

## STUDENT CLASSIFICATION IN E-LEARNING SYSTEMS

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### ABSTRACT

This paper proposes a model of an intelligent e-learning system by student's categorization in more classes, based on their qualifications, background knowledge and experience in the current domain. Before students start using the system, they have to complete a quiz with questions from specific content that student chooses.

Students can select two options: select level (beginner, medium, advanced) or don't select any level (system is going to propose the most appropriate level after the quiz is completed).

After the student's classification, system is going to provide learning materials adjusted to the student's performance in intensity and style that is set up from the registered student.

Students could take an online quiz at every moment, and after they have successfully passed the quiz, they could join the next level class.

The paper proposes adequate system architecture and algorithm for student's categorization.

### I. INTRODUCTION

Intelligent Tutoring Systems (ITS) are computer based systems that use the knowledge about the domain, the student, and the teaching strategies to support flexible individualized learning (Brusilovsky 1999). To have more efficient learning process by using e-learning system, it has to be able to select the most adequate materials (text, images, video, audio, links ...). It means system have to propose learning materials that are based on student knowledge and experience [1].

On the other hand, students come from different knowledge backgrounds and have different learning styles and preferences. To effectively meet these diversities, an e-learning system should be able to offer different learning experiences to different students. In addition, system will provide learning materials adjusted to the student's performance (e.g., his background knowledge and performance in the current domain) [1].

Except offering a series of conventional learning services, abundant information available, and instant message delivery, a complete online learning environment should be able to distinguish between students' ability and provide learning courses that best suit their ability [2].

### II. RELATED WORK

There are several authors that propose student categorization in e-learning systems for better productivity in the learning process. In that manner, authors in [3] propose a learning style classification mechanism to classify and then identify students' learning styles. The proposed mechanism improves k-nearest neighbor (k-NN) classification and combines it with

genetic algorithms (GA). In [4] authors show their practical experience with specific e-learning system and applied data mining technique for the analysis which served as a tool for grouping students with similar characteristics. In paper [5], every student is present via models which are built on the basis of Felder and Silverman model, together with student color choices. It is considered usage of two versions of two-phase hierarchical clustering algorithm for students' grouping. Paper [6] argues that virtual worlds (VW) possess the necessary tools to foster effective group collaboration for e-learning initiatives. The use of avatars, the support of verbal and non-verbal communications and creative capabilities offered in VWs are suggested as the key elements that promote effective group learning.

### III. PROPOSED MODEL

This model intends to perform adaptation of the learning materials based on the student's level. This paper describes a system that performs content-level (adaptive presentation) adaptation (Brusilovsky 1996). In other words, students with different performance levels get adequate content for the same domain topic. It means that students from basic label are going to receiving different learning materials than students from medium or advanced level. This system can be understood as tool for grouping students with similar characteristics [4].

The students are able to access the system without difficulty because it has user graphic interface that provides user-friendly interactions between students and the system.

#### A. System architecture

The general architecture of the proposed system contains three components:

- Student unit
- Teachers and system administrator unit
- Hardware and software

Each student has to be registered and login to the system to receive learning materials. In the process of registering, student needs to be assign in one of three knowledge level (basic, medium and advanced). To be student added, it has to complete the quiz. Then immediately student will get suggestion from the system about knowledge level that is the most adequate for them.

Teachers, as a separate unit of this system, can handle with quiz questions and correct answers. It means that they can add/change/delete questions and relate questions with appropriate knowledge level.

System administrator is able to handle with knowledge level categories, relations between questions and knowledge level

categories and control manage all registered users. Also, the administrator can manage time parameter (time response from student for answering the question) and limitation (minimum needed required points) for each level.

Described system is web-based application developed with PHP and using MySQL database for storing data (user's information, questions, answers and global settings) and its hosted on Linux server.

It has friendly user graphic interface, so it can be used from students that has not so much computer knowledge.



Image 1: GUI for the quiz

The database contains several tables: table for storing user information (tblusers), for knowledge level category (tbllevel\_category) tables for questions and answers (tblquiz\_questions), tables for student answers (tblquiz\_answers), table for learning materials (tbllearning\_articles), for global system settings (tblsettings) and so on. There is relation between tblquiz\_questions table and tbllevel\_category (relation between questions and knowledge level).

Both are standalone units, but works together in one large

This system is going to control the process of student classification by adding new question for the quizzes and changing conditions (limits) for each learning level.

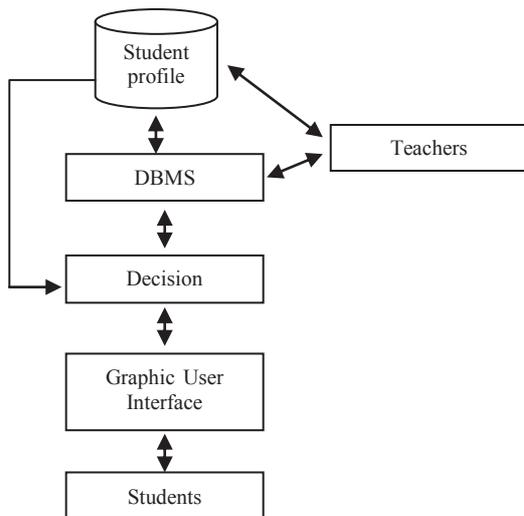


Image 2: System architecture

*B. How system works*

After running the application, system prompts the student to select the area of his interest. Entry test has questions from selected area.

The multiple-choice questions are assigned from the teachers, related with appropriate difficulty level (basic, medium, advanced). Student got total 20 pages with question. Each page contains three questions (question from basic level, question from medium level and question from advanced level). Each question has multiple answers, so student need to select one or more of them. Important factor in this quiz is students' time response for every answer.

Students can send request to get quiz for its level, and if students pass the quiz successful, it will be placed in higher level. Otherwise, student will stay at correct level.

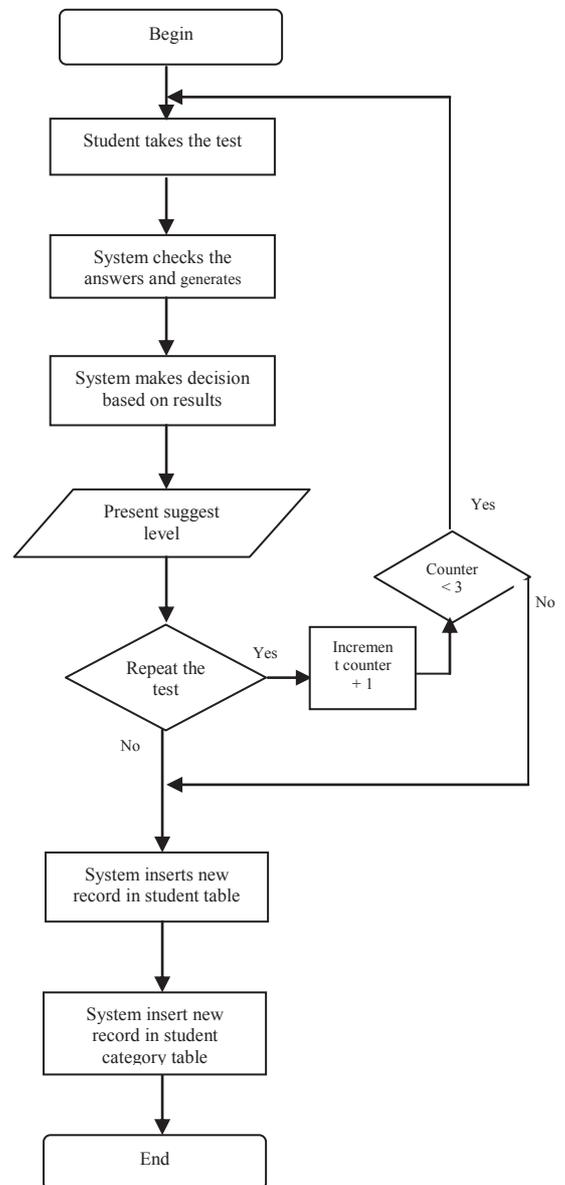


Image 3: The main control structure

#### IV. IMPLEMENTATION

The best and the most credible way to verify the quality and the effectively of this system is using in real conditions. Let's give one example of using this system:

- A student visit application URL
- System is going to ask the student for model that he want to use: (1) manually select level or (2) no selection – system is going to propose the knowledge level
  - o If student select (1), then system is going to generate quiz with questions only from that knowledge level
  - o If student select (2), system is going to generate quiz with questions from all knowledge levels
- After completing the quiz, system is going to check student answer and generate final results. Important factor is student's time responses for ever question. Responses from 1 – 20 seconds give additional 1 point to each question:
  - o If student select (1), system will notify student if he has knowledge enough for selected level
  - o If student select (2), system will propose the most adequate knowledge level
- Student can repeat the quiz / process (up to 3 times)
- When student accept the proposed level, system will insert new record in student table
- After creating new student, system will update table in database that related student table and knowledge level table

After student categorization process completed, student will receive learning materials (text, images, video, audio, links) based on student category.

Student can invoke process of categorization few times per semester to take quiz again and check if he can go one knowledge level higher.

After implementing the code for students' categorization, we were testing the system with one group of students from Faculty of law. They were using this system for choosing knowledge level for one subject. The quiz was made from 30 students:

Number of students	30
Students whose selected fist option (manually select knowledge level)	18
Students whose selected second option (system will propose the most adequate knowledge level)	12
Students that accept the system suggestion after 1 <sup>st</sup> quiz passed	22
Students that repeat the quiz	8
Students that accept the system suggestion	26

Students that not accept the system suggestion	4
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Table 1: Results from student categorization

Results shows that 60% of students selected first option (manually select knowledge level), 40% of them selected second option (system will propose the most adequate knowledge level). 73.3% of all students accepted the system suggestion after 1<sup>st</sup> quiz passed, while 26.7 % of them repeated the quiz. 86.7% of tested students accepted the system suggestion, while 13.3% of them do not accept.

#### V. CUNCLUSION

Intelligent learning systems are combination of modern approach to Web-based education and powerful intelligent tutoring and adaptive hypermedia technologies. All intelligent learning systems take care about student adaptivity and evaluation. Adaptivity refers to the capability of the system to adapt teaching to student needs, specified by the student model characteristics. Student evaluation refers to the evaluation of the knowledge level of a student, which is one of the most important characteristics [7].

That's why they are greatly using in the learning process. The main goal of each intelligent learning system is to provide adequate learning material to the students. That is prerequisite for success in learning process.

It is clear that there are more knowledge levels, so students what receive inadequate learning materials can't understand materials and will have more difficulty in learning process. Let assume that student have basic learning of English, and system send them materials and link for advanced users. In that situation the student will not be in situation to use those materials. In that manner, if students with advanced knowledge will receive learning materials for basic level, they are unusable for that student. That's why, its good practice to separate all students in several groups, based on students' background knowledge and performance.

The system described in this paper proposes that mechanism for student classification based on their knowledge. This mechanism was tested on one group of students from Faculty of Law. Results promises that this mechanism is effective way to separate the students in different group and got more efficiency in the learning process.

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