Points of view on Software Engineering for eLearning (Panel Session)

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***Abstract* — This paper summarizes and integrates the different points of view of the panelists who participated in the Panel Session on 'Software Development for eLearning' of the 3rd Workshop on Software Engineering for eLearning (ISELEAR'12), hold in Andorra in November 30, 2012. The paper also summarizes some of the conclusions reached as consequence of this panel session.**

***Keywords* — Software Engineering, eLearning**

I. INTRODUCTION

As part of the 3rd Workshop on Software Engineering for eLearning (ISELEAR'12), organizers scheduled a panel session in order to discuss different positions concerning the development of eLearning systems and applications. The aim of the session was to examine, among other topics, which process models and project management techniques are best-suited for the orchestration of eLearning projects, which are the more suitable specification, design and implementation approaches, best (and bad) practices in eLearning development, and, roughly speaking, all those aspects involved in the construction of eLearning solutions. In addition, panelists were encouraged to discuss practical experiences, as well as lessons learned from these experiences. Summarizing, the aim of the panel was to elucidate what works and what does not work in eLearning development.

In order to focus the discussion, organizers invited five recognized researchers in the Spanish eLearning research community as panelists: Juan-Manuel Dodero (from SPI&FM group, at Cadiz University), Francisco-José García-Peñalvo (Head of the GRIAL research group, at Salamanca University), Carina Gonzalez (La Laguna University), Pablo Moreno-Ger (from the e-UCM research group, at Complutense University), and Miguel A. Redondo (from the CHICO research group, at Castilla-La-Mancha University). The following sections summarize the points of view that they defended during the panel. The paper also includes some of the conclusions derived from this panel session.

II. DODERO'S ON THE AUTOMATIZATION OF SOFTWARE DEVELOPMENT IN ELEARNING

Juan-Manuel Dodero focused his discussion on the different techniques aimed to automate different aspects of the development processes in eLearning. Indeed, he highlighted Model-Driven Engineering [5], Domain-Specific modeling [15] and Software Product Line Engineering [22] as techniques that are being readily applied to the development of Technology-Enhanced Learning resources, applications and services. These techniques vindicate the adaption of eLearning products at a lower cost and with fewer failures than using traditional software engineering approaches. These approaches are moving the effort from software programming to software configuration in the engineering life-cycle.

Concerning these matters, he also pointed how these approaches pose a risk if software configuration is not readily facilitated to software engineers. Besides, he made apparent how to model adequately the educational requirements of eLearning applications and systems is still an issue that must be resolved in the analysis phase [4].

III. GARCÍA-PEÑALVO'S ON SOFTWARE ENGINEERING METHODOLOGIES IN ELEARNING SYSTEMS

Francisco-José García-Peñalvo focused his intervention on methodological aspects of eLearning systems. He motivated how eLearning and computer-based educational systems in general are very complex developments because of the nature of the projects might involve different actors, roles, contents, functionalities, services and so on. Usually, since a project does not start from the scratch, it will be impossible to achieve the temporal and functional goals. Also these educational products are usually able to interoperate with third party products that may require mash-up approaches.

As result of these considerations, García-Peñalvo made apparent how, due to this diversity, each project requires its own methodological approach, with a clear distinction between research contexts and development ones. For this purpose, García-Peñalvo argued that the agile approach [18] in both the project management and the process development is a widely accepted solution due to the higher risks of evolution and changes in the requirements and systems architecture and

also by the way in which developments (or research) teams are composed. On the other hand, García-Peñalvo indicated that, when the project size is huge, involving too many populated and distributed teams in a more formalized approach, such us Unified Process [14], should be taken into account for the overall development. However, he also defended that it can be compatible with agile approaches: indeed, he claimed that the internal management of each iteration/increment should be agile-oriented.

IV. GONZÁLEZ'S ON SOCIAL AND HUMAN ASPECTS OF ELEARNING ENGINEERING

In her intervention, Carina González indicated how, during the last 15 years, the software engineering applied to eLearning has been focused on the process of specification, systematization and standardization of models and teaching-learning processes supported by technology [6]. From this perspective, it is possible to found several standards initiatives (eg IMS, IEEE LOM, SCORM, LAMS, etc.), methodologies and techniques that help teams to conduct research and development of educational projects.

However, and regardless these purely technological aspects, González gave evidence on how, currently, one of the major challenges facing the software engineering in eLearning is the representation of knowledge management and instructional design in new open, ubiquitous, social and informal learning environments. As an example she referred to the Massive Open Online Courses (MOOCs) [12][13], a semi-automated courseware system with a characteristic instructional design (interactive video "pills", self-assessment and peer-assessment, etc.), which feeds the interactions of thousands of students allowing self-management of learning. Thus, she made apparent how these new course formats, raises open, structured and interactive teaching-learning processes. In addition, this practice also generates a lot of data over which it is possible to discover patterns of interaction, learning styles and knowledge on the teaching-learning process developed on the platform.

Moreover, González emphasized the modeling and representation of learning processes as another current interesting phenomenon for the field of software engineering, which is carried out at micro level (micro-content, micro-formats …) in technological ecosystems. This phenomenon is called micro-learning [9] and is characterized by the learning interaction with emerging micro-content structures during a short time (few seconds in mobile learning, up to 10-15 minutes or more). Also, González showed how micro-learning may be useful to describe informal learning processes, in which people acquire knowledge through micro-content structure in a microcosm or ecosystem.

Finally, González noticed how the main objective of software engineering for eLearning is the design and development of usable and accessible systems and services, in order to reach end users maximizing their user experience and to facilitate the teaching and learning. This goal can only be achieved through working in interdisciplinary teams and using agile user centered methodologies, including experts and users of applications and services throughout the design process.

V. MORENO-GER'S ON CHALLENGES IN THE DEVELOPMENT OF EDUCATIONAL GAMES

Pablo Moreno-Ger addressed in his intervention the topic of educational games and game-like interactive simulations. He remarked how, within the field of Technology Enhanced Learning, the use of digital games and game-like simulations has increased its presence in the last few years [8][23]. This idea started as a set of isolated initiatives, but has been increasingly accepted by the academic community. In fact, in the last years, the discussion has moved forward and the key question is not whether games can have educational value, but how to develop good educational games.

Moreno-Ger indicated how developing educational games presents unique challenges. The inspiration to use games in education comes from observing the engagement provided by top of the line commercial games. However, such games are backed by multi-million budgets, and developed by highly skilled teams of programmers, visual artists, writers and game designers. Unfortunately, educational games rarely have such budgets or human teams, and other approaches are required. For this reason, adequate software engineering techniques and development models are required to create affordable games that not only engage the students as their commercial counterparts, but also educate, train or inform. The typical approaches include using specific languages and game engines, or using authoring tools that reduce the development costs and facilitate the participation of instructors and content experts in the authoring process [1][16].

Moreno-Ger also addressed the topic of languages and specific engines for videogames. He showed how games often use special libraries acting as an intermediate layer between a high-level programming language and low-level operations of specialized hardware. Following the idea of raising the level of abstraction, most modern video games separate the low level logic and the high-level constructs that define the behavior of the game (AI management, level design, game script, events, etc.). Thus, the heart of these developments is a very efficient engine that manages aspects of graphics, physics, sound or visual effects. In turn, the game is built using scripting languages that are usually easier to use by non-experts. Some examples of commonly used game engines in non-professional developments are Ogre (http://www.ogre3d.org/) and jMonkeyEngine (http://jmonkeyengine.com/). However, the programming requirements for these engines are still too high, and more abstract tools are typically required.

In this way, Moreno-Ger presented authoring tools as essential assets in educational game development. Indeed, Moreno-Ger shown as, as far as possible from the requirement to have programming skills, there are a variety of tools that allow authors to create their own games, without writing a single line of code. Obviously, these initiatives need to reduce their expressiveness to achieve their goals of simplicity, and games that can be created are often very similar. This often is compensated with a strong focus on engaging narratives, as opposed to intense action and complex interactions [17]. Because of this, many of the initiatives include optionally a

complete programming language that let developers alter the default behaviors and create new situations.

Thus, Moreno-Ger indicated how authors can start with simple drag and drop procedures, and later on add scripting snippets to customize the behavior. Some commercial examples of such tools are Game Salad (http://gamesalad.com/) or Unity (http://unity3d.com/), while e-Adventure (http://e-adventure.e-ucm.es), an educational-oriented authoring tool developed by Moreno-Ger's group, is a specific example created to facilitate the development of educational games. In particular, e-Adventure has been used in academic environments to create low-cost educational game or for rapid prototyping of larger professional games [3][20].

VI. RENDODO'S ON MODEL-DRIVEN DEVELOPMENT, LANGUAGE-DRIVEN DEVELOPMENT AND SYSTEM INTEGRATION

Miguel-Angel Redondo centered its intervention in the use of model-driven and language-driven methods and techniques for the development of eLearning systems. Indeed, Redondo pointed out how the development of eLearning systems, as a particular case of software system, requires systematic methods to guide the process and to reduce production costs. Thus, he considered that Model Development Engineering (MDE) can be a suitable method, especially when the purpose is to build systems for Computer Supported Collaborative Learning (CSCL). In addition, he considered MDE as a widespread approach in the field of engineering and an emerging approach in the field of Software Engineering.

On the other hand, Redondo highlighted the need of having tools or eLearning platforms that support practical work and work in-group such as can be found in student-training production environments. Another approach is to ensure that these tools are integrated with usual eLearning platforms, for example, by mean of Personal Learning Environments [21].

As a particular example, Redondo cited the case of the Eclipse platform, especially in the scope of learning in group of group-programming (or pair programming) [10]. Indeed, Eclipse also allows the application of this approach in other domains in which activities of design are performed in order to learn and acquire specific skills [7].

Redondo showed how Eclipse platform includes support for Model Driven Development (MDD) as a method of development. For this, it uses technologies such as EMF, GMF, ATL, Ecore, etc. In [7] there are examples about the application of these technologies.

In addition, Redondo also shown how, in other cases, a similar approach that makes use of techniques of Language Processors can be used. These language-driven techniques are used for building specific modules of learning systems. For example, modules of assessment, advice, personalized feedback, etc. can be developed with this approach [2].

Finally, Redondo indicated that, when this development approaches are applied, important aspects like integration and interoperability had to be considered. Regarding with these aspects, different approaches may be cited as the standards-based architectures, modelling languages or tuple spaces based architectures [11].

VII. CONCLUSSIONS

The participation of the panelist and all the attendees to the session panel made it possible to elucidate several keystone aspects for successful eLearning development.

Dodero and Redondo interventions made apparent the important role played by generative approaches, and, in particular, by model-driven and language-driven methods, in the development of eLearning systems.

In some sense, this emphasis in model-driven and language-driven development is consistent with Moreno-Ger's perception on the need for the active involvement of domain experts in the development of educational games. In addition, as Moreno-Ger's indicated, in order to actively involve domain-experts in the development process it does not suffices to provide suitable domain-specific models and languages, but it is also needed to provide adequate instructor-oriented educational tools.

However, as García-Peñalvo indicated, eLearning is a very complex software domain. Indeed, to the inherent complexity of web development, also made apparent by Redondo with respect to the need of using sophisticated system integration techniques during eLearning development, it is needed to add the complexity of coordinating multidisciplinary teams of domain-experts, instructors, students, and developers. For this purpose, García-Peñalvo highlighted the benefits of adopting agile approaches as basic development techniques, a point of view also shared with Gonzalez. However, García-Peñalvo showed how it does not mean to dismiss more structured approaches. On the contrary, he claimed in favor of the consistent integration of agile methods in conventional ones in order to orchestrate the different development phases / iterations.

Finally, as Gonzalez highlighted, regardless aspects like active involvement of domain-experts, use of well-established standards, and other methodological and technological concerns, a distinctive facet in modern eLearning systems is given by the social and human aspects. Thus, facing this facet should be a priority in any successful eLearning development process. Concerning this subject, Gonzalez highlighted the emerging trend of micro-formats and micro-learning as a keystone topic in the current eLearning arena.

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