techplay.mobi: A Technological Framework for Developing Affective Inclusive Personalized Mobile Serious Games to Enrich Learning Competences

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Abstract. *techplay.mobi* is a research project aimed at building a platform for developing mobile serious games. The novelty is to support the design of games that consider affective features during the game interaction, provide personalized responses according to users' interactions, comply with accessibility requirements and focus on improving psycho-educational competences and on promoting critical thinking.

Keywords: Serious games, psycho-educational competences, affective states.

1   Introduction

Mobile devices are integrated into users' daily life, including their learning activities. Serious games (usually defined as 'games for purposes other than entertainment' [1, 2] embracing all aspects of education –teaching, training, advertising and informing– and at all ages [3]) follow suit. This type of games can support users to get a more motivating and efficient learning experience, delivering multimodal information and disseminating knowledge in a socially complex environment [4] by impacting on the users' affective, cognitive and metacognitive capabilities [5] (e.g. selecting and codifying relevant information, decision making, problem solving, communicating, monitoring). Often, users face difficulties in acquiring and applying knowledge because their learning, affective and critical thinking strategies are functioning in a poor or inadequate way. In these cases, learners face a gap between their skills and their performance. This distance can affect any user in any learning context (e.g. traditional, virtual...) and involve diverse cognitive and meta-cognitive processes (e.g. attention, reasoning, memory, communication, reading comprehension, planning, social abilities, emotional management).

From our experiences in past research projects (e.g. EU4ALL) effective and efficient virtual learning environments need to be adapted according with the user' physi-

cal, cognitive and perceptual abilities and limitations by integrating different types of adaptation, which allow the user to accomplish the tasks posed to them [6]. Serious games, like any educational resource, should consider those issues. Thus, *techplay.mobi* focuses on modeling users' needs and preferences, types of educational scenarios and device characteristics to support educators in designing serious games that can improve user's competences through their interaction with an inclusive and personalized multimodal mobile learning environment.

2   About *techplay.mobi* and UNED

Technological Framework for Developing Affective Personalized Serious Games to Enrich the Integral Human Development (IPT-430000-2011-1721) research project involves four partners (creativ IT, oneclick, AIJU and UNED) and aims at developing a platform to facilitate and support the design, creation and packaging of serious games with integrated applications, promoting the integral human development by improving users psycho-educational strategies, affective competences and critical thinking abilities [7].

There are few authoring platforms that enable non-expert users to develop place-based or narrative gaming activities designed for teaching and learning for mobile context (e.g. *ARIS* [8], *e-adventure* [9], *Collage* [10], *Infantium* [11]). However, these platforms do not deal with the integral human development considered by *techplay.mobi* (i.e. accessibility and personalization regarding user affective state, learning needs and competences), which is to be integrated into the serious games learning flow, activities and resources.

techplay.mobi covers both technological and educational goals. At UNED, we mainly focus on the educational goals and address the following objectives: 1) develop a support framework to create serious games by combining technology and education involving the user in a fun formative learning process, 2) define the appropriate instructional design for serious games, where selected contents, activities and resource are linked to foster the user affective, learning and critical thinking strategies when functioning in a poor or inadequate way, 3) facilitate inclusive personalized serious games adaptations taking into account the user functional diversity (cognitive, physical, perceptual) by providing usable and accessible interfaces, personalized learning flows, alternative contents, resources and activities, and 4) validate the benefits of this support framework integrated in inclusive personalized and affective serious games on the users' learning experience (e.g. achievement, satisfaction, motivation, engagement, generalization, etc. of acquired knowledge in real life contexts).

3   Ongoing work and expected results

Serious games should combine learning strategies guiding students' exploration of learning content with entertainment enhancing learning [12]. Specifically learning strategies integrated into serious games must facilitate active knowledge construction, practicing key learning skills such as problem solving, decision-making and collabo-

ration [13]. From lessons learned at EU4LL [14], MAMIPEC [15] and ALTER-NATIVA [16] projects on learning personalization taking into account the user profile (learning style, learning and affective level of competences, accessibility preferences, functional needs) and specific educational context features, at UNED we have focused on understanding how psycho-educational competences, emotional states management and critical thinking processes can be improved through mobile accessible videogames where formal and informal education and entertainment need to be matched. To illustrate this, Table 1 shows how learning competences, achieved affective states and critical thinking abilities can be integrated into a serious game learning flow for problem solving.

Table 1. Learning competences, affective states achieved and critical thinking abilities.

Serious games activity: Problem solving			
Step	**Learning competences**	**Affective state**	**Critical thinking abilities**
Identifying problems	Establishing relations, how, when and why. Identifying concepts. Grouping information according to target criteria	Interested	Development of a realistic view of the problem.
Selecting key information	Representing a structure, establishing main ideas, secondary information	Excited	Avoidance of ambiguous and useless information, Additional information search.
Developing an answer	Activating previous knowledge, focusing attention on problem issues, establishing order in solving process	Confident, relaxed	Initiation of positive actions
Evaluating the answer	Collaborating with others, asking orientations, reformulating problem from other perspective, facing critics	Pleased, satisfied	Improvement of believes about one-self and others, Improvement of personal and social adjustment, Acceptance of challenges

On-going work focuses on 1) studying the state of the art on which and how learning and affective strategies can be integrated into serious games, 2) determining how the EU4ALL outcomes [14] can be reoriented and adapted to mobile accessible videogames to take advantage of mobile devices capabilities (e.g. spatial inclination provided by internal accelerometer), 3) identifying, through varied sources of information (e.g. questionnaires, interviews, data mined from sensors such as eye trackers, biofeedback devices and interaction patterns [15]), relevant users' needs and preferences (educational, affective and accessibility) to build an open standards-based user model extending existing specifications (e.g. IMS LIP [17], IMS AfA [18] and W3C Emotion ML [19]) which informs the instructional design of serious games.

The expected result will be the definition of a synergy matrix that maps a) data collected about psycho-educational competences, affective states and accessibility needs and preferences detected, with b) technological requirements to design, create and package mobile accessible multiplatform videogames for the most relevant mobile operating systems (Android, iOS). Thus, this matrix will guide the framework design that support the creation of serious games that promote the integral human development by improving psycho-educational strategies, affective competences and critical thinking abilities. The resulting developing platform for mobile serious games will be evaluated in several scenarios involving educators and serious game players.

Acknowledgements

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