

A Learning Process in Resource-Based Well-Structured Instruction in Web-based Distance Learning Environment

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Abstract

This research is to articulate a learning process in resource-based well-structured instruction in web-based distance learning environment. To explore the learning process, a web resource-based self-learning program, which is highly structured with structuring elements from literature review, was developed as a college level course. Sixty-seven junior students at a cyber university in Korea, aged from 20s to 50s, were required to learn the program given for eight weeks. Students' perceived learning processes from Questionnaires, achievement scores, satisfaction levels, interview data, were collected and analyzed. As a result, an observable action model and a conceptual model of the learning process were derived, which students and experts verified. Cognitive achievement factor and satisfaction factor were also considered in the learning process model. Consequently the learning process constitutes a major phase (initiation ? contact learning material ? internal process ? individual understanding ? externalization ? internalization) and a minor phase (minor informal offline interaction among students) in resource-based highly structured self-learning. Implications of each stage in the model and recommendations for further study were suggested.

Context of the Research

Web and multimedia technology is changing the way of teaching and learning. There is also an increasing demand for a flexible learning framework that does not tie the learner, especially adult learner with full time job, down to a specific time or place. This is the very need for distance education. In distance education, people cannot interact well because of the 'distance'. For thousands of years, learning and teaching always took place in close proximity, and this has become firmly anchored in human consciousness. Learning and teaching at a distance has been therefore regarded as something extraordinary and as a defect. Because of the distance, educators have tried to make every effort to get over this spatial separation. The first pedagogic approaches specific to distance education aimed at finding ways by which spatial distance could be bridged, reduced or even eliminated. The question was asked (Peters, 1998): what must be done to make distance equivalent to proximity in distance education? The pedagogics of distance education is derived basically from the efforts to answer to this question.

One of the try to answer to this question is making and managing learning materials as best ever as possible, which almost does not need teacher's interaction. Educators at traditional distance university used most funds and most efforts for the professional development and production of qualitatively excellent teaching materials for the purposes of self-study, which are then distributed by post in early distance education and by web-based cyber instruction program in these days. They tried to include teacher's interaction into the well-structured material for self-learning. Moore(1993) conceptualized these characteristics as 'structure', because he regarded the main characteristic of the making and managing programs as the structuring of the learning and teaching. Also researches have presented elements and rationale of course/contents structure as well as instructional strategies for structuralization. Researchers emphasizing structure in distance learning seem to believe that well-structured material can get over the absence of teacher. Based on this belief, educators in Korea have provided mainly structure dependent program a lot, which are for self-learning with little interaction.

Unfortunately, however, it is not easy to find how the structure influences on learning process. Although majority of the literature on web-based distance education focuses on the effectiveness of web-based distance education or educational medium, and emphasizes structuring (converting existing, traditional course materials to a web-based format), they don't show how student's learning process is going in highly structured

instruction.

Therefore, the purpose of this research is to articulate the learning process in resource-based, highly structured instruction in web-based self-learning environment. The learning process model from this research will be able to explain how students learn with highly structured web materials and how course and contents structure influence on distance learning. And it will also provide better understanding of structural instructional strategies ' mechanisms as well as practical implications for distance instructional program design.

Literature Review

There is physical separation of teacher and learner, which is 'distance', in distance education. One of the efforts of reducing the distance between teachers and students was taken when people started to interpret distance education as the simulation of a conversation between teacher and student. They recommend that the contents be displayed in the form of a written dialogue. When writing teaching texts, teachers must imagine that they are speaking to someone, and this is supposed to make them use a spoken language wherever possible. The way in which the contents are shown must enable students to imagine the teacher in person while they are reading and to carry on quiet dialogues. Reading teaching texts and assimilating their contents is thus transformed into an internal or virtual dialogue (Holmberg, 1983).

The term of 'structure', Moore (1993) defined, is contrast to dialogical learning. It is consistently planned on a targeted basis and with small steps, therefore being closed to spontaneous interventions, its time is regimented and it is uniformly controlled and evaluated. The main instruments of this learning and teaching are printed courses or multimedia learning packages which contain carefully developed and optimized courses and set learning into motion and control it. Moore(1993) chose the brief description of 'structure' for this concept, because he regarded the main characteristic as the structuring of the learning and teaching - right down to the last detail. He used the example of a teaching film for television to show just how far this structuring could go: in the film 'literally every word, every action of the teacher, every minute of the available time and even the tiniest detail of the contents were laid down beforehand'. This kind of reduction of structuring program is on the basis of criteria from educational technology. The structure is seen most clearly and most densely in programmed instruction. It was the representative of an instructional theory in which each word, each learning step, each teaching strategy was planned and developed with the greatest care in order to simplify learning and to make teaching more successful.

The structuring of learning and teaching is in fact nothing new and certainly not unique to distance education. Presenting knowledge through books has usually been broken down by means of components such as a foreword, an introduction, chapters, a summary and a conclusion. And in the last two centuries, the articulation of instruction has been a central theme of pedagogics, especially in the field of instructional design. What is nevertheless new in Moore's suggested concept is not structuring in itself but the extreme extent of its application (Peters, 1998).

This 'structure' discussed here, is about the elements in the course design and contents design. A course consists of such elements as learning objectives, content themes, information presentations, case studies, pictorial and other illustrations, exercises, projects, tests. All these may be very carefully composed, very carefully structured. In addition, we need to consider another type of structure especially in web-based environment, which is interface structure. Interface structure is related to site structure, navigation structure, or screen design structure on the screen that students face directly(Lee, 2004b). Therefore, highly structured instruction in this research means that the extent of structuring is quite high in terms of course, contents, and interface structure for self learning without teacher's interaction. Structural elements in detail, modified from Lee(2004a) and Peters(1998), are shown in Table 1.

Table 1. *Modified structural elements (Lee, 2004a; Peters, 1998)*

Structure	Structural elements
Course structure	<ul style="list-style-type: none"> • Dosing • Course orientation: welcoming, characterizing the course contents, description of the required preliminary knowledge, indications of correlations to other areas of knowledge and possibly to job practice, description of rough learning and teaching objectives, naming advantages obtained by reaching and learning goals... • Scheduling • Self-tests • Peer evaluation • Assignments and pre-scheduled deadline

	<ul style="list-style-type: none"> • Systematic management of course pace and learning speed • Strict grading according to notice announced in advance
Contents structure	<ul style="list-style-type: none"> • Portioning • Contents, lists • Indication of learning and teaching aims • Sequencing • Stressing what is important • Showing perspectives for further study • Branching • Cross-references • Arrangement in blocks and characterization by marginal notes • Summative map, structural site map, procedural map • Concept map, concepts tree • Comparison/Contradiction • Abstracts • Index • Instructional methods: questions for repetition, questions for training, simulated dialogue • Writing contents with spoken language, like conversation style
Interface structure	<ul style="list-style-type: none"> • Spatial layout to avoid cognitive overloading • Search index function • Emphasizing by spaced printing • Marginal notes • Visualization with graph, table, or figures • Frames, underlining, bold, italic print, decimal numbering • Use characters like avatar for students not to feel isolation

Research Method

In order to articulate the learning process in structured distance instruction, we developed a resource-based highly structured web-based distance instructional program as college level. The program was developed and implemented mainly with resource-based highly structured self-learning mode. Structuring elements in course/contents/interface from literature review (Lee, 2004a; Peters, 1998) were applied to the program. We designed and developed the instructional program according to traditional ISD(Instructional Systems Development) model, considering structural elements from the literature. Three WBI(Web-Based Instruction) experts and practitioners verified the program on and off throughout the development process. The subject of the program was about general social science.

Sixty-seven junior students at K Cyber University in Korea, aged from 20s to 50s, randomly assigned, were required to study highly structured web material for eight weeks and to undertake assignments given every week. Instructor's feedback was provided as little as possible. Instead, most possible instructor's feedbacks were structured into the web materials. The instructor was trying to neither encourage nor discourage interactions among students. Throughout the course, students' perceived learning process from questionnaires, cognitive achievements, satisfaction levels, online messages, interview data, and participatory investigation data were collected and analyzed. Various statistical analysis methods such as correlation analysis, contents analysis, t-test, frequency analysis, were applied to the data.

For evaluation reliability, three evaluators' gradings were correlated (Pearson $r = .84^{**}$). In terms of satisfaction level, a satisfaction measurement tool (Kim & Ryu(2000) were developed and validated) was used after modification (reliability $\alpha = .93$). Twenty students were interviewed at the end of each course to verify all quantitative data and to provide more detailed information to the researchers regarding the factors of learning process.

Modeling procedure of learning process was following Rubinstein (1975)'s perspective. According to him, modeling procedure is for simplifying and abstraction. So the procedure in this research was as follows: Development of treatment instructional program ? Implementation of the program and collecting data ? Coding questionnaire data ? Deriving rough pattern of learning process ? Analysis of learning output variables ? Correlation of learning output variables and learning process ? Interview ? Analysis of interview data ? Verification learning process action model by learners ? Conceptualization of learning process and its visualization ? Verification of conceptualized learning process model by experts and learners ? Production of finally verified conceptual diagram of learning process in resource-based well-structured WBI learning environment.

Results and Discussion

Learning process; an action model

To explore a learning process in resource-based structured distance self-learning, we coded sixty-seven students' perceived learning processes in questionnaires and derived rough average pattern of the students' learning process. The students' perceived learning procedure after first coding was composed of 11 stages as follows: reading notice & information provided, reading free board, reading Q/A board, posting messages on free board or Q/A board, studying web-based material, editing and printing web text, doing assignments, making reference to other materials through on/off line, off line interaction (telephone or offline meeting), assignments submission, check individual learning pace in learning management system. Among these items, activities less than 10% frequency were removed, and the learning procedure was recoded again. Also all stages were analyzed and correlated with learning output variables such as cognitive achievement or satisfaction. Throughout this procedure, a learning process, in which all stages were rearranged with logical sequence, was finally derived (see Figure 1). Figure 1 shows an observable action model of learning process in resource-based highly structured instruction in web-based distance learning environment. Subscript 1) represents cognitive achievement factor and subscript 2) indicates satisfaction factor.

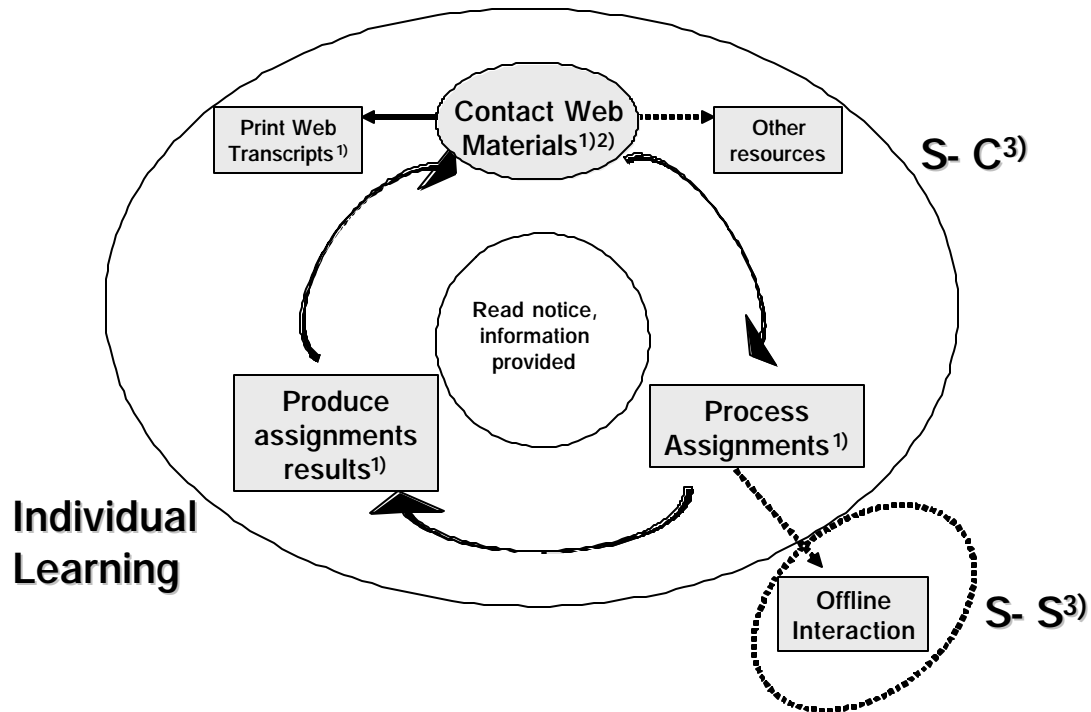


Figure 1. An observable action model of learning process in resource-based highly structured instruction in web-based distance learning environment; 1) Cognitive achievement factor, 2) Satisfaction factor, 3) Interactions (Students -Contents(S-C), Students-Students(S-S)).

The learning process in this research constitutes a major phase and a minor phase. Major phase is about individual learning and the minor phase of the model is about minor informal offline interaction among students. In major learning process, students [contact web material], which is highly structured, and then are involved in [undertaking assignments]. After the process of their assignments of each web lecture, students finally [produce results]. While undertaking assignments, some students (33%) informally interacted with other colleagues. This interaction was offline out-of-class communication, by telephone or face-to-face meeting. Although asynchronous bulletin boards were provided during the course, students' interaction was not so activated. Instead, students interacted informally outside of class, mainly about social or procedural topics, far from academic discussion. This interaction, therefore, didn't seem to be main learning process. Interviewee indicated that students studied alone but sometimes they were hungry for social relationship with classmates,

especially in distance learning environment.

One of the significant findings in this model is that the stage of [print web transcripts] is found to be a learning achievement factor ($p < .01$). Students who printed web material showed higher achievement score than those who didn't print. The interviewee said that they printed web materials because it was easier to read printed text on paper than to read the text on the screen, and it is easy to take a note on it what they learned. Apparently this could mean that reading texts on paper would be more effective than reading texts on screen. But the effectiveness in this context could be from well-structured contents in the material, not from printed format itself. That is, structuring, rather than printing, could be main reason for the effectiveness. So we suggest that the exact critical success factor in achievement be further researched. Anyhow, printing activity in this research was used for studying more intensely and for externalization of what they understand.

In terms of satisfaction level, the structure of course and contents was found to be a critical factor. Upper 30% of achievement group showed significantly higher satisfaction on the course and contents structure than lower 30% group showed ($p < .01$).

Learning process; a conceptual model

The action model of learning process was abstracted to a conceptual model (see Figure 2), with considering previous literature (Lee, 2004a; Stahl, 2000). In Figure 2, bold solid arrow shows major learning process and fine solid arrow shows back process or minor process experienced by some students. Dotted line represents partial experience of some students, not a major process.

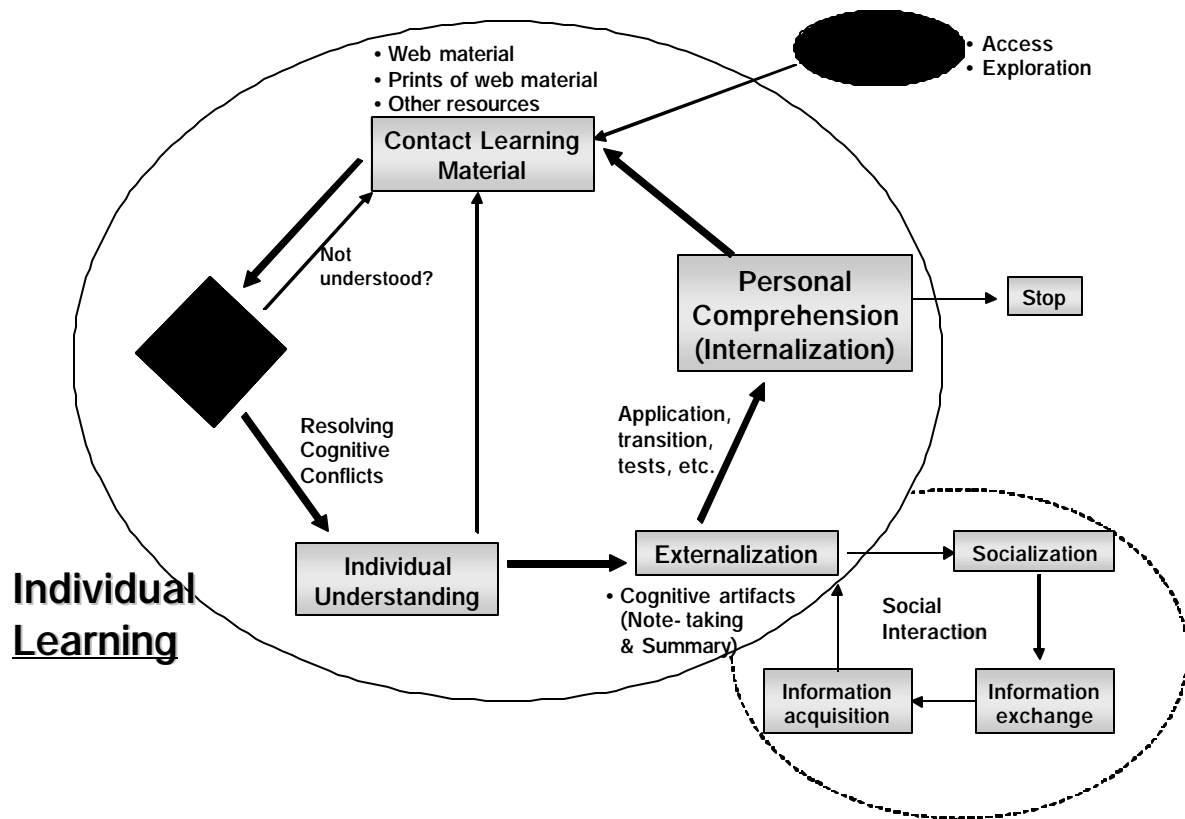


Figure 2. A Conceptual model of learning process in resource-based well-structured instruction in web-based distance learning environment

In the conceptual diagram of learning process, there are two phases. One is about 'individual learning' and the other is about 'social interaction', which is differentiated from 'social learning'. In individual learning phase, the process is beginning with [initiation] at first. [Initiation] includes access, reading notice or announcement, clicking menu, exploration on web-based class sites. This activity is not exactly main learning process, rather pre-activity before learning process. So it is shown outside of the learning cycle.

After initiation, learners [contact learning materials], which were highly structured web-based

instructional program in this research, printed materials of web-based instructional program, and other resources. At this point, students printed web materials for reading more intensely and for note-taking. Making printed material was found to be a critical achievement factor and satisfaction factor in this research as mentioned in Action model section.

When learners contact learning material, there must be [internal process] in their brain, which is many learning theorists have concerned about. At this stage, students are trying to absorb knowledge into their own cognitive schema over reflection. This is occurred in one's brain for self-asking or intrapersonal communication, which is not observable but explainable by learning theories of cognitive scientists. But we don't discuss how the internal process is going on here because it is beyond this research.

If students understand the contents well enough throughout the internal process, they arrive at [individual understanding]. Otherwise, they get back to [contact learning material] and repeat this cycle until they understand it. [Individual understanding] is differentiated from 'shared understanding' presented by Stahl (2002). Whereas 'socially shared understanding' is from consensus among interactive team members, [individual understanding] is the arrival stage of the process from individual learner's cognitive structure through internal process to resolving cognitive conflicts. This [Individual understanding], which is temporary understanding but not externalizable, is also different from final [internalization] that is personal comprehension of knowledge.

To get to [internalization], it is found that students summarize or take notes of what they understand. This activity is conceptualized as [externalization] in this research, which is found as a critical cognitive achievement factor. The observable behavior in this step was printing web-text and utilizing it. This means that physical behavior of printing represents significant cognitive activity in learning process.

After this whole cycle, a learner eventually arrives at [internalization] that is personal comprehension of knowledge. Then you have to decide to continue or stop learning. This whole process can be visualized as a conceptual diagram of learning process (see Figure 2). The conceptual model presented in Figure 2 was verified by five distance education experts and 10% of students in this research. Respondents used a 5-point Likert scale (5 = fully verified, 1 = not verified), which was referred to previous literature (Choi, 2002; Rha & Hong, 2004; Rha & Jung, 2001), to rate validity, explicability, usability, generality, and comprehensibility. Average rate of experts was 4.28 and average rate of students was 4.10.

Conclusion and Recommendation

This research is to articulate the learning process in resource-based well-structured instruction in web-based self-learning environment. To explore the learning process, a resource-based self-learning program was developed. Quantitative and qualitative data were collected from the implementation of the program and an action model and a conceptual model of learning process were derived. In conclusion, the learning process in resource-based structured distance learning constitutes a major phase (initiation ? contact learning material ? internal process ? individual understanding ? externalization ? internalization) and a minor phase (minor informal offline interaction among students).

The findings in this study provide some significant implications. One is that this study provides a conceptual framework to understand how the learning process is going in highly structured, web resource based distance instruction with little interpersonal interaction. This article also contributes to understand how the course and contents structure influence in distance learning. The other is that we can suggest some instructional strategies in self-learning mode, such as externalization strategies or design of appropriate social interaction. Printing and note-taking turns out to be a critical success factor in this research. So externalization tips like trying to require students to submit reflection note for assignments could be a good strategy for better cognitive achievement. Also social interaction among students needs to be encouraged in especially distance learning environment. We may design this to be structured in a course. Historically educators have tried to include most possible student-teacher interaction into a learning material. But findings in this research show that now we need to consider structuring student-student interaction, as well as student-teacher interaction, in instructional design of web-based distance learning program.

Finally recommendations for further research to get over limitations in this research are suggested as follows: a) This research is a case study, based on Korean context. There could be difference in other cultural context. So we suggest that similar research in different context as well as in different learning subject be studied to enrich the implications in this article. Besides, learning process study in mainly interpersonal interactive learning environment or their comparative study can be proposed for further research. These researches providing quantitative data from more cases with various learning contexts could verify and generalize the findings of this research. Also researches considering emotional or social evaluation as well as

cognitive evaluation on various learning contents could be recommended for more comprehensive understanding in web-based distance education. b) This research did not consider each structural element's effect or influence on learning, although many structural elements from the previous literature were applied to structured instructional development. But there could be many different design types among structured instructional program. Analysis and comparison of each element's influence on learning would be a good theme for further research. c) Learner analysis in each group might contribute to elaborate the implications in this research. We didn't analyze learners' characteristics with objective measurement tools. Rather we simply checked perceived learners' characteristics. More objective analysis of learners' characteristics with verified measuring tools, including special characteristics such as learner autonomy or self-regulating ability, would give us significant and more articulated implications.

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