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IMPLEMENTATION OF ELABORATION THEORY IN MATERIAL DESIGN FOR DISTANCE EDUCATION

Asist. Prof. Dr. Unal CAKIROGLU,
Karadeniz Technical University,
Trabzon, TURKEY

Lecturer Mucahit OZTURK,
Aksaray University, TURKEY

ABSTRACT

Distance Education is a kind of teaching in which a variety of teaching activities and the communication between students are achieved through peculiarly prepared contents and environments at a certain station in the cases when there is no possibility to conduct in-class activities. One of the most significant constraints of distance education conducted by several universities is the lack of qualified content and the limitations in the presentation of the content. Herein there is a need for reference models that will show how to make material design, constitute an efficient theoretical base for presentation of the course content. Therefore, in this study for material design in Distance Education, Elaboration Theory was employed, and a sample course design was accomplished. With its seven basic components (an Elaborative Sequence, Learning Prerequisite Sequences, Summarizers, Synthesizers, Analogies, Cognitive Strategy Activators, Learner Control) Elaboration Theory guides the teaching designers about how the teaching content and its presentations should be. In this study, a material design including four subjects was conducted for an introductory programming course in the scope of guiding principles of ET, and at every stage of this design, four experts' views were received in order to ensure its validity. The suggested style of material design is hoped to eliminate at a visible level the insufficiencies in favor of synchronous distance learning practices.

Keywords: **Distance Education, Material Design**

INTRODUCTION

The developments in information and communication technologies parallel to the emergence of the terms such as information society, lifelong-learning, and equality of opportunity in education has caused alteration in commonly used teaching methods. Thus as a new form of teaching having more different practices than the conventional education, "Distance Education" has come into being. In Distance Education (DE) teacher and learners in different environments realize teaching and learning practices thanks to information and communication technologies or postal services (İşman, 2008). Generally, DE can be carried out as synchronous, asynchronous, and blended depending on the times when teacher and learners communicate (Collis and Moonen, 2001). Transition from traditional educational organization to DE has introduced many differences, particularly, in course designs and presentations. When these differences are attempted to be compensated through traditional ways, in DE, specifically, in course and material design some of deficiencies are encountered.

In recent years, with the tendency towards constructivist approach, in DE as well as traditional education, the variables like the quality of the material, the style of communication, and transfer of information are needed to be carefully planned and practiced (Tuncer and Taspınar, 2008). The research studies conducted in recent years have shown that the application of constructivist approach in DE is far to be easy; and that there are some restrictions before the learners to establish learning environments in which they can construct their own information. It reveals that the instructors' preparation or use of interactive materials for online environments in Distance Education is a crucial need (Kim and Bonk, 2006).

The directives that will facilitate student's interaction with computer have to be presented in accordance with a particular standard (Virgil and Varvel, 2004). Ranging from the design of materials to be used to the presentation of the course, every step towards achieving the aims of DE has to be arranged within a scheme. Here in the design of materials to be used in DE, a need for evaluation of instructional design models, and in this context, rearrangements of in material designs arises. In that way, along with students' learning conditions taken into consideration, teaching materials can be developed in a specific order and system. In this respect, Elaboration Theory (ET) is thought to constitute an effective theoretical frame for teaching material preparation. With its seven components (an elaborative sequence, learning prerequisite sequences, summarizers, synthesizers, analogies, cognitive strategy activators, learner control) ET comes up with some principles and suggestions both for teaching designers and instructors in preparation and presentation of course content.

Elaboration Theory (ET)

Although ET accepts the prevailing teaching theories, it seeks to compensate their inabilities in practice, and puts forward the principles concerning the sequence and presentation of course content. It brings forward suggestions for selecting, sequencing, synthesizing, and summarizing the content. One of the most important strategies of ET is that the information is introduced from the simplest to more complex order (English, 1992). ET has seven major components (Reigeluth, 1987):

Elaborative Sequence

It is a specific form of sequencing knowledge from simple to complex (Reigeluth, 1987). The sequence of content in ET is like zooming in at a picture to examine it. At the beginning of the course, the picture is examined with a wide angle view, which allows one to see the major parts of the picture and the major relationships among those parts but without any detail. After studying those subparts and their interrelationships, the whole parts can be reviewed with a wide-angle (Korkmaz, 2007).

Learning Prerequisite Sequences

The content of every course pursuant to ET is needed to be sequenced. Firstly, the type of lesson content should be determined. Learning prerequisites should be sequenced just before the content, and being classified and organized, the concepts should be presented.

Summarizers

In order that the content learned in the class becomes retentive, regular content reviews are needed (Reigeluth, 1983). The summarizers include a brief statement of what has been taught, a reference example which is easy to remember for each idea, and a diagnostic practice item.

Synthesizers

In instruction it is necessary to periodically interrelate what has been learned. Providing the learners with content on concepts, principles or processes, synthesizers embody a meaningful whole, and enhance retention of learning (Reigeluth at al., 1994).

Analogies

Analogies enable learners to relate the content to their' prior knowledge and achieve learning. This relation can be revealed through analogy or discrepancy.

Analogies pave the way for compensability of the content difficult to understand, build a meaningful whole by relating the unknown or difficult content to the already known content (Needham et. al, 2012).

Cognitive Strategy Activators

In the process of instruction,cognitive strategy activators can be seen as mental reminders or analogies used for any content, thereby the instruction becomes more effective (Reigeluth, 1987). In order to achieve this, the visuals (pictures, maps, flowcharts, etc.) or verbal strategies (making up stories) can be utilized (Needham et. al, 2012).

Learner Control

Learner Control refers to the opportunity the learners have to take directly command for instruction process (Cook, 2001). Learner Control is to give learners who have achieved their prerequisite learning to exercise control over their own learning process (Reigeluth, 1987).

AIM OF STUDY

The aim of the study is to prepare a teaching material according to ET for introductory programming course in a distance education program and to introduce models on how to design instructional material meeting pedagogical requirements for distance education.

METHOD

This study focused on "Analysis" and "Development" phases of instructional design process. Accordingly, "Articulate Storyline", authorware program, was employed. By means of that software, a learning environment within the frame of ET principles was prepared for introductory programming course, which is taught through DE. This teaching software consists of 4 sessions. Upon the preparation of every session, the domain experts' opinions were received, and if necessary, the concerned sessions were revised. In this respect, it was inspired from Hannafin and Peck's (1988) framework of revising and receiving feedback at every stage, and accordingly reaching the final design following the hierarchic mid-term evaluations. For Introductory programming is a course in which the students learn new concepts (memory, addressing, coding, etc.) start to solve problems in a new environment rather than paper-pencil use; and experience intensive cognitive processes. Researches have showed that students face some difficulties in learning this course (Dunica, 2002; Jenkins, 2002; Proulx, 2000; cited in Gulmez, 2009). Among the reasons for these limitations, the efficient use of material is overemphasized.

Therefore, when considered that the students may face constraints in the use of material in DE, the use of strategic components of ET in the process of material design is thought to be efficacious.

Elaborative Sequence

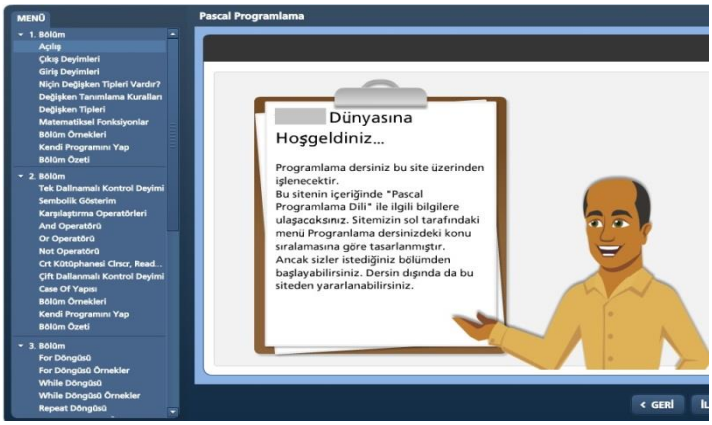

Figure: 1
TheIntroduction Course

In Figure: 1, the interface for designed material is shown. Content of the course on the left side of figure is presented in 4 stages. It is clear that the content scheme for every stage is sequenced from simple to complex and at every successive stage the subjects handled more profoundly. For example; in Session 1, the command to type a text on the screen which is the first step to teaching programming is shown. In the following stages, there is a transition to more complex subjects like reading the data entered on the keyboard, identifying the variables and the types of variables.

Learning Prerequisite Sequences

As for introductory programming course has many new concepts, conceptual content sequence is employed. At every session before the actual content is taught, a content that will provide prerequisite learning is presented. For example; in Session 2, for relational operators in programming to be learned, conditional structure has to be learned first. Thus, in the course content, the conditional structure which is prerequisite learning for relational operators is given.

Summarizers

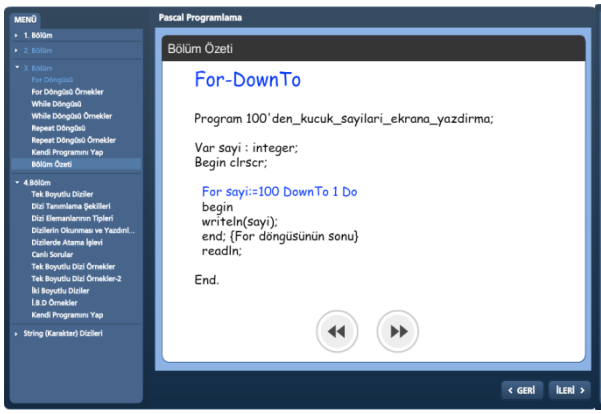

Figure: 2. Summarizer-1

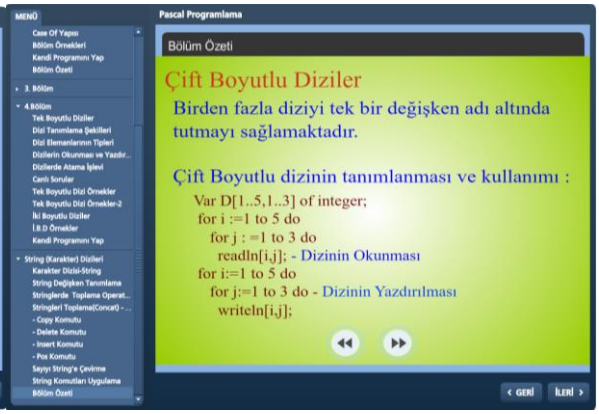

Figure: 3. Summarizer-2

Being a key component in interpretation and retention of what is learned; summarizers have been employed at the end of every session of learningware. As shown in Figure 2 and Figure 3, flash animations that summarize all the subjects taught in every session are used.

Synthesizers

The content learned needs to be related at certain intervals. With this object in mind, there is a "Session Examples" part (shown in Figure 4) that is thought to enable learners to integrate and relate what has been learned.

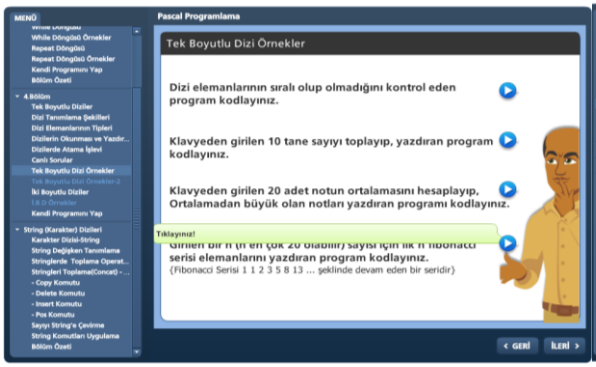

Figure: 4. Synthesizer-1

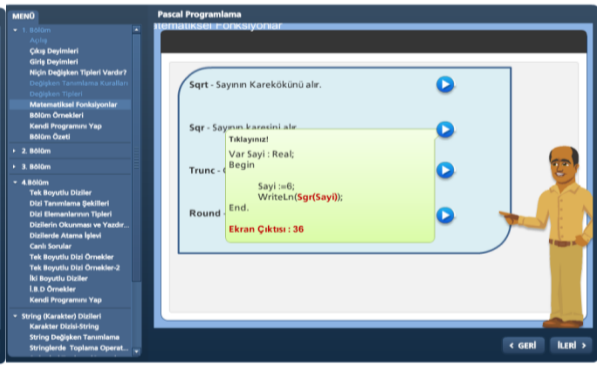

Figure5. Synthesizer-2

Also following the explanation of every concept, a sample problem related to the concept is solved. For example; in Figure 5, mathematical functions used in Pascal and their features are presented. On the same screen when the arrow icon is clicked, model practice of related function is viewed. In this way, learners can profoundly achieve learning by practicing the content they have learned.

Analogies

In every session, the subjects difficult to learn are attempted to be taught by use of prior concepts learned by students. For example; an analogy is used to explain the logic of "For Loop" in Session 3. For loop is pre-controlled. Namely, loop number is foreknown. Considering this fact, the logic of for loop is explained in Figure 6.In the subjacent screen a space for round number is allocated.

Figure: 6. Analogy-1

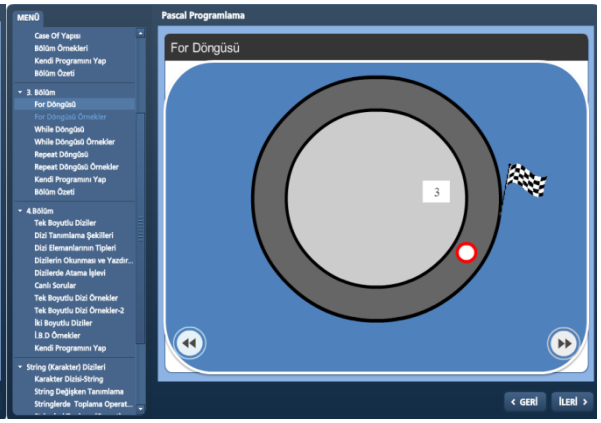

Figure: 7. Analogy-2

After round number is entered to this space, the number of rounds that the ball is going to make around the circle is determined as shown in Figure 7. In this way, as a pre-controlled loop, For loop is related to the analogy that the loop number is pre-controlled and in accordance with this number the ball revolves around the circle.

Cognitive Strategy Activators

Learningware includes pictures, flash animations, graphics, flow-charts, and videos which are cognitive strategy activators. In Figure 8, the use of "Copy command"- a command of Pascal- is demonstrated with a flash animation.In Figure 9, on the other hand, "variable definition rules" in Pascal are presented on a diagram. In every session of the process, Cognitive Strategy Activators have been employed depending on the content of lesson. These activators are thought to be helpful for students to construct meaningful content structures and achieve a retentive learning.

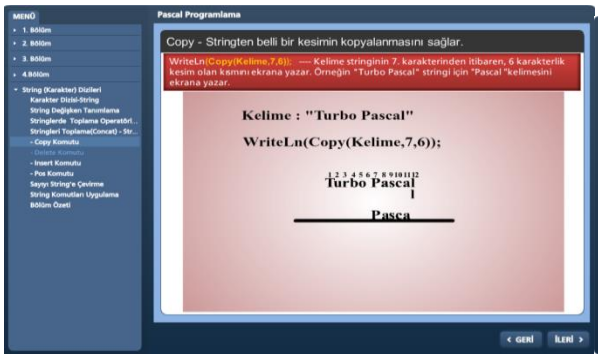

Figure 8. Cognitive Strategy Activator-1

Figure 9. Cognitive Strategy Activator-2

Learner Control

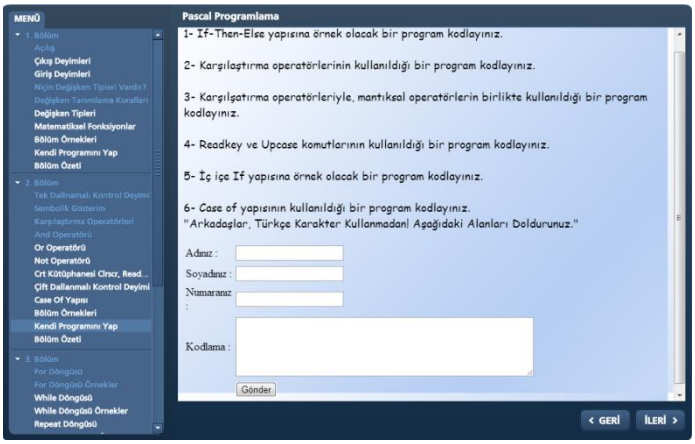

Figure 10. Learner Control

In the material, a module of "Build Your Programme" in which students can control their learning and practice what they have learned has been prepared. In this module, students are expected to create questions and provide solution related to already taught subjects in every session. For instance; in Figure 10, students are requested to code their pragramme templates concerning the subjects taught in Session 2, and load it to the system.

Thus students are given the opportunity to evaluate their learning at the end of every session.

Table: 1
Learningware Relationship Items of ET

ITEMS OF ET	LEARNING MATERIAL
Elaborative Sequence	Course content has been prepared in order, from simple to complex.
Learning Prerequisite Sequences	At every session before the actual content is taught, a content that will provide prerequisite learning is presented.
Summarizers	At the end of each chapter "ChapterSummary" modules are available.
Synthesizers	Ineachsection, "Section Examples" modules are available.
Analogies	1. Session "Why are variable types" 2. Session: "One-Branching Control Statement" "Double Branching Control Statement" 3. Session: "For Loop", "While Loop" "Repeat Loop" 4. Session: "One-Dimensional Arrays", "Multidimensional Arrays"
Cognitive Strategy Activators	Learningware used in all sections, images, video, flash animation, flow diagrams.
Learner Control	In each section, the "Make Your Own Program" modulesareavailable.

DISCUSSION & RESULT

One of the major constraints of DE is that unlike classroom environment, it lacks face to face interaction. Therefore, in teaching process, instructional materials play a big part in providing teacher-student, students-content, and student-student interaction at a desired level. Certainly, the adaptation of material design models to DE is not easy.

This study has asserted the clues towards the fact that the frame drawn by ET which supports the principles of several theories of teaching and learning, and attempts to compensate their constraints can be used. As a matter of fact, with its seven major strategy components ET guides instructional designers and instructors about preparation of course content and in what sequence this content should be presented. In ET teaching style shelters a specific form of sequential order with a simple-to-complex sequence. After studying the content, and the interrelationships of content sub-parts with a wide angle view, one goes deeper into details, and concentrates on certain concepts. Then he goes back to the whole picture, and reviews the context of the sub-part in the whole (Şimşek, 2011). With this respect, all strategies of ET have been utilized in the prepared learning material.

The content has been prepared in a successive order with a simple-to-complex sequence, and separated into 4 sessions in accordance with its specifications.

Every session in itself has been divided into sub-parts, and presented in this form. In every session of the designed learning material, the practices of all other components (summarizers, synthesizers, analogies, cognitive strategy activators, learner control) of ET have been involved (see Table: 1).

ET able to constitute the base for material design to reduce the restrictions in distance teaching of for introductory programming course. Also, as for introductory programming course is concept based, it can be regarded to be suitable for material design within the frame of ET. Within this study, it has been revealed that materials can be prepared in the frame of a model consistent with the concerned theory; and accordingly, it is thought that thanks to the materials prepared in this way, some constraints (student, teacher, and system based) caused by the nature of DE can eliminated.

Consequently, it can be stated that if ET is taken into account in the design of materials that will constitute a framework for materials inDE that the instructor will no longer be the focal point and interaction role can have a balanced distribution among teacher, learner and content.

BIODATA and CONTAC ADDRESSES of the AUTHOR

Dr. Unal CAKIROĞLU is currently an assistantproffesor at the Department of Computer and Instructional Technologies at Karadeniz Technical University. His academical qualifications were in Computer Engineering (B. Sc.), in Computer Engineering (M.S) and Technology of Education (PhD.). He teaches computer programming, operationsystems, andother IT related courses. His research interests include e-learning applications, social networking in education, technology integration and distance education.

Asist. Prof. Dr. Unal CAKIROGLU,
Department of Computer Educationand Instructional Technology
Karadeniz Technical University, Fatih Faculty of Education, Trabzon,TURKEY
Phone: +90 4623777113
Email: cakiroglu@ktu.edu.tr

Mucahit OZTURK is currently a Lecturer at department of Computer Technologies at the Aksaray University. His acedemical qualification is doing Computer and İnstructional Technologies Education at the Karadeniz Technical University. He teaches computer programming, web programming, graphic design and information Technologies courses. His research contains distance education, material design, instructional design and e-learning applications.

Lecturer Mucahit OZTURK,
Department of Computer Technologies
Aksaray University,
Ortaköy Vacational School, Aksaray, TURKEY
Phone: +90 3823515287
Email mucahit.ozturk68@hotmail.com

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