4 D Model of E-Learning

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Abstract— the paper presents a 4 D model for increasing the personalization of the e-learning process. Its 4 directions (4Ds) are: Previous student competences, Individual student's needs and style, Progress and Meaningfulness. An approach for application of the model is also suggested. It uses preliminary processing and simulation of the teaching and learning process for proactive assessment and transformation of the existed e-learning content towards the individual student needs.

I. INTRODUCTION

Our modern life is strongly influenced by effects such as rapidly changing and developing information, technology-enhanced communication and information access, and new forms of production and services.

This situation requires individuals to adapt their skills and competencies. Consequently, educational objectives and societal expectations have changed significantly in recent years.

The effectiveness of e-learning depends on the quantity and quality of the teaching materials, the time needed to pass through a course and the results achieved at the end.

Serious problem in e-learning is the low level of personalization of the teaching and learning process. In the Internet space can be found countless courses in one and the same theme, presented in different way, with different level of usage of multimedia elements, directed to different user profiles, with different duration and complexity.

The user has the very difficult task – to find the most appropriate course for his/her learning style, basic knowledge and skills. This is not always possible, and even when the choice of an appropriate course is a fact, the chance the initial goal (gaining knowledge and skills in a given field) to be reached for a short time is really minimal.

The personalization in e-learning may be described as a set of procedures, approaches and techniques for providing to students learning content, which is most appropriate for their needs, interests, previous knowledge and skills and individual learning style. This problem is deeply discussed and analyzed in many publications [1,3,4,5,6, 9,10,11, 16,17].

Personalized Learning is the tailoring of pedagogy, curriculum and learning environments to meet the needs and learning styles of individual learners. Personalization is broader than just individualization or differentiation in that it affords the learner a degree of choice about what is learned, when it is learned and how it is learned [18,19].

The adaptation of educational content to the personal characteristics of the students (learner profile) is a complex process and is a research field for many authors nowadays [12,13,14,15].

It requires:

- Collection of user data (interests, level of knowledge in a particular area, learning style, etc.). This can be done in the registration stage.
- Storage of the received data and user profile support.
- Accumulation of data for the learner behavior in interacting with the system and in collaborating with other learners (in which scientific area are his/her interest, how often he/she used a given course, what results did he/she achieve in the final assessment in a given course, what keywords he/she used most often in searching information in the system, in what thematic area he/she was involved in collaboration with other students, etc.).
- Collection and accumulation of group assessment in order to be obtained adequate information of how much the learning units are interested to the students, meet their needs and preferences and are useful for improving their level of competence and their successful application in future employment or other training.

II. 4D MODEL FOR E-LEARNING– DESCRIPTION AND MAIN CONCEPTS

The 4 Ds of the model are shown on fig.1:

	Past	Future
Individual assessment	**Previous competences**	**Individual student's needs and style**
Group assessment	**Progress**	**Meaningfulness**

Figure 1. The concepts of the 4D model of e-learning

The model's 4Ds are: Previous student competences, Individual student's needs and style, Progress and Meaningfulness.

For the 4D model design are important the following main concepts:

A. Every student has individual needs and learning style.

There are a lot of theories for learning style and a lot of research could be found in this field [7,8,9,14,17]. In the present report is used the so called perceptual modalities or learning styles, defined according the sense perceptions.

There are three basic modalities to process information to memory: visual (learning by seeing), auditory (learning by hearing) and kinesthetic (learning by doing). Each of these different types of learning and absorbing the new information has specific characteristics.

The learning style reflects the way of absorbing and processing the information.

The human has the three styles but in different ratios. Every person develops preferred and consistent behavior and specific approaches to learning. This is related to three processes that form the differences in styles:

- knowledge – how the knowledge is acquired;
- conceptualization – how the information is processed;
- motivation and emotions – the way of making decisions and emotional preferences [2].

Many students do not know their dominant learning style. This is a very serious problem when searching for an appropriate for them learning material.

When the e-learning system "knows" the individual learning style of a given student, it could select and offer him/her the most appropriate learning content.

B. Every student has different previous competences, obtained in the past.

The level of competence of each student is different. It depends on many different factors – the knowledge obtained by previous passed courses, the individual needed time and speed of absorbing and processing the new material, the level of real interest in the subject area, the formalism and low level of personalization in the traditional form of learning – each curriculum consists of N disciplines distributed in K educational years, etc.

Regardless of the educational level and form of studying the curriculum and syllabus are preliminary defined. For obtaining the relevant qualification level the student has to pass successfully all disciplines, i.e. he has to gain all credits, according the ECST.

In the traditional form of studying, the teaching is realized in front of a group of students with different learning profile (style, needs, interests, individual characteristics, etc.).

In most of the cases, although the professionalism and the wish of the teachers to work individually with each student separately, the personalization is very low. The education period is fixed and is not depending on the speed of adoption of the new material of the different students.

C. Every course could be assessed by the students most precise at its end.

The assessment should be very useful if it is based on two different directions – the first one is the progress that the students detect after passing the course and the second one is the level of meaningfulness (their vision where and how these competences could be applied for real problem solving or could help them understand more complex and specific knowledge). This could be easily realized by providing a survey among the students at the end of the course.

D. The group assessment implies greater reliability.

It is well known that sometimes the assessment of students may be not so realistic. It may be influenced by accidental negative for him/her event during the study, disparity in the characters of the course participants and as a result difficulties in the collaboration process, individual problems in understanding the material, etc. That is why the group assessment is so much important, because it ensures greater reliability and low level of subjectivity.

III. ONE APPROACH FOR APPLICATION OF THE 4D MODEL

The suggested in this section of the report approach applies the 4D model of e-learning. This approach ensures higher level of personalization of the e-learning by preliminary processing and simulation of the teaching and learning process for priori assessment of the effectiveness and for transformation of the existed e-learning content towards the individual student expectations.

The approach consists of seven main stages. They are visualized on fig. 2:

Stage 1 – the courses versions are description by experts according to the following criteria: for which learning style are most appropriate, level of complexity, what kind of previous competences are needed, for which thematic area are directed, group affiliation, etc. on this stage the course versions' profiles is created and saved in a Course profile database.

Stage 2 – includes the student's registration and determination of his individual learning style [1,7,8], previous competences and group affiliation. Thus the individual profile of the student is created and saved in a Student profile database.

Stage 3 –includes the student request for learning.

Stage 4 – software application, defines the best versions of the existed e-learning courses for the individual learning profile of each student. This choice is made in accordance with the specifics of each individual student profile (learning style, previous competences and group affiliation), the course versions' profiles and the results of the assessment of the group to which this student belongs (this includes his vision where and how these competences could be applied for real problem solving or could help him/her understand more complex and specific knowledge).

Stage 5 – the selected most effective e-learning course is offered to the student and the online activities are started.

Stage 6 – actualization of the student profile.

Stage 7 – this step includes student assessment about the progress that he/she detects after passing the course and the level of meaningfulness (his/her vision where and how these competences could be applied for real problem solving or could help him/her understand more complex and specific knowledge). The received information is saved in Group assessment database.

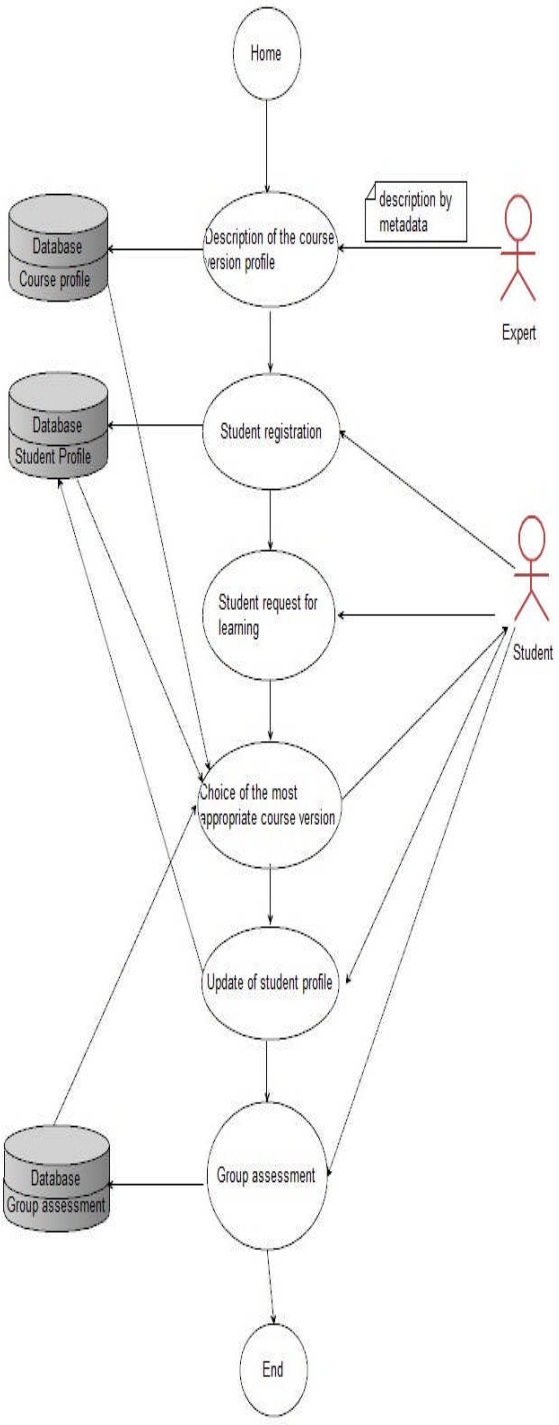

Figure 2. Approach for application of the 4D model

IV. CONCLUSIONS AND FUTURE WORK

In the future work the authors plan to define concrete criteria for determination of the group affiliations. The group affiliations are very important for the personalization of e-learning, because they define the needed competences within the group. It is also planed an experiment with current students from the two specialties "Computer Science" and "Informatics" of the VTU "St. Cyril and St. Methodius" and graduated students who are working already in companies to be provided and analyzed in order the presented in this report 4D model and approach to be applied in real environment.

We plan to develop multimedia modules, which will be accessible by a cloud technology and each student will be able to learn according his/her own learning profile. For the pilot case we will choose 20 students, which will be grouped into 5 teams. The 4 members of each team will have one and a same group affiliation and will study and cooperate using the most appropriate for the group module. The results of this experiment will be analyzed and discussed. Thus a "group personalization" in the e-learning process will be achieved.

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