Developing a Child-Centred LMS to Enhance Learning and Creativity of Students in Elementary School

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***Abstract*— What is preferred by adults and what works for them will not necessarily be appropriate for children. Nowadays, most things designed and created in the world still have not been designed for children as a user group. eLearning systems, as an important human achievement in the age of technology, exhibit a similar situation to other experiences. Much research and many innovations in these systems are accomplished for young people in higher educational environments. In this paper, we design and implement a learning management system (LMS) for students in elementary school, which leads to their meaningful learning enhancement. Decreasing competitive pressures and fear of failure through changing assessment process and improving motivation of learning through sending some informative and positive feedback are the other features of our LMS. Pedagogical constraints and children's preferences are the foundations of our system that is implemented based on MVC pattern. This LMS has successfully passed primary tests and started to be used in a real elementary school; however, its development is still on-going.**

***Keywords*— Child-centred LMS, elementary school, modelling, personalization**

I. INTRODUCTION

Rapid development of information and communication technology has provided new learning environments, bringing online education as a necessity in many sectors of society. Research in this area has led to many advanced tools and methodologies to satisfy learners' needs and improve their performance. Personalized learning environments, as an important achievement of this research, have been identified as the base of other developments [1]. Identifying the concept of life-long learning with the advantage of social relations in online environments causes educational environments move to constitute networks of learning [2]. Standard user profile is the common element of all these networks.

Despite accomplishments of much research in on-line higher education, and even for adults, there are limited studies focused on children [3]. Special psychological and pedagogical approaches, educational circumstances and constraints, as well as inappropriate experiences of computer applications and online interactions in children reduce domain of research that familiarize children with eLearning systems. Nevertheless, life-long learning approach proposes an integrated educational profile of students, comprising primary education situations as well. Therefore, existence of eLearning environments for children equipped with a standard profiling process is an essential element.

The purpose of this paper is to introduce a personalized child-centred LMS which leads to learning and creativity enhancement. Considering children's circumstances and pedagogical polices, the implemented LMS guides students in navigation and learning process. In this respect, children's knowledge level, learning preferences, and interests are determiners of delivering appropriate learning contents. Through positive informative feedback, the system guides and encourages students in learning trend as well as increasing their motivation. Moreover, in order to eliminate assessment stresses and competitive pressures; the LMS uses a self-assessment process. Applying all these features is utilized through a child-friendly user interface, considering children's curiosity and fantasy-driven nature.

The paper is organized as follows. Section 2 gives a brief overview of pedagogical policies necessary in learning management systems with a focus on elementary school students as their users. Section 3 presents child-centred LMS architecture and its components. The processes of the system are introduced in section 4, and implementation details are discussed in section 5. Finally, section 6 concludes the paper and outlines areas for future research.

II. PEDAGOGICAL POLICIES

Primary education is a critical stage in children's development. In addition to learning about many domains, primary education has profound effects on shaping children's lives [4]. Ordinary children experience many learning activities, such as writing, reading, discovering, solving problems, etc., for the first time in elementary school. Many individuals' skills are more flexible in childhood, and educational environments have a key role in shaping them appropriately. In terms of developing intellectual skills, such as creativity, [5] proposed that the capacity of original thinking is 90% at the age of five, but this is only 2% for adults. Therefore, eLearning endeavours for improving intellectual skills in children are too vast to be compared with those in adults.

Although eLearning facilities can encourage children's creativity, they impose some constraints that can inhibit it. Fear of failure and existence of competitive pressures in evaluation process are some barriers of creativity. Educational systems can sever these constraints by taking assessment as a mean to promote learning, not to score students [6]. In this respect, children should be assessed during all learning phases in order to deliver personalized content based on their profile. Continuous assessment with the aspect of learner-centred can reduce children's concerns and improve their learning.

Because of children's curiosity and fantasy-driven nature, computer games often motivate them [7]. These characteristics can encourage children to participate in other activities, such as learning. Curiosity is the result of a knowledge gap, and fantasy is defined as an object that "evokes mental images of physical or social situations not actually present" [8]. Fantasy-learning environments may increase intrinsic motivation of individuals—especially children—through satisfying their needs not available in face-to-face interactions.

According to self-determination theory, individuals' motivation for engaging in activities can be distinguished between intrinsic and extrinsic. Intrinsic motivation originates from internal enjoyment or satisfaction of individual in an activity, but extrinsic motivation is directed at attaining or avoiding something outside the self [9]. Children do some activities when they are intrinsically motivated, but social demands and role responsibilities curtail the freedom of being intrinsically motivated, which lead to highlight extrinsic regulation in adults [10]. Several studies have shown that feedback messages, punishments, and rewards can affect students' motivation, whether intrinsic or extrinsic. Regarding [11], positive performance feedback enhances motivation, whereas negative feedback reduces it. These effects are more common in children. Therefore, it could be beneficial if eLearning systems were equipped with feedback mechanism that would encourage children to learn, as well as enhance their motivation.

In face-to-face educational environments, students and teachers have active interactions, but the brisk nature of children makes these interactions more dynamic. Effectiveness of eLearning systems is facilitated through joyful environments that encourage children's desire to engage with them. Operative feedback should not only encourage positive motivation of children, but it should also enhance their self-esteem [12]. One of the relevant key feedback aspects is a model that posits seven principles of sustainable feedback [13]. Five principles of this model are necessary in child-centred eLearning system, which include:

- Clarifying what the desired performance is;
- Facilitating the development of self-assessment;
- Delivering high quality information to students about their learning;
- Encouraging positive motivational beliefs;
- Providing opportunities to close the gap between current and desired performance.

One possible problem of designing an applicable LMS for elementary schools is the ability of students to work with computers. Regarding [14], children's working memory is more limited compared with adults, so text-based or graphical user interface with complete descriptions is the best way for their easy interaction with computers. Selecting appropriate sentences, colours, sizes, and font types is more effective in attending to and understanding of children. eLearning systems can be more successful in improving children's learning, if they can engage more children's senses in the learning process. Utilizing intriguing and meaningful pictures, animations, and other media seems necessary in these systems. Designing simple navigation, removing complex processes, using different colours, and observing symmetry are the other important features [15].

III. System Architecture

The goals of our child-centred LMS are delivering personalized learning contents to elementary school students and enhancing their meaningful learning. This system comprises four main elements. Admin Core is the management component of the system that is composed of databases and is being controlled by administrators and instructors. Student Core consists of all parts relating to students, such as personalization engine. Domain Model and Student Model are delegation of owners in this system. Fig. 1 presents architecture of child-centred LMS.

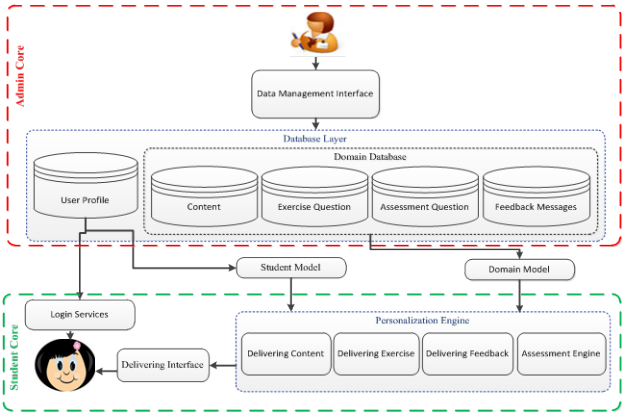


Fig. 1: Architecture of child-centred LMS

A. Admin Core

LMS administrators and instructors should be able to access the system databases and add, edit, remove, and control their contents. The accessibility is authorized based on their role in the system. Obviously, a teacher can control only his/her course files.

B. Student Core

Providing personalized services with observing all the pedagogical policies is the main goal of the system. Delivering learning contents which are appropriate to students' knowledge level, interests, goals, and learning style is the first obligation of the system. Obtaining exercises and encouraging children to accomplish them is another goal of child-centred LMS. Selecting appropriate questions for sending to learners in the form of self-assessment and delivering positive and informative feedback in the suitable time are other special features of this system. As noted in section 2, the students' assessment should be accomplished without stress and with the aim of students' learning improvement. In this respect, our system evaluates students' responses automatically utilizing

expert-provided correct responses that are stored in system database.

C. Student Model

User model is a virtual delegate of a user in the system. Student characteristics and impressive features in learning process are represented via the model of students composed of their profile, demographic characteristics, interests, learning style, and information of knowledge level in each domain. During the registration phase, the student profile, demographic characteristics, and interests are determined. Learning style is defined based on an electronic questionnaire merged with LMS. A modified MMTIC (Murphy-Meisgeier Type Indicator for Children) as a child version of MBTI (Myers-Brigs Type Indicator) is being used in this respect [16]. Knowledge level of students is measured using a pre-test at the beginning of a course.

D. Domain Model

One of the highlighted objectives in designing the child-centred LMS is the possibility of working with several learning domains. Consequently, we decided to have a general domain repository to store several domains with different definition levels. In each domain, different topics form a conceptual network in which all the concepts are defined as nodes. Concept relations are logical links represent prerequisite, subset, and parallel dependency. Regarding the conceptual network, the sequence of delivering learning material is determined and the level of user knowledge defines the start-up point. Fig. 2 presents a diagram of conceptual network.

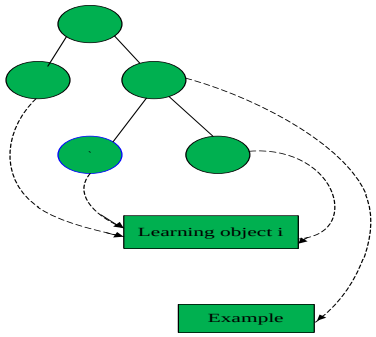


Fig. 2: Conceptual network of a course domain

IV. System Process

Delivering personalized learning services to children involves five operations: logging in, delivering learning contents, exercising, assessing, and sending feedback. The process of system operation is summarized as follows:

- Students log in to the system via a login interface. When a student logs in, the login service checks his/her account via the user profile database. If the student is a beginner, the system guides him/her to complete the registration process, and then it administers a questionnaire to assess his/her learning style. In the following steps, the system evaluates the student knowledge level via a pre-test in the course domain in which user wants to participate.
- If the student is registered, the system guides him/her to the course page where student's courses are listed. Selection of any course navigates the student to the corresponding course page and provides the overview and continuation possibilities to him/her.
- Review process provides all the previous phases which the student has passed. Selecting an on-going process is feasible if the student can pass learning topics prerequisite of other topics in the network domain concepts.
- Instructor specifies the specific times when assessment or exercise questions should be delivered to the student. Assessment questions are in the form of self-assessment. Although the student can ignore them, both receiving more appropriate personalized services as well as gaining of better learning performance depend on them.
- For every student action in this LMS, the system sends positive informative feedback to him/her. This feedback can notify the student about his/her knowledge level, motivate him/her for continuing learning, and guide him/her to better learning performance.

Fig. 3 shows some schemes of this system.

V. Implementation and Evaluation

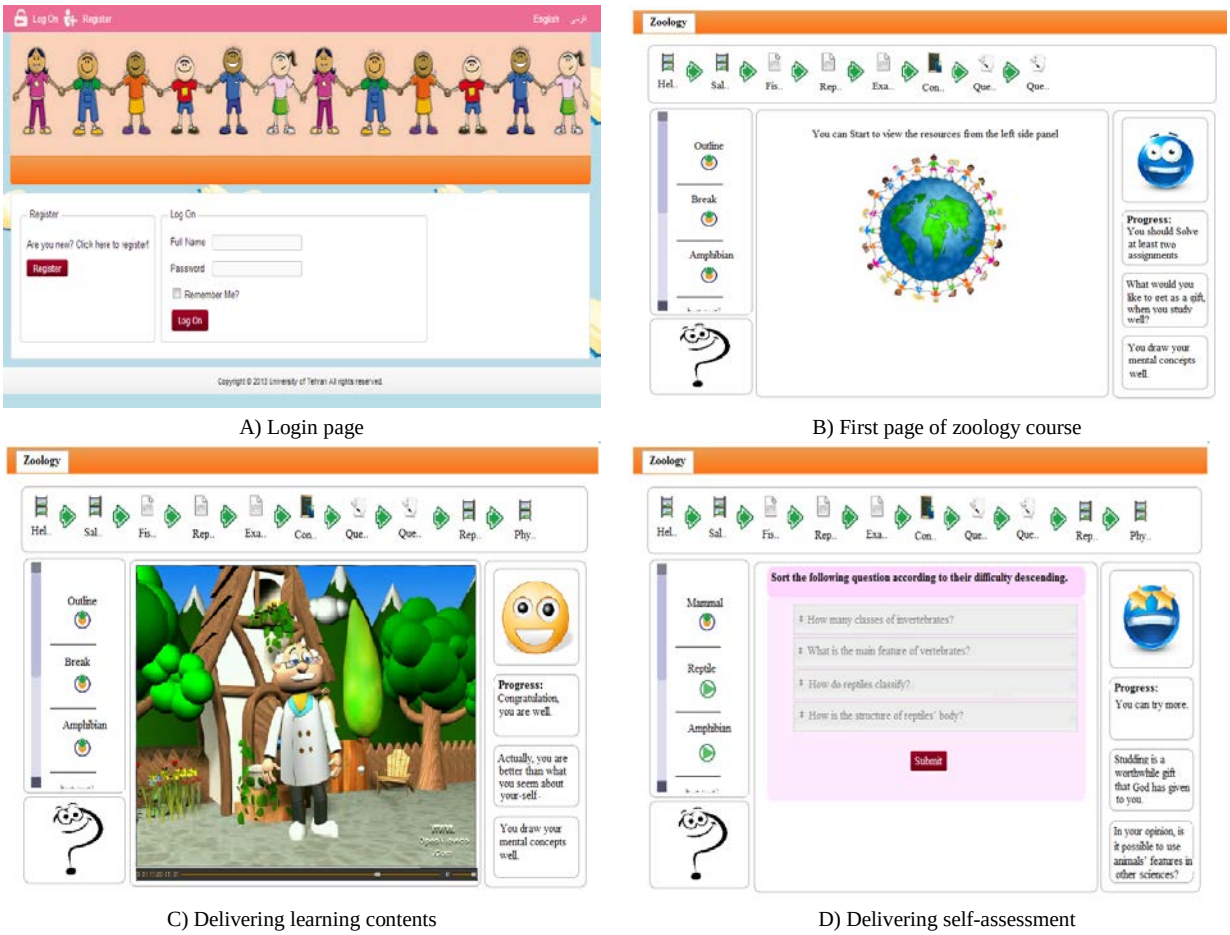
For implementing the first version of child-centred LMS, Microsoft ASP.NET MVC 3 framework and Microsoft Visual Studio 2012 as IDE was chosen. In addition to default libraries and packages of ASP.NET MVC 3, many other free and open source JavaScript libraries such as jQuery, jQuery UI, jScrollPane, VideoJs and Kendo UI are were used. The main reason for choosing ASP.NET MVC 3 framework was its MVC based (Model-View-Controller) pattern and object-oriented aspect of C# programming language which makes it reasonably easy to build standard and scalable web applications.

Child-centred LMS produced by eLearning laboratory at the University of Tehran passes the primary tests and is already in use in some elementary schools. Moreover, this system is being used as a pilot for other research focused on children in online educational environments.

The first result of system application shows the satisfaction of both teachers and students in regard to the system facilities and its effect on learning stimulation, as well as child-friendly UI. However, illustrating effects of the LMS on students learning needs a long-term use of it, at least entire course duration. In future publications, we will describe results of applying this LMS in some elementary schools.

VI. Conclusions

In pervious sections, we introduced a child-centred LMS designed, implemented, and applied to elementary school students. Using this LMS, children's intrinsic motivation to engage in learning activities can be increased. In addition, there are some important features of this LMS which make us to believe that it can decrease competitive pressures and fear of failure, such as impalpable assessment, self-assessment, and positive and informative feedback. The proposed system personalizes delivering services through modelling users and instructional domains. With applying some personalization rules, learning contents are delivered to students based on their knowledge level, interests, and preferences. All the provided facilities can improve children meaningful learning, which



A) Login page

B) First page of zoology course

C) Delivering learning contents

D) Delivering self-assessment

Fig. 3: Some schemes of child-centred LMS

leads to enhancement of their creativity. Design and implementation of this system is accomplished by ASP.NET MVC 3 framework which implements the standard MVC (Model-View-Controller) pattern.

Improving this LMS may continue with more detailed studies about the possibilities of synchronous and asynchronous group discussions and collaborative learning. In this respect, applicable grouping algorithms for children should be verified. Monitoring students' interactions and analysing their behaviours need to become the focus of other future research that can be applied to optimize personalized services. In addition, it seems beneficial and in some extent necessary to improve our LMS to enhance other intellectual skills of learners.

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