PASELS : Personalized Assessment System to Enhance Learner's Success

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***Abstract*—** Online assessment has become an important part of modern education. Feedback is a very important task in online assessment systems and a vital part of learning and interaction in e-learning systems. The amount and quality of feedback provided to the learner has an impact on the learning process. This paper aims to develop a model of assessment and personalized feedback to improve the learning and motivation of learners. First, the students are classified into 8 categories of learning styles then their motivation level is investigated. We have introduced PASELS (Personalized Assessment System to Enhance Learner's Success) based on learning style and motivation level of learners to personalize feedbacks. PASELS was applied to 30 students of Writing and Presentation (WPS) course offered at faculty of electrical and computer engineering, university of Tehran. Our empirical studies show that after the feedbacks were given, the overall performance of students in next exams was improved.

فیدبکها بیشترین تاثیر را به ترتیب روی دانشجویان دسته ی ساماندهی بیرونی و ساماندهی ناخود آگاه و ساماندهی بیرونی داشته است.

Keywords— personalized Assessment; Feedback; Learning style; Motivation

I. INTRODUCTION

Online assessment has become an important part of modern education. Nowadays, its application is not limited to e-learning, in fact it is widely used as a part of learning process in blended learning too. Online assessment could be used as a part of a complete course assessment and may be considered as a potential substitute for traditional assessments in future. Learners must be notified about the results of their activities during the learning process, therefore, giving an appropriate feedback to them would be a very important task the online assessment system must accomplish. Feedback is information that is provided to users informing them about the outcome of their action and to motivate them to further interact with the system. Therefore it may have too much influence on learning, this impact can be either positive or negative [1]. Feedback can differ in the content and time of presentation and in the manner of representation. Properties of feedback are especially important in applications for users with a large variety of individual characteristics and goals. The appropriate type of feedback and the way it is given can enhance its effectiveness. Feedback may change the way Web-Based Learning System (WBLS) interacts with the user; it can tell the student about the correctness and accuracy of his responses, complete the student's knowledge by presenting information he appears not to know, and try to overcome misconceptions the student may have [2-4]. The existing diversity of the feedback functions and types which could be supported make the authoring and design of the feedback in e-learning complicated [5]. In a WBLS, feedback can have different functionalities (confirming, informing, correcting, explaining, motivating, rewarding, or evaluating), complexity (no-feedback, knowledge-of-response, knowledge-of-correct-response, answer until correct, or elaborated), time of occurrence (immediate or delayed feedback), user's progress within a task (immediate, continuous, or summative), and way of presentation (textual ,visual, audio, or video) [5]. It is important to mention that different feedbacks may have different effects in the learning process and surely the interaction of learner with the system[1]. Giving no feedback or giving an inappropriate one might cause a leaner to abandon using an e-learning or a blended learning system. Personalized feedback could be a solution to this problem[6]. Personalizing to the learner's individual characteristics is organized on the basis of a user model[7, 8]. A user model determines the user's goals, tasks, beliefs, knowledge, background, experiences, interests, preferences, environment, individual traits and characteristics which are important for personalization [8]. Personalizing makes us capable to customize the system for the learner and recommend him contents based on the extracted user model. The purpose of personalized feedback is providing useful feedbacks based on the characteristics of each learner to improve the learning of learners[6].

According to Brusilovsky [9] a hypermedia application can be personalized to the user model of the learner. Since motivation level and learning style are the most two important characteristics of learners which affect the learning process,

we aim to combine these two features, providing personalized feedback.

The goal of this paper is to present an approach for giving personalized feedbacks to learners based on their learning style and their level of motivation.

II. Feedback Personalization to Motivation

The learners' motivation has an impact on the quality of learning, no matter how it is provided (via classroom, e-Learning or blended learning [10]). Being motivated means to be wiling and desired to do something. A person who is not inspired to act toward an end is thus characterized as unmotivated, whereas someone who is energized toward a goal is considered motivated [11]. According to Self-Determination Theory, different types of motivation are being distinguished based on the different reasons that make some action get executed. Intrinsic motivation refers to doing something because it is interesting by itself, and extrinsic motivation, which refers to doing something because some external outcome like rewards are included [11]. We used AMS-C questionnaire [12] based on Self-Determination Theory that is composed of 28 questions subdivided into seven subscales assessing three types of intrinsic motivation (intrinsic motivation to know, to accomplish things, and to experience stimulation), three types of extrinsic motivation (external, introjected, identified regulation) and amotivation. In this paper, we have focused on extrinsic motivation category for feedback personalization. Extrinsic motivation is described as follows [13]:

A. External

This is the classic type of extrinsic motivation and is a prototype of controlled motivation. When externally regulated, people act with the intention of obtaining a desired consequence or avoiding an undesired one (e.g., I work when the boss is watching).

B. Introjected

Introjected regulation within a person is a relatively controlled form of internalized extrinsic motivation (e.g., I work because it makes me feel like a worthy person).

C. Indentified

With identified regulation, people feel greater freedom and volition because the behavior is more congruent with their personal goals and identities.

Feedback personalization to extrinsic motivation is presented in Table I.

TABLE I: FEEDBACK PERSONALIZATION TO EXTRINSIC MOTIVATOIN

Extrinsic motivation	Assessment
External	Use of rewards and punishments
Introjected	Feedback about the current status
Indentified	Feedback based on goal

III. Feedback Personalization To Learning Styles

Learning style is an individual's natural or habitual pattern of acquiring and processing information in learning situations based on strength, weaknesses and preferences. It should be mentioned that individuals differ in how they learn [14]. Felder-Silverman's four-dimensional (active-reflective, sensing-intuitive, visual-verbal, and sequential-global) model [15] is considered as the best suited and feasible LS theory with respect to WBLS design and development. There are different types of feedback personalization to learning styles in a web-based learning system: *sequential*, *global*, *active*, *reflective*, *sensing*, *intuitive*, *verbaliser* and *visualiser*. Feedback for sequential learning style is always immediate and presents short and correct answers. Global presents continuous feedback and uses grades for motivation. Active presents answers until the correct feedback is given and external rewards are collected within the test for motivation. Reflective provides elaborate feedback and doesn't use audio as a main source of feedback. Sensing presents immediate but non continuous feedback. Intuitive Provides immediate corrective or elaborate feedback with brief theoretical explanation only in the case of an incorrect answer. Verbaliser presents feedback as a text or in figures and Uses feedback in audio form (verbal praising, etc). Visualizer Uses more graphic information in feedback presentation (pictures, diagrams, charts, animation and short movies). [16]

IV. Classification of Motivation Levels

According to Cocea & Weibelzahl time spent on a task and performance can be used to classify students based on their level of motivation. [*] We used a decision tree algorithm for this classification. (Why?)

Change in the motivation of the students is probable. To track this change we checked their motivation during a term after each task of practice and moved students between groups of motivation using a decision tree algorithm after each task. Each group had its own tree in wich its threshold was set by the means' extracted from students of the group. The tree had three levels; First: Mean of time spent on the task, second: mean of grade achieved on the task, third: mean of time spent on the source prepared for practice. Transfer between the groups depends on whether a student has a lower or higher grade and spent time than the group's mean; If the group is more motivated its mean must be achieved, if less, the student's grade and spent time must be lower than the group's mean. If they are from a less motivated group the properties of the new memeber is set by the lowest amounts existing through the members of that group but if from a more motivated one their properties will be set to the highest amounts.

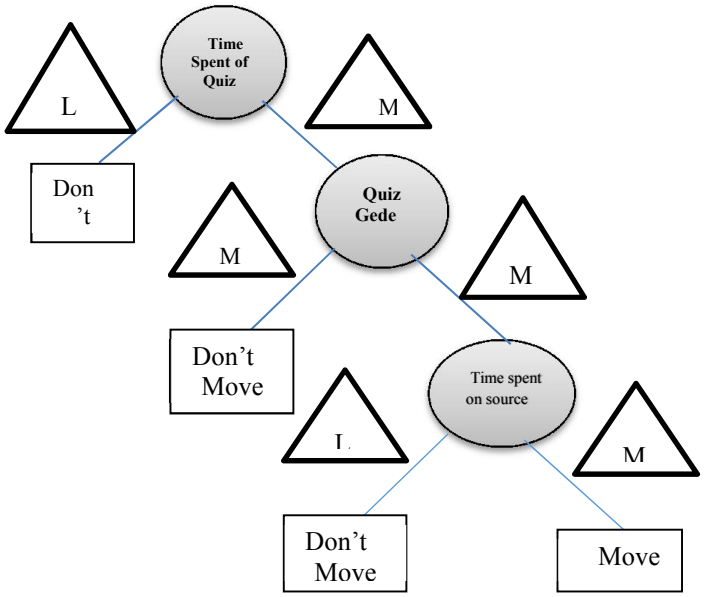


Figure 1 – Desicion Tree for Classification Based on Motivation

V. Feedback Personalization Experiments with Moodle and Pasels

In this section, the results of applying PASELS to 30 students of Writing and Presentation Skills (WPS) course are discussed. The course was offered at faculty of electrical and computer engineering, university of Tehran in February 2014. Students of the class were asked to complete Felder-Silverman's LS questionnaire (44 questions) [15] and also AMS-C questionnaire (28 questions) [12]; 24 out of 30 students completed these questionnaires. After analyzing the students' answers, 13 out of 24 of them were identified to have extrinsic motivation.

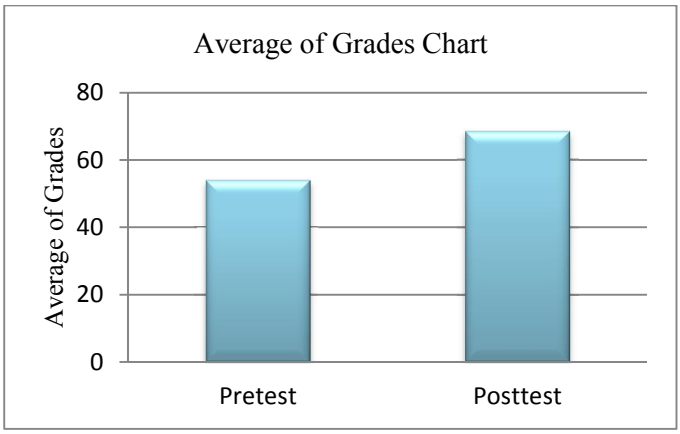
Several online tests consisted of 10 multiple-choice questions were organized before and after applying PASELS. A paired-samples t-test was conducted to compare the students' grades before and after giving feedbacks. Table II shows the descriptive statistics for the pretest and posttest. Pretest is the result of a state when no feedbacks were given to the students and posttest relates to results of a state when feedbacks were given to students.

همانطور که در شکل ۱ مشاهده می‌کنید

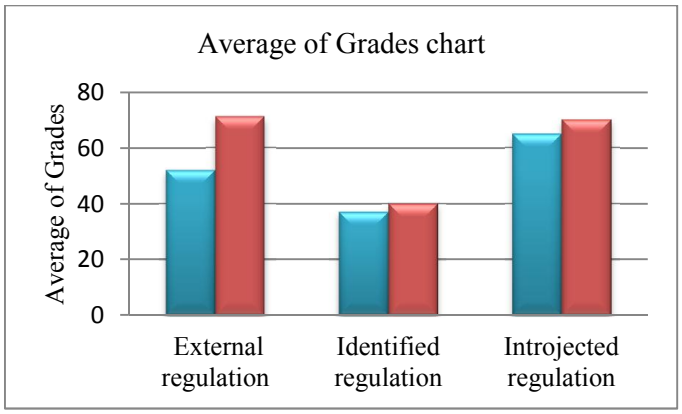
The mean of the grades in posttest is roughly 14.61 point higher than that of the pretest. It is determined that the personalized feedback given to students has positive effects on how they do in exams. Since grades are one of the most important parameters showing the progress of a learner, it can be concluded that by improving students' grades, we have improved the learning process.

Table II : Pretest and Posttest Statistics

	N	Minimum Grade	Maximum Grade	Mean	Std. Deviation	Std. Error Mean
pretest	13	32	80	53.8462	15.27441	4.23636
posttest	13	40	90	68.4615	15.19109	4.21325



در شکل ۲ میانگین نمرات دانشجویان در سه دسته ی ساماندهی بیرونی، ساماندهی خودآگاه و ساماندهی ناخود آگاه مشاهده می‌کنید. در هر سه دسته میانگین نمرات دانشجویان بهبود پیدا کرده است. همانطور که در شکل ۲ مشاهده می‌کنید سیستم پسلز بیشترین تاثیر را روی دسته ساماندهی بیرونی داشته است.



in posttest ($Mean = 68.5$, $Std = 15.2$) is higher than grades of pretest($M = 53.8, S = 15.3$), $t(13) = -2.903, p \leq 0.05$. The significance of the paired t-test is 0.013, which is less than 0.05, it proves that there is a significant difference between the grades of students in pretest and posttest. In other words, it means that feedback given to students has positive effect on learning and motivate them to learn. These differences show the effectiveness of the personalized feedback.

Table III shows the results of the paired samples t-test. A two-tailed paired samples t-test revealed that grades of students

Table III : RESULT OF PAIRED T-TEST

	Paired Differences							
	Mean	Std. Deviation	Std. Error Mean	df	Sig. (2-tailed)	t	95% Confidence Interval of the Difference	
							Lower	Upper
pretest - posttest	-14.61538	18.15461	5.03518	12	0.013	-2.903	-25.58610	-3.64467

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