On Transferring of Traditional Learning Materials into Virtual Learning Environment

Iliana Chakarova, George Totkov

Abstract: *Intensive development of virtual learning environments as well as their propagation raises the question of inventing new learning materials that can be properly situated in this environments. In the paper considers briefly methods for transformation of traditional learning materials into electronic units. Examples have been given for transferring of the lesson "Number Systems" from a computer science textbook into a network of virtual materials. The experiments are carried out in virtual learning environment PeU 1.0.*

Key words*: e-Learning, Virtual Learning Environment, Learning planning with resources, Pedagogical concepts network, Course schedule.*

INTRODUCTION

Intensive development of virtual learning environments (VLE) [3-10, 13] as well as their propagation raises the question of inventing new learning materials that can be properly situated in these environments. The already existing educational handbooks for secondary schools and universities aren't in relevant form for disposition in VLE.

There are ***three methods*** for solving the problem of using already existing (traditional) learning materials in certain VLE. The *first method:* the lessons (learning materials) are directly transferred into their corresponding electronic versions (for example: file's format html, doc, pdf, etc.). Afterwards they are disposed as a sequence of links to the date base of the same VLE [4]. *The second method:* the authors of a learning course invent virtual learning materials following the methods of the design and release of VLE (possibly using templates for creating electronic learning materials). In fact this means re-writing the traditional learning materials for the new VLE. *The third (effective) method:* the authors transfer learning materials, situated on traditional media into virtual ones, using intrinsic features of the VLE.

In the paper we suggest methods for practicing the third method within the VLE of PeU 1.0, developed in Plovdiv University "P. Hilendarski" [7-10]. The special feature of PeU 1.0, that permits the realization of this method, is the fact that the system allows design of concept method in learning, based on resources.

CONCEPTS IN LEARNING

In the process of reflecting one subject properties or an everyday occurrence on human brain in one's mind raises an unusual form of mental activity called "concept". In science or in theory as well as in our daily routines we speak about "concept". We often define "thinking" as a process of using concepts [12].

Development of experimental methods and research of the process of concept formation has a long and intricate story, initiated by Aristhotel. The shortcomings of classical methods for studying concepts, mainly the methods for specification and examination of abstraction, can be compensated by inventing the N. Ah's synthetically–generic method. Modern methods of L. Vigothski and L. Saharov (1960's) are related with the general concept of Vigothski for the structure of superior mental function, one of which is the process of concept formation.

In traditional education giving different types of definitions is one of the ways to set up concepts [1, 2]. While studying certain subject domain (SD) it is important not only to know the dialectics of concept formation and development, but also its structural and logical characteristics, basic operations, etc.

In every SD a single concept is identified by: setting up its most important features; defining its semantic relations with other concepts; specifying its place in the concept system of the same SD; describing the concept, etc.

The concepts and the relations between them can be studied in different points of view (further called *layers*) – definition, relations with other concepts, and character of these relations, classification schemes, etc. The student begins the learning in certain SD, knowing some concepts and the relations between them (entry level), and in the process of education the student's knowledge is extended. The final purpose of this teaching is to add new layers – knowledge and skills, related with the concepts of the course of the every level. While the students accomplish this purpose they not only have different basic knowledge, but they also need different resources for working with the learning materials – time for assimilation, access time, price, etc.

VIRTUAL LEARNING ENVIRONMENTS

The concept "*Virtual University*" (VU) was set up in the beginning of the 90's. The special features of the VU are [3, 5, 13]:

- it is an accessible learning environment, based on integration of information and communication technologies;
- it provides educational and communicative service for the users, that doesn't depend on the time or the place;
- it maintains, substitutes and combines traditional ways of teaching and learning by using modern technologies, pedagogical methods and media;
- it's model can be adapted and is applicable for different pedagogical schemes and systems.

First research works in the field of Virtual University Environment in Bulgaria have been done in Sofia University (system ARCADE [6]), Plovdiv University (system PeU [7-10]) and Rousse University (system eLSe [4]).

Provisions were made so that the system *ARCADE* can support five levels for access – student, author of a course, instructor, course administrator and system administrator, and three types of communication: e-mail, chat and guest-book. There are only two types of test questions and answers that the system uses.

The system *eLSe* supports electronic versions of conventional education materials (usually in pdf format), and so provides access to the student's resources, administrator's resources and lecturers' resources. There are two forms of communication: forum and guest-books. eLSe supports three types of test questions, a set of templates for web-based courses and statistic information for the students.

The system *PeU* (The **P**lovdiv **e**-**U**niversity) [7-10] is the first experiment for creating VLE, that is not based on a lecture, developed by an author, but on a great amount of information and control units (independent from each other), laid down in an integrated data base. The system supports five levels for access (visitor, student, lecturers, author of a course, course administrator) and five subsystems (information, test, author's, communication and administrative). There are twenty-four types of electronic test questions and assignments, including all types of tests, used in education. Three types of communication between students, lecturers and authors are supported: e-mail, chat and guest-book.

PeU is a modern platform for virtual education, that puts into practice and supports concept method in education.

CONCEPTS IN VIRTUAL LEARNING ENVIRONMENT PeU 1.0

PeU has special features, that distinguish it from the other VLE: presentation of a learning course (on the basis of the concepts and the relations between them), automatic building of a plan for education of a certain user, the use of wide spectrum of test

assignments, etc. Every virtual learning course comprises of units that can help the user to study the concepts of the environment or to test the user's knowledge and skills.

The virtual learning course consists of electronic learning materials (information materials and test materials), that can be studied according to previously developed *learning planning with resources*. Every electronic material presents one or several concepts of the studied SD. Concepts included in the learning units are presented from different points of view, called layers. Examples of different layers, used in studying a certain concept are introduction, definition, example, classification, comparison, application, etc. Every concept, presented in a certain virtual learning material, is characterized by the value of the following resources: appropriate presentation for the students' level, time needed for assimilation; material price; access period, etc.

PeU supports lists of layers and resources, created by the users (authors or lecturers). The learning plan of a certain virtual course is presented as a graph with nodes – groups of learning materials (units), connected by relations of the type successor – ancestor. The integration of the learning units is realized by a series of operations: *and*, *or*, if (*yes*, *not*). The selected presentation creates potential for applying individual method in education process, and it is possible for the student to select the sequence of the learning materials, depending on the type of the studied group of learning materials.

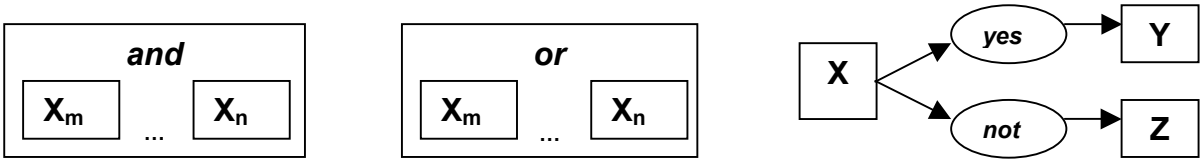

Figure 1. Grouping of learning materials by nodes of type *and, or, if*

The grouping permits automated training adjustable to every student: defining compulsory learning units (*and* group); variations of training – the student selects the sequence of the learning materials (*or*); options for extra learning units (in case of failure), etc.

METHODS FOR CREATING VIRTUAL LEARNING MATERIALS

The suggested methods are based on a learning planning with resources and layers [9]. For every concept that belongs to a definite theme of the learning course there is a special point of view (*layer*) and a list of couples (resource-value), that defines resource limits, registering the concept in the data base. The methods are based on theory of developing learning programs, mainly on its general principles, as well as on the specialty of the learning course.

Methods for developing and disposition of virtual learning materials in VLE (based on a conventional learning course) include the following stages:

A. Selection of an learning course in a certain subject domain and corresponding conventional learning materials along with information units as well as a set of tasks and tests.

B. Defining categories for future students along with corresponding entry levels and purposes in training, presented by concept lists.

C. Selection of key concepts for every theme of the current conventional course.

D. Division of the themes into smaller parts (that can cross), proper for transformation in their corresponding electronic versions (units).

E. Selection of the levels, layers and resources as well as database input of every unit in stage D. and every concept in stage C., defined in the same unit.

F. Developing of training plan, appropriate for students at different levels, with the corresponding resource limits. The plan is represented by graph that have for nodes electronic learning materials, and edges of the "successor " type between the nodes.

G. Consecutive disposition of the layers and resources lists, the units and the concepts included in them (along with their characteristics, layers and resource values), learning plans, resource limits in the database of the VLE.

It should be mentioned that in stage D. it is necessary:

- to specify whether the available learning materials include several types of virtual learning for different categories students (the answer gives us the number of the levels in the course);
- to specify the situations (different points of view) used in conventional learning materials for presenting the studied concepts (specifying the layers list);
- to estimate the resource limits of the units that had been created (that's really important when specifying the volume of the unit and it is connected with the time needed for studying and solving problems), etc.

Decisions made in stage D. and stage E. can be presented as a table (see Table 1).

The process of transformation conventional learning materials into electronic, in order to be disposed in VLE, is actually iterative. For example, after finishing the design and the creation of the virtual database as well as conducting real training experiments, it can be necessary to return again to some stages and to re-estimate our decisions.

EXAMPLE. Creating virtual materials in PeU for the lesson "Number Systems"

We are to use a textbook for conventional (traditional) learning in program for Bachelor's degree in computer science [11] for a base learning material. For transformation of the lesson in proper form for virtual education, it is necessary that the lesson is divided into smaller units. The lesson can be studied by students in three levels, marked as it follows: 1 (beginners), 2 (intermediates), 3 (advanced). Concepts are usually taught by introduction, definition, example, classification, comparison, realization, etc. which determines the layer list [11]. The possible resource list includes level, time, duration (the deadline for long-distance access to the learning material for a certain students' group), etc.

Unit		***Concept***	***Layer***	***Resource/value***			
				Level	***Time (min)***	***Duration***	
						From	***To***
U1		Number Systems (NS)	Introduction	1	4	01.04.	31.05.
		Decimal NS	Example				
U2		Number systems	Definition	1, 2, 3	1	01.04.	31.05.
U3		Basic numbers	Definition	1	1	15.05.	15.06.
U4		Digit	Definition	1	1	15.05.	15.06.
...		...	...	...	...	...	...
U12		Old-Bulgarian NS	Introduction	3	3	15.05.	15.06.
		Old-Bulgarian NS	Example				
U13		Number systems	Classification	1, 2, 3	1	10.06.	30.06.
U14	U15	Unpositional NS	Definition	1, 2	2	20.06.	20.08.
	U16	Unpositional NS	Example	2	1	20.06.	20.08.
	U17	Additive NS	Definition	2	3	20.06.	20.08.
		Additive NS	Example				
	U18	Multiply NS	Definition	2	4	20.06.	20.08.
		Multiply NS	Example				
	U19	Unpositional NS	Disadvantage	2	3	20.06.	20.08.
		Unpositional NS	Task				
		Unpositional NS	Example				
U20		Positional NS	Definition	1, 2	1	20.06.	20.08.
...		...	...	...	...	...	...
	U25	Positional NS	Application	3	8	01.08.	15.09.
U26		Positional NS	Principle for construction	1, 2, 3	2	01.08.	15.09.
		Positional NS	Main theorem	2, 3	10	01.08.	15.09.
...		...	...	...	...	...	...

Table 1. Units for the lesson "Number Systems"

The number of the concepts in lesson "Number Systems" is 11, and the number of the units is 37.

On a Figure 2 is presented the beginning of a model plan for virtual learning of the lesson "Number Systems". The elements of the plan are the units from Table 1.

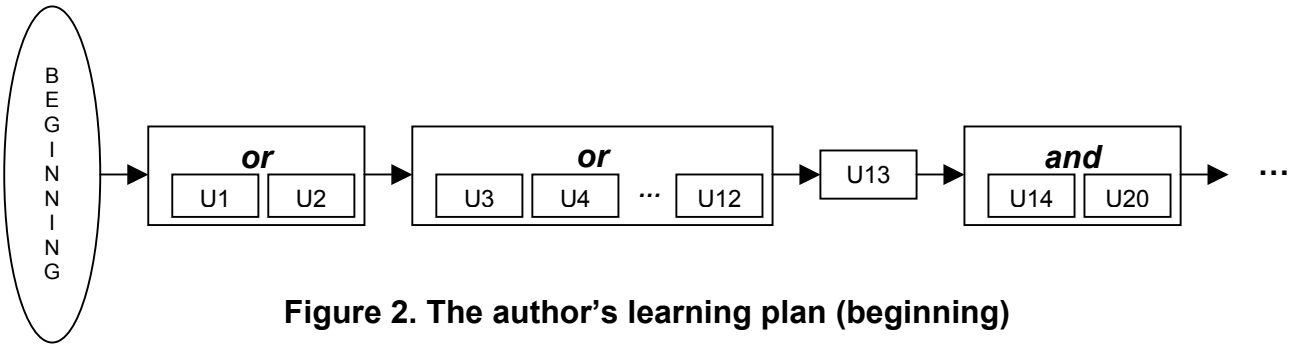

Figure 2. The author's learning plan (beginning)

For creating the learning plan we used the following rules:

- if certain units are compulsory, but the sequence of the learning units doesn't matter then they are grouped into a node of the type *and* (the students can select the sequence of the learning units on their own);
- if it is enough for the student to be well grounded in the contents of a single unit from a set of units then they are grouped in a node of the type *or* (the rest of the units can be selected as extra learning materials for the corresponding level of the training);
- if the unit is a test unit then the student can pass the exam by a node of the type *if* (yes / not) depending on the fact that the student passes the test (or fails in the test).

CONCLUSION

The presented methods are applicable for quick and effective transformation of conventional learning materials into novel electronic resources, particular for virtual education. The suggested methods are based on the consequent application of the concept method in learning as well as using VLE. The methods are suitable for working with concepts in various subject domains.

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