

Adaptive Learning and Testing in Moodle

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Abstract

E-Learning systems are becoming an asset in education. Although there exist a lot of e-learning systems very few of them can adapt to learning styles and other characteristics of students for learning and testing processes. The aim of this paper is to present the adaptations that are done to the Moodle platform to provide the tools and features to best serve the students and educators to adapt the learning materials according to the students' learning styles and to perform adaptive testing according to their level of performance. An experimental adaptive quiz was set up and a survey was used to evaluate learning effectiveness and learning satisfaction of 50 students who took the test. The results of the survey were presented and discussed followed by the conclusions and future directions.

Keywords 1

Adaptive quiz, learning styles, adaptive learning.

1. Introduction

During COVID-19 pandemic the universities in Albania have been obliged to switch to e-learning systems. These systems have gained a great value during this period as the only way of communication between students and professors for the learning process, spreading the learning materials, assessments, and evaluation tests. There are a lot of advantages that these systems offer to their users as the possibility to attend the lectures anywhere and anytime. However, there are some drawbacks as well such as missing the experience face to face learning and practicing. Adaptive e-learning systems aim to overcome the lack of direct contact by applying a personal approach of teaching.

Traditional education and the e-learning systems which are designed with the same approach follow the concept of one size fits all, presenting the same content to all students. Adaptive learning on the other hand provides participants with a personalized and dynamic learning experience. This experience can

elevate motivation, engagement, satisfaction and learning outcomes [1]. The goal of e-learning systems should not be only to provide the learning materials but also to tailor them to various characteristics of the learners such as goals, preferences, and learning styles [2]. An adaptive e-learning system is an interactive system that personalizes and adapts e-learning content, pedagogical models, and interactions between participants to meet the individual needs and preferences of users [3]. We have enhanced Moodle e-learning system with features that enable it to adapt to the students learning styles and other characteristics. We have chosen Moodle platform because it is an open-source platform offering the possibility to make changes and other platforms integration [4]. This paper will present the main tools that are used for adaptation for both students and professors. Another important aspect in the learning process is testing and evaluation of the acquired knowledge. Online quizzes which serve as a type of assessment allow students to be independent of the location and time. However, quizzes need to address the issue of

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enhancing the students learning process, lacking the feature of ‘Personalization’. To extend our work toward adaptation of the system for testing, an adaptive quiz is created and evaluated with a group of 50 students. After providing a short overview of the works related to this research, another section will follow with the aim to represent our work for the adaptation of the Moodle platform. The rest of the paper will show the results of the adaptive quiz followed by the conclusions and the work for the future.

2. Literature Review

Adaptive learning systems have been demonstrated to improve student commitment and learning outcomes [5].

Heba Fasihuddin et al. [6] have proposed the personalization of the system and its adaptation based on Felder-Silverman Learning Style Model (FSLSM). This model works through two agents: the first one identifies the learner’s style and the second, using the information from the first agent, provides an adaptable navigation system. FSLSM was used in the work of S. Graf et al. [7] who have proposed a framework for the adaptation of the course content based on learning styles identified by the model. The research in [8] proposed an enhanced LMS implemented in Moodle platform that support adaptive features. The major adaptation features were based on visual and verbal dimension of Felder-Silverman Learning Style Model (FSLSM) and the student’s knowledge level. In [9] the system "E-school" is described. In this system the characteristics of the user are used by the administrator to create different learner groups which have access to specific lectures. Quizzes, generated on the same content, are used to evaluate the knowledge acquired by the users. The paper in [10] focuses on the major components of adaptive features and techniques to implement an adaptive quiz. Three main components are identified: student model, domain model and adaptation model. The adaptive quiz system will serve to assess the knowledge of the students based on skills, knowledge, and preferences of each learner.

3. The adaptation for Learning materials

An adaptive e-learning system which personalizes the learning materials to the students learning styles would be very useful to them [11]. We have modified Moodle to include the questionnaire that was based on Index of Learning Styles (ILS) [12]. This instrument is used to evaluate a student’s learning style according to Felder-Silverman learning style model. FSLSM defines four dimensions (Preprocessing, Perception, Input and Understanding). For each dimension two types of learning styles which can be viewed as learning preferences opposites of each other are defined. The combination of the learning styles for each dimension creates individual’s learning preferences [13].

In order to identify the students learning styles and help the professors to understand better the learning styles of the students and the materials that they should produce three plugins are created in [14] and added to the Moodle platform. The first one is used to identify, and store student’s learning styles based on the questionnaire, the second which is called “Learning styles” represents in a graphical view the distribution of learning styles between students, and “Activity Report” that shows for each student, the number of interactions with each material. We have tested the modified Moodle Platform with a group of 73 students in Bachelor of Informatics Program. The results from the created plugin “Learning styles” are shown in Figures from 1 to 4.

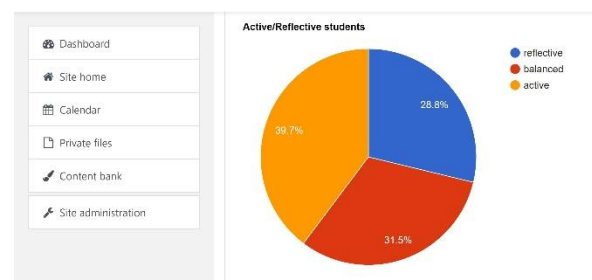


Figure 1: The results from “Learning styles” report for preprocessing dimension.

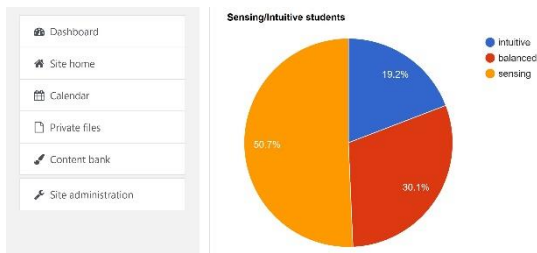


Figure 2: The results from “Learning styles” report for perception dimension.

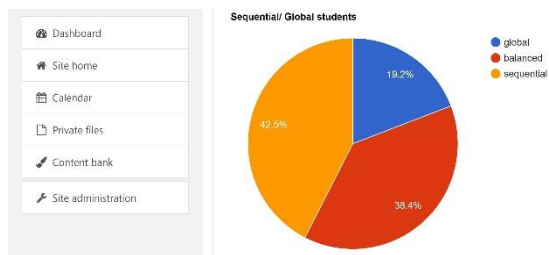


Figure 3: The results from “Learning styles” report for input dimension.

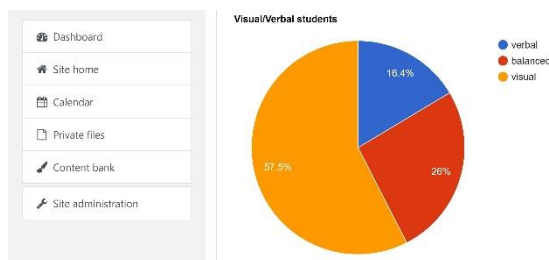


Figure 4: The results from “Learning styles” report for understanding dimension.

This report shows to the professors the distribution of the students according to their learning styles. The professors of the course having this information would be more aware of the type of the materials that they provide for their students. For example, if most of the students are visual learners, they can understand better the concepts with pictures, diagrams, flow charts, and demonstrations while verbal learners understand by reading more text material or listening to spoken explanations.

4. Adaptive Quiz

We have set up an adaptive quiz by using Adaptive Quiz Activity in Moodle. It creates tests that can estimate users' level of knowledge by adapting the question difficulty.

A question bank of 20 multiple choice questions from two modules in the subject “Programming Java” was created. Each question was tagged with the level of difficulty (easy, moderate, advanced). The parameters of the quiz can be determined by the professor such as difficulty levels of questions, the starting level for the first question or minimum and maximum number of questions. In the Figure 5 a screenshot from the adaptive quiz is presented.

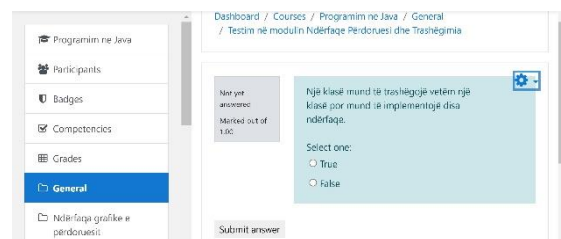


Figure 5: Adaptive quiz presentation

After the student answers one question, the algorithm selects the difficulty level for the next question depending on the student’s answer. If the student answers a question correctly, a question with a higher level of difficulty is chosen next otherwise a less difficult or will the same level of difficulty question will be chosen.

Another adaptation that this quiz does is about the number of the questions that will be asked. The number of questions will be between the minimum and maximum values which are determined during the process of configuration of the quiz. The quiz will stop if the user's ability level is determined to the required accuracy or if the maximum number of questions have been answered.

The students can have an unlimited number of attempts to the quiz. The quiz will choose the question in random depending on the configuration made by the professor and the answers given by the student.

5. Students' survey data results

To understand the perceived value of an adaptive quiz to the students a survey was filled by 50 students who took the adaptive quiz.

The survey data were examined to explore whether the students perceived benefits from the adaptive quiz and also to gather suggestions from them about the features that could be added to the adaptive quiz to increase their level of motivation and learning outcomes. The survey was composed of 5 questions.

The first question was whether they have heard before about adaptive quizzes. Surprisingly 42% have heard before and 58% have not. The second question was whether adaptive quiz helped the students to identify the problems in their knowledge about the subject.

96 % answered that this quiz helped them to identify their problems and 4% that it did not.

The third question was about whether the reaction of the adaptive quiz encourages students to try more to increase their performance. All of them answered that this feature of adaptive quiz encouraged them to try more(36% answered that it helped very much and the rest that it helped sufficiently).

The fourth question was about the statement that adaptive quiz was a very good tool to increase the knowledge about the subject. All the students agree to this statement (24 % strongly agree and the rest agree).

The last question was formulated to gather the suggestions from the students with the aim of enhancing the adaptive test in the future to serve them better. In general students liked the adaptive quizzes but some of them would like to integrate in it some features from traditional quizzes like the possibility to skip an answer with the possibility to return to it later or to have a summary in the end with the number of correctly and incorrectly answers. There were also some answers that were more related to adaptive quizzes. The students suggested that adaptive quizzes keep the results of the students from previous tries. This information can be used in such a way that the question that was answered correctly to not appear in the future tries. Another interesting answer was about further adaptation of the quiz. The student suggested that the quiz should provide more question in the topic where the students did not answer correctly and possibly giving

information about the lecture where that concept was introduced.

6. Conclusion and future work

Adapting the e-learning systems to the learning styles and other characteristics will provide value and encourage the students to learn and perform better. In this paper we presented the work that is done to adapt Moodle platform to learning styles of the students following Felder-Silverman Learning Style Model. This adaptation will help the professors to provide learning materials according to learning styles of the students. In the future we aim to adapt the system to automatically present to the students the materials that are more suitable to their learning styles. Adaptive testing is another important tool that can help students to better learn and assess their level of knowledge. An adaptive test is set up and taken by 50 students. The results of the survey showed that the adaptive quiz was perceived as a valuable tool by the students that encourages them to learn and increase their level of performance. Some suggestions from the students will be used to enhance the features of the adaptive quiz in the future. Future research will explore further whether the students who did use adaptive quizzes, improved their performance compared to those that did not or took traditional ones.

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