

Motivational & Affective Aspects in Technology Enhanced Learning: Topics, Results and Research Route

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Abstract. Motivational and affective aspects have long been neglected in research and development of technology enhanced learning (TEL) solutions, but it is now increasingly recognized that they are key to acceptance and sustainable success. However, the consideration of these aspects still suffers from fragmented research activities that are in between established disciplines. We summarize the results from three editions of the EC-TEL workshop series MATEL, which has established a forum for interdisciplinary conversations and joint research activities. This includes an overview and systematization of current research and its findings as well as prioritized research challenges. The paper concludes with a research agenda that advances the inclusion of motivational and affective aspects into TEL from art to an engineering approach.

Keywords: Motivation, Affective, Emotions, Workplace Learning

1 Introduction

Motivational and affective aspects are frequently neglected in TEL - although experiences from research and practice consistently show that they are one of the most important acceptance and success factors of learning solutions. This becomes even more important as we move towards more open, independent, and informal learning settings. Addressing these aspects requires a multi-disciplinary perspective, including pedagogy/andragogy, psychology, human resources management, computer-supported cooperative work, knowledge management, serious games engineering, affective computing and sensors engineering, among others. To provide a forum for such multi-disciplinary activities, to collect the scattered state of the art in the various fields, and to stimulate further research, the authors have initiated a successful workshop series at EC-TEL. This paper highlights findings from the first three editions of the workshop series (in 2010, 2011, and 2012). Each workshop consisted of research

papers on results, short papers on ongoing work, position papers for highlighting research directions, and tool demonstrations. Additionally, there were extensive interdisciplinary discussion sessions including “landscaping activities” of key concepts and identifying key challenges for further research (see for more extensive material under <http://matel.professional-learning.eu>). The accepted submissions were 8 for 2010 (22 participants), 5 for 2011 (17 participants) and 6 for 2012 (17 participants). The following sections highlight outcomes of the workshop series and present the identified research challenges, both for the motivational and the affective strand. We conclude by discussing the link between affective and motivational aspects.

2 Motivational Aspects

As a result of the discussions at the workshops, we could identify three main types of motivation relevant to TEL:

The **motivation to learn** addresses the question on what moves or hinders learners to learn, what makes them persevere in the face of difficulties and how the learners’ motivation is influenced by teachers/tutors, practices as well as peer behaviour. The motivation to learn is understood as an individual’s characteristic. This can be connected to concepts like learning outcomes, attitudes and self-efficacy [1, 2]. The FP7 project IntelLEO focused on a goal driven approach and developed a model on how to increase the motivation of self-regulated learners at the workplace. Holocher-Ertl [3] presented the evaluation results of TEL tools built according to this model which showed that self-regulated learning activities, like planning and monitoring of one’s learning, are important for self-motivation and keeping oneself on the learning. Attention has to be given to potential conflicts between staff and management regarding the usage of the collected learning information, as well as to efforts spent with these activities. The project suggested putting further research in the investigation of “light-weight” tools for self-regulated learners and their role on motivation to learn.

The **motivation to share** knowledge is increasingly important where learning becomes more social. But challenges arise on how to make the individual tacit knowledge of experts explicit and useful for other workers and how to motivate employees to share their knowledge. Studies focus on drivers [4] and barriers [5] for knowledge sharing, investigating intra- and inter-personal as well as external influencing factors. The motivation to share knowledge was the aspect which was most intensively addressed by contributions from research in the MATEL workshop series. IntelLEO identified the importance of collaboration on the motivation to share knowledge and self-efficacy [3]. Cress [6] discussed the aspect of free-riding, which occurs when people read others’ contributions but do not actively contribute because of manifold barriers. Further research in experimental settings investigated how far bonus systems, social norms, etc. influence people’s contribution behaviour. Within MATURE, Kunzmann & Schmidt [7] have developed an analysis model for identifying motivational barriers in a concrete work context, with the perspectives (i) individual (values, interest, needs, and capabilities), (ii) interpersonal (cooperative, affective), and (iii) enabler (organization, infrastructure). Several concrete barriers were

identified based on ethnographic fieldwork [8] and theoretical considerations, and the analysis model was embedded into a proposal for an iterative design process which has been used by Ravenscroft et al. [9]. Based on the model of Kunzmann & Schmidt [7], Cook et al. [10] extends this perspective further towards larger networks of users where direct involvement is no longer possible.

The **motivation to use a specific tool** is related to the general question of technology acceptance, which is not specific to TEL. Research in this area investigates factors that influence future users' acceptance and satisfaction with innovative tools and reflects on supportive research and user-involvement methodologies. One approach in the workshop was gamification, which makes use of game mechanics, such as giving scores for user activities and introducing leader boards for stimulating competitive behaviour [11], but it also has to acknowledge gender and cultural differences [12].

During each of the MATEL workshops, there was extensive space for discussion amongst the participants. Next to the motivational landscapes, the main outcome from these discussions was the identification of **research challenges** (see Fig. 1).

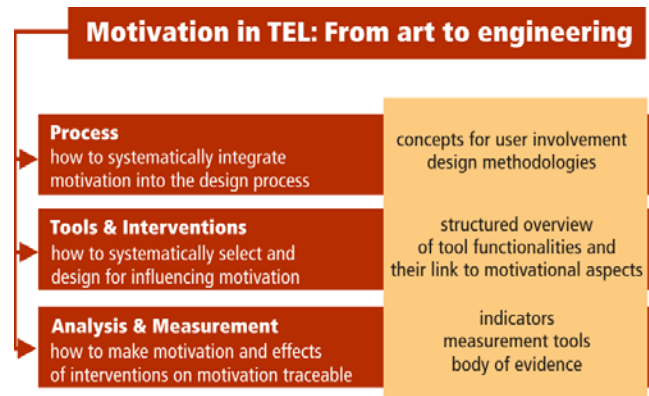


Fig. 1. Research challenges in TEL with respect to motivational aspects

The main challenge is advancing this topic *from art to engineering*, i.e., evolution towards more systematic approaches. Motivational research is often dealt with in different contexts, some research is based on existing theories on motivation from psychology, others focus on empirical investigations, some address motivation via tools and organisational interventions, others via the design process. It is still a collection of detached case studies and ideas on how to solve problems in a certain domain.

We have to search for synergies between researchers and advance our joint knowledge on motivation to provide systematic approaches (based on a sound body of evidence) on three levels: (i) the level of *design processes*, where empirically grounded guidelines are needed on how to involve the future users into the design process in different contexts fostering aspects like autonomy, ownership and acceptance of innovative solutions; (ii) the level of *tools and interventions* where an inventory of functionality and other measures is needed, similar to design pattern approaches, and (iii)

the level of *analysis & measurement* where indicators and measurement methods are needed to make motivation more traceable and to assess the effects of interventions.

On all three levels there is the aspect of *context*, which needs to be investigated specifically and influences processes, tools and measurement. The challenge is finding ways to keep the complexity manageable while on the other hand not completely neglecting the different contexts where motivation is key to success. Towards that end we will need more specific investigations in comparative research between different approaches, preferably within a similar environment, which is often hard to achieve at the workplace. One example was to compare learning solutions that define and monitor goals vs. learning solutions that create challenges.

3 Affective Aspects

In contrast to motivational aspects, affective aspects in TEL are still an emerging topic. There are first prototypes and studies (e.g., [18], [19]), but a common understanding of the role of emotional aspects is challenging and not achieved yet. There is a broad base of theory from psychology, but these theories are quite complicated and hence difficult to apply in a design process. The Circumplex Model of Affect by Russell [20] and the model by Krathwohl [21] are two theories that are often considered in TEL. Both provide an understanding of emotions and offer a starting point to design a technological support. The affective domain of education is a relatively little understood phenomenon, especially when considering technology support, and several tools are introduced in learning contexts. A discussion is presented in [22] along two conceptualizations of the affective domain of learning.

As part of the MATEL series, the main contributions were related to specific approaches to apply technology in a learning context, based in a certain psychological theory (or a part of it). These approaches presented three purposes for which emotions are taken into account in TEL:

- A first research direction investigates how emotions can be used for **adaptive systems** [19], which adapt themselves and react according to the emotions of the user.
- **Raising awareness and making emotions available for reflection** (as content of the reflection itself) [18], [25] is another trend of employing affective aspects in learning. Being aware of emotions and reflecting on them can be supported both at individual as well as collective level.
- Affective aspects in TEL are considered in approaches **to influence and regulate emotions of users** [26].

The goal of tackling affective aspects in TEL was also a discussion topic during the MATEL workshops. This goal is still undefined and it is unclear if the aim should be to feel and induce always positive emotions, similar to motivation, where the main goal is to achieve a high motivation. In the case of reflective learning, not only positive emotions are considered, but negative emotions play an important role as well. The discussed TEL solutions are facing similar problems, because they tend to follow one single theory coming from psychology, and this complicates the definition of a

common understanding. The main challenges are (i) the lack of a common language, (ii) the dependency on the users' context and (iii) the specific barriers and problematic assumptions for the success of applications.

The discussion of a common understanding of affective aspects was an on-going theme during all MATEL workshops. A *common language is lacking* to connect the different involved disciplines, as designers, psychologists and sensor experts can use completely different terms. The communication between an application and the user suffers from a similar problem, because they depend on the *visualization* of the data, e.g. an icon that is selected to express mood can be used to communicate the current mood to others or store it for later reflection. Textual or graphical descriptions create different notions depending on the reader's background. There is a wide variety of user interfaces that support the reporting of subjective impressions. In the field of HCI, interfaces and representations for emotions have been extensively researched, but we still lack guidance on which methods or visualizations are more suitable for which contexts and purposes, especially in learning. There is not a *universal preference to express and communicate* emotions from the user's point of view and some users may prefer to use smileys, while others prefer a term from a taxonomy. This fact adds barriers and challenges to developing tools that may offer support to all of them.

Finally, emotions are dependent on the current *personal context* e.g. the reaction of a person to a certain event can be different depending on the time of the day or the place where she is. This dependency originates that the meaning of the representations of emotions varies depending on the person's context.

Major *concerns or barriers* regarding affective aspects have been raised and discussed in the MATEL workshops. For instance, while humans are trained in detecting affective state of others, automated methods for detecting affective state will never be as good at it. This means that we should not seek to replace human perception, but rather to augment it. *Problematic assumptions* which may not be taking into account in research about emotional aspects of TEL are also discussed in [22].

4 Conclusions

The MATEL workshops between 2010 and 2012 have identified concrete research challenges to guide future research in the field. It has become obvious that emotions and motivation are linked to each other closely, although their relationship is not an easy one. Emotions are on a low level of abstraction and close to what can be observed; but rather short-lived and quick to change. Effects of emotions on learning processes are very complex as short-term effects often differ from long-term effects (such as the effects of stress, or anxiety), but the field of affective aspects still lacks a more stable notion of affective factors. Motivational aspects on the other hand are on a higher level of abstraction, which is more stable and makes it easier to link it to impact on learning processes. But motivation remains hard to observe, detect, and to influence. Motivation is influenced by emotions, aggregating series of emotions into a more stable motivational state. Due to its closeness to learning, research on motivational aspects has reached a higher maturity, while affective aspects have not yet a

coherent research area. Overall, in both areas, the workshops have clearly highlighted the importance of contextual factors, ranging from individual characteristics, via learning context to tool context. To advance the field from an art to an engineering approach of designing motivational and affective aware systems, investigation of more concrete examples have been proposed to gain a richer body of evidence. Suitable engineering methodologies will probably be based on design-based research as a method and agile project management methodologies that refer to a shared conceptual model at the centre such as [24].

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