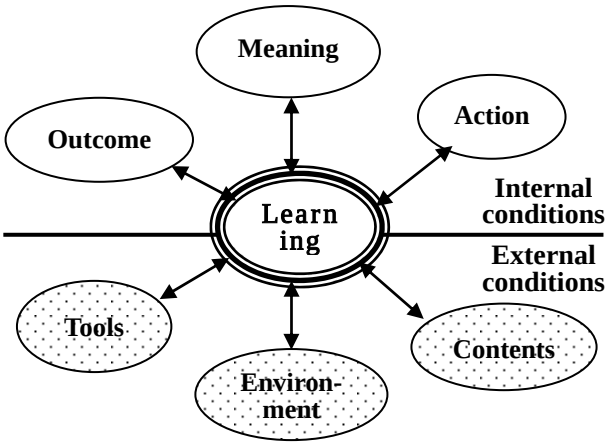

Figure 1 Structure model MACETO

The Structure model abbreviated MACETO consists of Meaning, Activities, Contents, Environment, Tools and Outcome. This model is utilized to describe the instructional design in its initial stages and thereby to clarify the whole structure of the course. Instructional design starts from understanding the attitude and intention of the learners, taking into account the meaning of learning, learners' activities and anticipated learning outcomes.

It is very crucial to find an authentic theme suitable to enhance the learners' interest and motivation. After clarifying these internal conditions, designers proceed to the arrangement of external conditions to stimulate the learners and promote their learning. We also produce instructional modules consisting of printed materials and ubiquitous devices such as mobile phones and PDA.

The Process model ITISCA is applied to develop segmental instructional modules for generating specific learning events during the course. These modules are described in

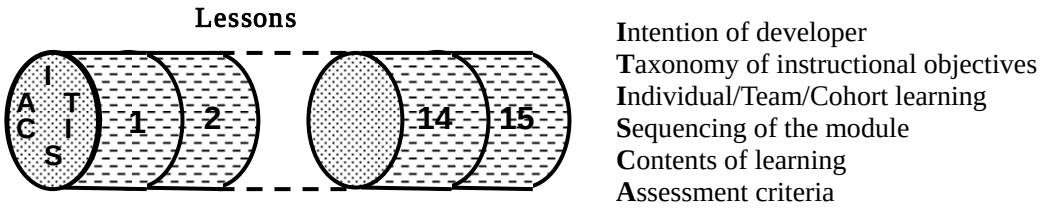

Figure 2 Process model ITISCA

terms of ITISCA, or Intention of the developer, Taxonomy of instructional objectives, Individual/Team/ Cohort learning, Sequencing of the module, Contents of learning and Assessment criteria. One course is usually 15 lessons per semester. For each lesson, students receive three to seven modules, each of which has usually one to four pages, and generates distinctively different learning events. Each module has unique and specific characteristics and aims, and is described in the terms of ITISCA. The introductory course, 'Instructional Technology', is composed of about sixty modules, of which some are compatible to modules applicable to other courses. They are all stored and managed by an Access package for common use by developers.

Empirical Approach for u-Learning Development

Teaching is a complex and changeable enterprise. Printed materials are the most suitable media to accommodate ceaselessly changing instruction. In this circumstance, the

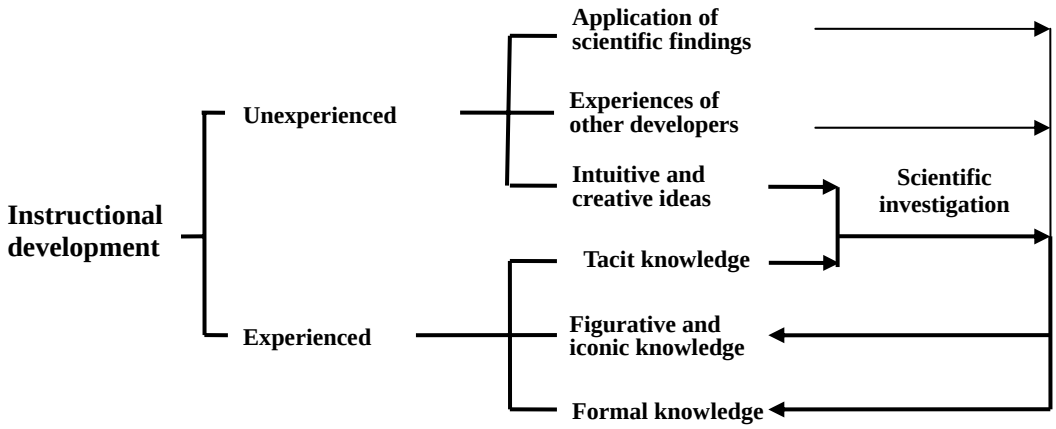

Figure 3 Empirical approach for u-Learning development

procedure shown in Figure 3 is adopted to develop a ubiquitous and universal learning environment, or u-Learning. We start with empirical, tacit knowledge and intuitive ideas to design learning events, which are entirely free from specific media. The instructional events are described in intuitive images at the beginning of the course and gradually in figurative and iconic models and judgmental propositions for effective instruction. In this framework, media are not the starting point for developing instructional materials. The experiences of instructional designers and instructors are crucial and indispensable to create and improve instructional materials.

Instructional technology for distance learning can base its theoretical background on empirical as well as scientific knowledge. The judgmental procedure of planning, designing, developing and implementing the course materials depends on the teachers' empirical laws, describable in the form of a figurative presentation of images and models of learning situations and judgmental propositions. A mobile device system named 'l-support' can be introduced for the management of students' learning, and to provide e-mail and internet functions entirely compatible with the ordinary internet functions of PCs.

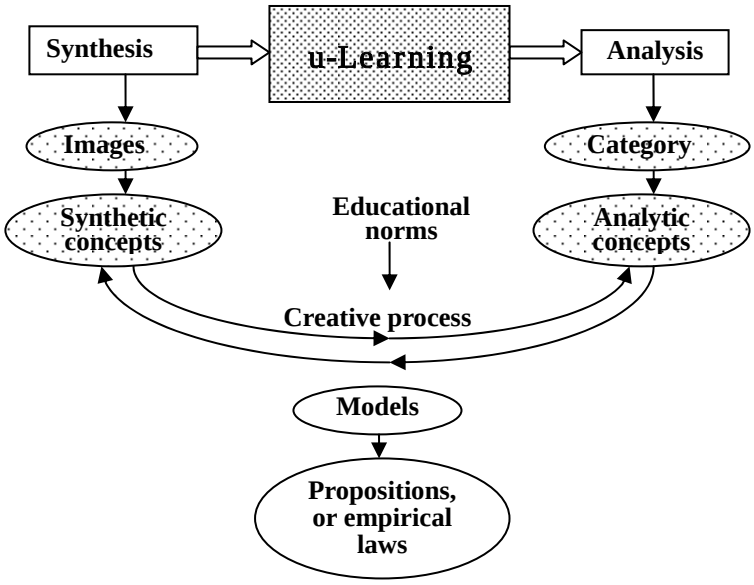

Figure 4 Procedure of empirical research on u-Learning

Usually teachers work on the PCs while students work on their mobile phones, PDA and/or PCs compatibly. In this situation, scientific findings are not sufficient to solve problems which emerge from the real and complex instruction. Creative thought is indispensable to develop efficient and effective distance learning without an excessive cost.

Conclusions

Two courses, 'Introduction to Instructional Technology' and 'Instructional Technology for Informatics', are being developed. Both adopt printed materials and ubiquitous devices

in their curricula. In the process of their development, more than thirty different iconic or figurative models and more than sixty propositions have been developed and tested for validity. Four graphs introduced in this paper and ten propositions described in the appendix show examples of principal models and propositions created during the process of instructional development and validity testing. Results from this u-Learning project are the printed materials themselves, the software implemented in the ubiquitous devices, and conceptual products such as figurative models and judgmental propositions. These are being improved ceaselessly and accumulated in a database.

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(Appendix)

Some instructional propositions emerged from this project. (5 propositions out of 65)

- Transformation from image to key concept, graphic presentation and modeling is indispensable but hard to achieve in student teachers with success. Modeling requires a great leap from the previous step.
- Realization of autonomous learning requires cultivating the students' heightened attitude towards learning. To cultivate such an attitude, it is effective to require repeatedly the same behavior of filling in the framework sheet (MACETO format) before students can organize learning by themselves.
- Alternative strategies of degrees of freedom in learning:
  1. When we increase the degree of freedom in learning and give more initiative to the students, learning results in a wide range from excellent to poor in quality and quantity.
  2. When we decrease the degree of freedom in learning and give less initiative to the students, learning results in a reliable but mediocre outcome of both less excellent and less poor quality.
- To manage a large group of students to learn autonomously, it is effective to form groups and clusters of groups, encourage active participation and let them recognize their responsibility towards autonomous learning.
- To make learning meaningful, it is effective to start the lesson from one's earlier experiences relevant to instructional contents.

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