# User-Interface Supporting Learners' Motivation and Emotion: A Case for Innovation in Learning Management Systems

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**Abstract.** Lately, elearning has been making a comeback not only in business education of global corporations but in academia as well. Offer of classes for masses of population, regardless of time, place or social status, has become a norm in great world centers of learning. One of the most respected MOOC portals, Coursera, joins 138 partners from over 28 countries in its portfolio. Majority of universities offer a comprehensive portfolio of open or paid courses of wide range of specialization, from technical fields to humanities. Rising popularity of this type of education is well documented by the number of students, which reaches 17.5 million [1]. This way, even those whose life circumstances do not allow them to become full-time students can take part in classes. This form of education also enables suitable social conditions for inclusion, which is a welcomed bonus in current situation of population exodus. In the Czech Republic, MOOC projects are among top priorities of the Ministry of Education for 2016 [2]. Design of education systems and applications has undergone distinctive changes lately. Modern technologies, such as mobile and wearable technologies, cloud services and global expansion of the Internet make education accessible for almost anybody and make it largely available. Structure of users and their learning activities expand, which logically brings about a call for better personalization of learning environment. This paper examines what role the user interface plays in the learning process and what requirements on management system the education process reflects.

**Keywords:** Learning management system · elearning · Massive open online courses · Education systems and applications · User interface · Evaluation · Design guidelines · Human computer interaction · Motivation · Emotion · Semiotic · Effective learning

## 1 Learning, Emotion and Motivation

Based on a number of studies by Marcus [26], Marzano [14], Stuchlíková [8] and others, it is obvious that effective learning process relates combination of previously gained knowledge (alternatively existing cognitive schemes) with new subject matter, which is acquired through different contexts of individual's knowledge fond, active knowledge and motivation support, which creates emotional background to the educational process.

Out of effective pedagogic approaches, which work with emotions as with the bearer of motivation, Maria Montessori's educational program can be mentioned [3]. According to Stuchlíková [8], UNESCO International Commission on Education emphasizes "four pillars of education" in "learning society", learn to become aware, learn to act, learn to live together with others, and learn to be (authentic integrated individual). Emotional literacy is one of essential prerequisites leading to fulfillment of these requirements – it is a prerequisite of positive self-acceptance and effective and sensitive conduct in social environment [18].

In our paper, we are focusing on emotions and emotional conditions related to the learning process and on methodological tools that can work with emotions. Emotions can be both positive and negative and either increase or decrease motivation towards accomplishment of a learning activity. In life and in the learning process as well, pleasant emotions perform especially motivational and cognitive functions (assessment of incoming stimuli as good or bad), supply energy for realization of activities, speed up our reactions, enhance efficiency, and nurture belief in our capabilities. Good feeling as a positive emotion can be created e.g. by accomplishment of our duties, overcoming of weaknesses and strengthening of our will, discovering of correct solutions or sharing of our successes. And on the contrary, unpleasant emotions lead us away from certain activities and focus our attention in different direction. Feelings of anger, lack of interest, disgust, frustration, envy, fatigue or shame caused by failure, uncertainty or stress are uncalled for in the learning process. However, even these negative feelings can have, under certain circumstances, favorable implications for the learning process. Mild stress (caused by higher level of cognitive stimuli) can be given as an example. This stress will help us recollect certain pieces of information because this situation is seen as a threat from our inner criteria viewpoint. What level of stress is still beneficial for an individual and what stress level is harmful remains a question. Stress hinders performing of creative activities because these are tied to a state of relaxed concentration, which is preclusive of psychical state of stress [6]. Stress and negative emotions induce series of changes in cognitive processes. At first, it manifests itself in reduced ability of concentration; other qualitative changes arrive later: The individual loses cognitive capacity, speed, concentration, and attention, serious problems with memory come about, the person loses ability to perform more complex tasks or absorbs new facts with difficulties, interpreting of subject matter as well as its structuring is difficult; decision making process (simplified analytical approach) is inhibited as well. Distinctive changes in motivation towards learning arise, the individual does not feel like doing anything.

## 2    Role of Interface in the Learning Process

Specifics of user interfaces of learning systems lie in providing support to the learning process, which brings about distinctive mental strain of the user. While focusing on the content of the subject matter and the process of acquiring the knowledge, there is not much mental capacity left to be used on the system itself. In ideal case, the user interface of the elearning system should be an invisible companion providing right tools for

desired activities in right time. User interface should actively influence users' behavior and effectively motivate and support them in the learning process.

Proceeding from beforehand determined evaluation rules for LMS user interface [27], it is possible to build on agreement among aims of several main pedagogical movements for the work with emotions and motivation, which is linked to them. Our research is therefore based on Robert Gagné's research [4] and his model Nine Events of Instruction (Fig. 1), on Skinner's operant conditioning theory (orig. Programmed Instruction Educational Model) [13], on Keller's Personal System of Instruction [9], on Bloom's Taxonomy of Learning Domains [5], and on Keller's [16] ARCS Model (Fig. 2). All of these theories assign a prominent role to the work with motivation during the learning process and insist on effort to avoid a failure in students' learning process.
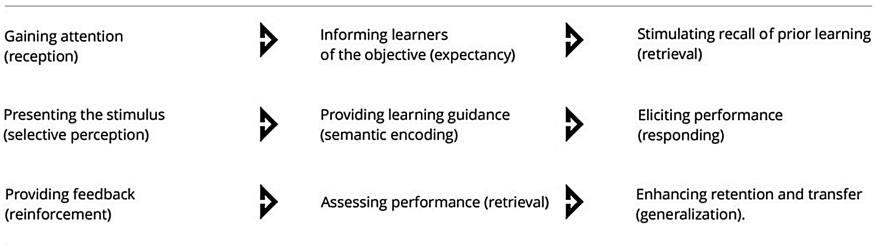
| Gaining attention (reception) | ▶ | Informing learners of the objective (expectancy) | ▶ | Stimulating recall of prior learning (retrieval) |
| Presenting the stimulus (selective perception) | ▶ | Providing learning guidance (semantic encoding) | ▶ | Eliciting performance (responding) |
| Providing feedback (reinforcement) | ▶ | Assessing performance (retrieval) | ▶ | Enhancing retention and transfer (generalization). |

**Fig. 1.** Robert Gagné: Nine Events of Instruction

| Motivational Concept | Motivational Strategies | Motivational Concept | Motivational Strategies |
|---|---|---|---|
| Attention | Incongruity and conflict Concreteness Variability Humor Inquiry Participation | Confidence | Learning requirements Difficulty Expectations Attributions Self-confidence |
| Relevance | Experience Present worth Future usefulness Need matching Modeling Choice | Satisfaction | Natural consequences Unexpected rewards Positive outcomes Negative influences Scheduling |

**Fig. 2.** J. M. Keller: Motivational Concept of ARCS Model

## 3   Requirements of the User Interface in LMS Environment Based on Effective Learning Methodology

**Gaining Attention.** Arousing of students' interest is the main goal of the first event. This pre-learning activity does not require any kind of effort, it is up to the lecturer what kind of tools and method he or she chooses to provoke students' curiosity. It is the students' first encounter with the topic. When comparing with the work in the system,

it is possible to compare this activity to the first encounter with the system and its interface. That is why we place high demands on simplicity, comprehensibility and attractiveness. From the viewpoint of interface grammar [25] and information architecture, it is desirable to use for interface layout design patterns derived from users' mental models and respecting mental consistency and intuitiveness. Many experimental studies were carried out in the field of design approaches, defining relationships between objective and subjective factors of interactive systems aesthetics perception, e.g. Seckler et al. [7]. However, the results show that universal principals for design patterns cannot be unambiguously defined. Our recommendation therefore is to respect common typographical rules and composition solutions, which harmonize the complex in dependence on the number and mutual relationship of individual components, and sociocultural customs of target audience. First impression is often crucial and determines further motivation of users to work with the system.

**Informing Learners of Objectives.** Informing of objectives allows the learners to organize their thoughts on what they will learn and perform. This works by helping to cue the learners on the goals of the instruction and how they will be able to use their new skills in the workplace. Marzano [14] reported an effect size of 0.97 (which indicates that the achievement can be raised by 34 percentile points) when goal specification is used. When students have some control over the learning outcomes, there is an effect size of 1.21 (39 percentile points) [10]. From the standpoint of the system, there is a requirement for structure transparency and clarity, possibility of linear and non-linear classification, visibility and control. Grammar of interaction is emphasized, "where to go" is suppressed at the expense of "what to do". Every tool, which the students have to their disposal, must be uniquely identifiable with respect to function and use. For this purpose, mental models and design pattern are use yet again.

**Stimulating Recall of Prior Learning.** Support through "proctors" [9] or, more likely, "scaffolding" - building upon the learners' previous knowledge and skills [15]. In the learning process, it is deliberate collecting of existing information with relation to given issues, search activities within one's knowledge fond, and directive creative activity pointed to action preparation. With respect to system requirements, it is directed use of analytical capabilities of the system recording history and attributes of user action, and offer of functions and tools required for search and creative activities (notes, tags and flash cards systems, tools for creation of mind maps, lexicons, collaborative wiki systems, cloud services, etc.).

**Presenting the Stimulus.** Methodology of learning materials presentation covers wide range of looking at information, its presentation and interpretation. According to Marzano [14] all information that is perceived via the senses passes through three processors that encode it as linguistic, nonlinguistic, or affective representations (Fig. 3). In the educational and training world, knowledge is most commonly presented linguistically, so perhaps this mode receives the most attention from a learning standpoint [17]. The linguistic mode includes verbal communication, reading, watching (e.g. learn the rule of chess through observation), etc. [10]. The nonlinguistic mode includes mental pictures, smell, kinesthetic, tactile, auditory, and taste. And finally the affective mode

can be thought of as a continuum of feelings, emotions, and ultimately moods. Possibilities of distribution and perception of information (alternatively personal preferences in dependence on student's study type [11] and personality) are therefore one of the key topics. The amount of information in time also plays an important role in the learning process. To prevent cognitive overload, it is necessary to serve information sequentially. This is related to Skinner's sequenced learning events - allowing the learners to receive feedback on individualized tasks, thereby correcting isolated problems rather than having little idea of where the root of the learning challenge lies [10].



**Fig. 3.** Robert Marzano: The Three Representational Modes

First of all, learning management system must provide wide range of tools for distribution and content structuring. There we perceive a large space for experiment on content distribution so that it combines traditional linguistic mode with nonlinguistic and affective modes. This will support easier saving and subsequent retrieval of information from memory. As the form is concerned, it is possible to highlight incorporating of modules that integrate gamification components (virtual environment). Variability of content form makes choice according to personal preferences possible. We also consider essential technological shift from currently common interface to less traditional forms that permit use of more senses, such as haptic or kinetic interfaces [19].

**Providing Learning Guidance.** Often, when students interact with new subject matter, they lose motivation due to negative emotions [6]. In this study phase, it is essential to arouse or boost positive emotions and suppress the negative ones. This phase is the most demanding on students' mental load, on support of their motivation and interaction with the lector of the system. It is therefore a subject of utmost importance to sustain (preferably automatically) early feedback concerning students' actions (action - reaction). There might be many forms of reaction, from a positive message through reward (e.g. very popular system of badges, which makes possible sharing of success or reaching of certain level of understanding or knowledge) to regulation of students' behavior (e.g. repeated use of wrong path to the outcome). Collective problem solution can be an important type of feedback. Another request on the system consequently is a module of social connections (linking with social media, discussion forums or other means of communication, such as videoconferences, etc.).

**Eliciting Performance.** Opportunity to apply newly acquired knowledge, findings and skills in different contexts is desirable for their consolidation and retrieval later. These activities cover eliciting student activities with asking deep-learning questions, eliciting recall strategies, facilitating student elaborations (elaborate or explain details) and

helping students integrate new knowledge (provide content in a context-rich way) [12]. There is a wide range of tools serving to this purposes, such as control questions, auto-corrective exercises, auto-tests, educational games, quizzes, etc.
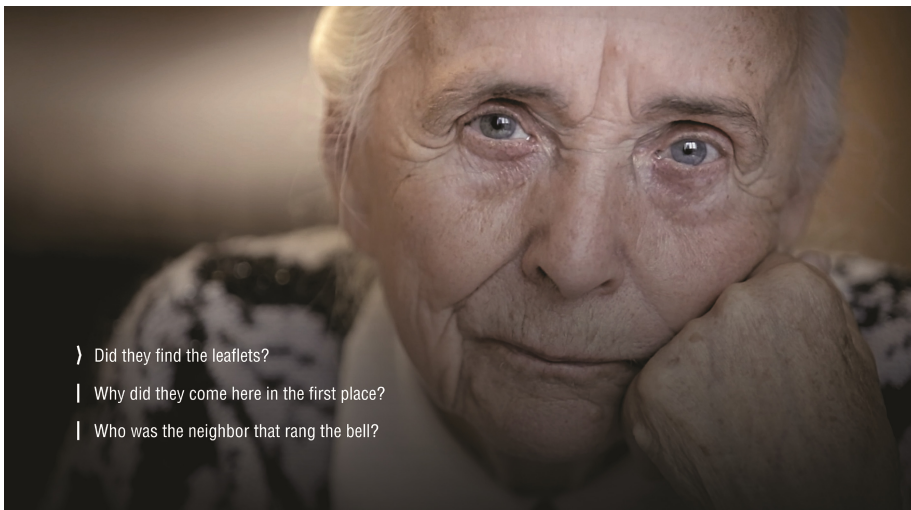
**Providing Feedback.**   There are many forms of feedback; its form depends on the phase of the learning process and what aim it has. It can be generally stated that feedback works effectively with users' emotion only when its frequency and form are chosen aptly. For example, we can confirm correctness of chosen course of action, correct it or make instructions more specific, without revealing the correct procedure. We can evoke feeling of active listening or participation by informative addition or suggest analytically new solutions for correction of unsuitable solution [12]. Feedback can be provided by a lector, system or by another student. On the other hand, some forms of feedback are highly individualized and thus difficult to automate. However, in the requirements on the system, we can boldly mention automated mailing of feedback messages about reading a message, about control or completion of a task, about meeting all the requirements and so on. System of reminders and motivating messages can be added among the requirements on the system because they enable linking of the system to other media and devices. This way, better accessibility is reached (mobile technologies, wearable technologies etc.).

**Assessing Performance.**   In order to evaluate the effectiveness of the instructional events, one must test to see if the expected learning outcomes have been achieved. Performance should be based on previously stated objectives. Methods for testing learning include pretest for mastery of prerequisites, post-test to check for mastery of content or skills, embed questions throughout instruction through oral questioning or quizzes, objective or criterion-referenced performances which measure how well a student has learned a topic and identification of normative-referenced performances which compares one student to another student [12]. Assessment scores may cause motivation drop in further learning; it is therefore important to pay due attention to selection of the right form of assessment. Verbal comments or activities that make assessment by fellow students possible (for example evaluation of a presentation according to given criteria) are a welcomed addition to commonly used written tests (filling in the blanks, multiple choice, etc.) [20]. Tools for advancement assessment or learning process outcome must be variable, so that assessment of students in all phases is possible (using fitting form and scale).

**Enhancing Retention and Transfer.**   Transfer of training is effectively and continuing applying the knowledge, skills, and/or attitudes that were learned in a learning environment to the job environment. Closely related to this concept is Transfer of Learning—the application of skills, knowledge, and/or attitudes that were learned in one situation to another learning situation [22]. This increases the speed of learning [21]. Virtual environment can be a convenient help in such a situation, because it can simulate use of gained knowledge and skills in "real" world [23]. The system can contain modules of "test applications", simulations and games, can be interconnected with commonly used applications from public life, use real data from publically accessible databases, etc.

**Fig. 4.** Czechoslovakia 38-89: a complex educational simulation (http://cs3889.com) (reproduced with permission).



**Fig. 5.** Czechoslovakia 38-89: a complex educational simulation (http://cs3889.com) (reproduced with permission).

## 4 Summary

The process of user interface design is a communication process among the system designers and the users. According to de Souza's account [24], both designers and users are interlocutors in an overall communication process that takes place through an interface of words, graphics, and behavior. The designer of the learning management system

communicates with two groups of users through the interface. There are the lectors on one side, being the content creators, and the students, the content consumers, on the other side. Learning process and its methodology become a basic strategic starting point, from which framework for both the designer pattern and user behavior comes to being. Course methodology determines measure and type of user interaction with study content. Through the system, the designer gives the content creator a set of tools for effective content presentation and distribution.

Respected theories of learning are ground for this paper, in which we are trying to define all aspects of effective learning process that set requirements on the LMS interface. Apart from general rules for LMS [27], we are completing the criteria with aspects related to the support of motivation. Resulting set of criteria will be used as a ground for analysis of current learning management systems used at Czech universities and as basis for their innovation. The aim of the research is the design of experimental modular system of plug-ins, which will be arbitrarily combined and will be easily included into existing learning management systems.

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