



# GAMES AND CREATIVITY IN EDUCATION AND TRAINING

EDITORS

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# Games and Creativity in Education and Training (GACET'11)

Rome, Italy, 17-18 November, 2011

EDITORS:

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# Preface

This book contains selected contributions presented at the **GACET'11 - Games and Creativity in Education and Training Conference**, held in Rome, from 17 to 18 November, 2011. You will find examples of GBL from theory to practice.

**GACET'11 - Games and Creativity in Education and Training Conference**, is an intent to gather researchers, specialists and practitioners from different countries to exchange experiences and academic work in the field of game-based learning. This is a refereed scientific conference acting as a forum for scientists, teachers / trainers, and practitioners to present their latest research, results, ideas and developments on games and learning. The focus is on the use of educational games in creative teaching methodologies. The conference is organized by the project **ProActive — Fostering Teachers' Creativity through Game-Based Learning**, and from the project **T3 — Teaching to Teach with Technology**, both funded by the European Commission (Lifelong Learning Programme) during 2010-11.

**ProActive** is a project that aims to foster creative teaching by designing and using educational games in the classroom and in training sessions. Through a multiple pedagogical approach, the project has created learning contexts in which school teachers, lecturers and trainers apply creativity in designing GBL scenarios by using game editors. For more information about the ProActive project, visit [www.proactive-project.eu](http://www.proactive-project.eu)

The main topics covered by the book are:

- Creativity in educational game-design
- Game-Based Learning (GBL) in compulsory education
- GBL in higher education and academia
- GBL in vocational and professional training
- Students designing games
- Teachers designing games

The Conference has been organized by Sapienza University of Rome, the University of Barcelona and the National Research Council - Institute of Cognitive Sciences and Technologies (University of Naples). We thank both the Scientific and the Organising Committees for their work, a team of enthusiastic people who has put the best efforts in bringing this event to a successful end:

## **Scientific Committee:**

- Mario Barajas (Chair, University of Barcelona)
- Alessandra Talamo (Chair, Sapienza Università di Roma)
- Orazio Miglino (Chair, CNR Rome and University of Naples)
- Malcolm Padmore (CAST)
- Martin Owen (CER)
- Anna Trifonova (University of Barcelona)
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- Frédérique Frossard (University of Barcelona)
- Barbara Mellini (Sapienza Università di Roma)
- Alessandra Delliveneri (University of Naples)
- Javier Torrente (Complutense University of Madrid)
- Anisoara Dumitrache (University of Bucharest)

We hope that everyone interested in game-based learning applied to all education and training levels, can take advantage of these contributions and of the outcomes of the project ProActive.

Finally, we would like to thank the sponsors of both the book and the Conference, the European Commission - LifeLong Learning Programme, who co-funded the project ProActive, together with with the University of Barcelona (ES), Sapienza Università di Roma - DPPSS (IT), the Complutense University of Madrid (ES), the University of Naples Federico II (IT), CAST (UK) and the University of Bucharest (RO) as well as Spazio Europa, the public space of the European Commission's representation in Italy where the Conference takes place.

Mario Barajas (University of Barcelona, PROACTIVE coordinator)  
Alessandra Talamo (Sapienza Università di Roma)  
Orazio Miglino (Chair, CNR Rome and University of Naples)

November, 2011



# Conference Organisers

## **Alessandra Talamo (University of Rome “La Sapienza”)**

She is a social scientist and Associate Professor. She got a PhD in Experimental Pedagogy working on educational cooperation inside the school. Her research activities deal with social ergonomics applied to educational and organizational cooperation in Computer Mediated Communication and Virtual Environments. She teaches Social Psychology at the University of Rome “La Sapienza”.

## **Mario Barajas Frutos (University of Barcelona)**

He is the lead investigator of the coordinating team of ProActive. He is a Doctor in Education and professor in the Department of Didactics at the University of Barcelona. He is a co-director of the post-graduate course ‘Knowledge, Science and citizenship in the Information Society’ and he teaches in the doctoral programme ‘Diversity a Change in education’.

## **Orazio Miglino (University of Naples “Federico II”, ISTC- CNR Rome)**

He is full professor in General Psychology, head of the Natural and Artificial Cognition Laboratory (NAC lab website: [www.nac.unina.it](http://www.nac.unina.it)) at the University of Naples Federico II. His main area of research concerns Cognitive Science and Artificial Life.



# Moderators and Invited Speakers

## **Five Metaphors of Learning: Patterns, Preferences, Applications**

***Robert J. Simons***

He is director of the Netherlands School of Educational Management, where he focuses his research on learning processes of school leaders and schools. His main field of research interests are the role of ICT in learning, both in education (all levels) and in work related learning. Especially, he studies computer supported collaborative learning, communities of learners, reflection and feedback.

## **Raise your game – Getting learning games sold and used**

***Donald Clark***

He is a Director of several e-learning companies and has been producing games-based learning for over 25 years. As well as consumer games, he has produced learning games for healthcare, telcos, government, corporates, military and education. He has written, blogged and spoken extensively on the psychology of learning and games.

## **Applications of serious games in the medical domain**

***Carl R. Blesius***

Dr. Carl Robert Blesius is the Director of Knowledge and Learning Technologies at the Mass General Lab of Computer Science and leads a group of software engineers focused on this and related clinical informatics work. His group currently supports a learning and knowledge management system in use by tens of thousands of clinical and non-clinical staff across the Harvard teaching hospitals and Partners Healthcare. It serves as an integrated web-based educational portal for residents, staff and researchers. It is currently being enhanced to help unify simulation-based training and research across the clinical community of practice. The system provides course registration functionality, a large number of tools that support learning online (e.g. forums, file sharing, quizzes, weblogs, wikis, group calendaring, and more), data collection, and reporting mechanisms so that end users can be targeted with tailored information and offerings. Recent work involves integrating serious games and physical objects into the learning workflow using low-cost electronic and software prototyping platforms like Arduino and e-Adventure.

## **Serious Games: a proposal of taxonomy based on the relationship between game and simulation**

***Giada Marinensi***

She is graduated in Sciences of Communications at Sapienza University of Rome. She is researcher at CATTID (the research center for Information and Communication Technology of Sapienza University of Rome), and she coordinates the research team of LABeL, the Laboratory of CATTID specialized in e-learning methods and technologies, whose scientific director is professor Valerio Eletti. Her fields of scientific interests are e-learning and new technologies and methods in teaching/learning process such as social learning, mobile learning and digital game based learning, with special focus on simulations and serious games. Before that, she was for several years team leader at an Italian ICT company, and, as Instructional System Designer, she was responsible of the design of many e-learning projects.

## **Round table: “Do technologies change the training / teaching environments and how?”**

***Chairman: Roberto Vardisio***

Labor psychologist with a master degree in Human Resources management, he works since 1997 as consultant in the field of managerial development. He deals with vocational and managerial training, assessment and personal development, research within organizational settings. He carried out the role of project leader within consulting societies at international level (Ernst & Young), furthermore he teams up with national and foreign universities. In

January 2006 he founded Entropy-KN, a consulting company focused on managerial development and training projects based upon new technologies.

### **Round table: “GBL nowadays”**

#### ***Chairman: Martin Owen***

Martin Owen is a research fellow. He is a well-known developer, conceptualist and speaker on innovative use of ICT - particularly in Science Education. As Director of Learning at UK's Futurelab he lead development of game-like learning in Science including Size Matters, Racing Academy, Savannah, Space Signpost and Space Missions -in collaboration with national and international science, media and educational bodies. He is currently working on projects on Career Education icould and development of researchers Vitae. Recent publications and keynote presentations are on mobile and game like learning. He has experienced 30 years as an academic in teacher professional development, a Masters in Science Education and has been an Apple Distinguished Educator.

## Keynote Speeches



# Metaphors of learning and computer gaming

P. Robert-Jan Simons

A. P.R.J. Simons<sup>1</sup>

<sup>1</sup> Prof.dr. P. Robert-Jan Simons, Professor of digital learning, Centre for Learning and Teaching Utrecht University, the Netherlands, p.r.j.simons@uu.nl

In her article on two metaphors for learning and the danger of choosing just one, Anna Sfard (1998) describes the distinction between the acquisition and participation metaphors. Probably the most common view of learning is as the *acquisition* of something. Knowledge of the world is treated as the objective truth that can be transmitted from one person to another. Social-constructivism treats learning as a process of *participation* in various cultural practices and shared learning activities. The focus is on activities and not so much on outcomes or products of learning. Knowledge exists neither in a world of its own nor in individual minds but is an aspect of participation in cultural practices. Cognition and knowing are distributed among individuals and their environments, and learning is 'situated' in relations and networks of distributed activities of participation. Knowledge and knowing cannot be separated from situations where they are used or where they take place. Learning is a matter of participation in practices, enculturation or legitimate peripheral participation. Paavola, Lipponen & Hakkarainen (2002) have argued convincingly that the distinction between the acquisition and participation metaphors should be supplemented by a third metaphor: the *discovery metaphor*. Learning is understood broadly to involve knowledge advancement in general. The dynamics of knowledge creation and the pursuit of newness is a focal starting point. Individuals play important roles as instigators of innovation. There is a focus on conceptual and theoretical modeling, using symbols and externalization of tacit knowledge and theory. This theorizing and conceptualizing goes with risk-taking, uncertainty, looking for new and promising ways, etc. The focus in the knowledge creation or discovery metaphor is on deep understanding and meaning construction. The main vehicle for learning according to the fourth metaphor is *imitation and observation*, both implicitly and explicitly. It is a type of learning best described as 'on the spur of the moment', working on a highly complex issue, looking around, searching for what works, analyzing and copying it. Managers reported that they learn mainly from apparently impossible assignments, failures and disappointment, role models, conflicting norms and values, collaboration with employees, personal problems and power politics (pressure from above and below in a political environment). The fifth theoretical approach is Ericsson's deliberate practice theory, which describes how musicians, sportspeople and workers deliberately practise on a regular basis in order to reach higher levels of expertise or competence. The *exercising metaphor*, thus focuses on learning abilities with an active role for the learners, who are consciously learning in collaboration with others in order to be able to function in a learning organization. Learning is often the foreground and working the background. It is explicit learning, which focuses not on knowledge (like the acquisition metaphor) but on skills, attitudes and expertise. For learning to occur, people need guidance by experts and collaboration with others in safe environments.

On the basis of these, Ruijters (2006) distinguished five metaphors of learning: the acquisition, participation, discovery, observation-imitation and exercising metaphors. After discussing the often subtle differences between the metaphors based on our research into individual differences with professionals, they will be related to gaming. Here we will treat the metaphors as categories and patterns of learning. First we will discuss various kinds of games.

Games have the following characteristics:

- Players have to reach certain goals. Sometimes they choose goals themselves; sometimes the game determines the goals.
- There is competition with other players or a computer; sometimes players try to improve their own previous results.
- There are rules and barriers.
- There is a context that makes the game realistic or attractive and contributes to motivation. These contexts refer to a story, realistic developments/impediments, division of roles, or availability of information.

It is doubtful whether all of these characteristics are necessary before we can speak of a game. There are shifting boundaries between games, simulations and cases (Holsbrink-Engels, 1998). Sometimes simulations become games and sometimes games are based on cases, etc. This is illustrated in figure 1. For pure games, all of the above characteristics apply, whereas for mixed forms and for pure simulations and cases, one or more of the features are absent. Pure games will trigger exercising learning. Pure simulations will be closest to participation learning and pure cases are close to imitation and observation.

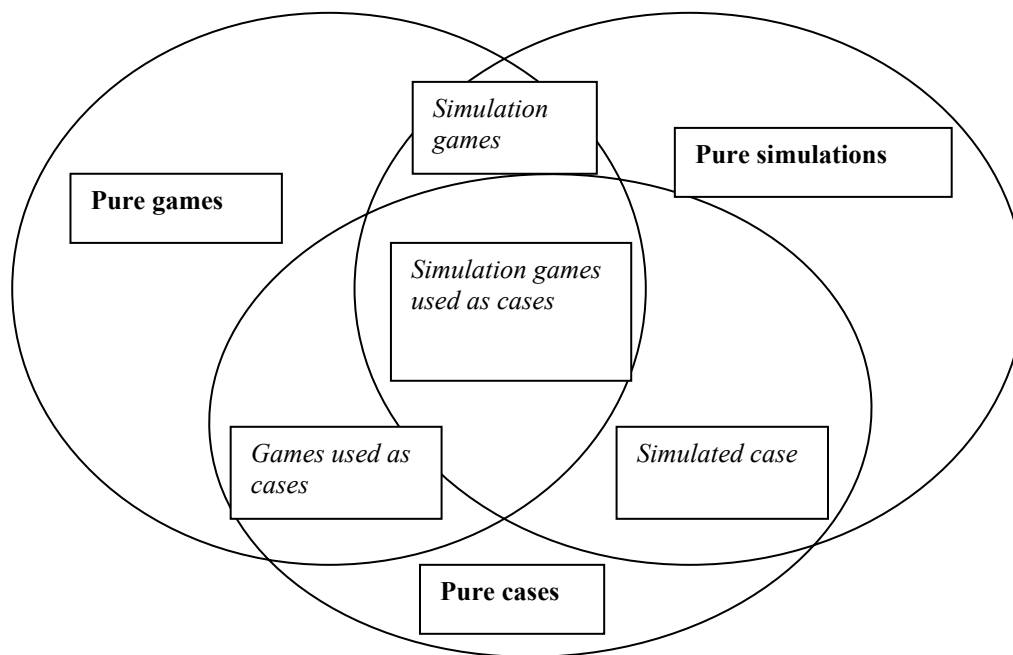


Figure 1: Kinds of games according to Holsbrink-Engels, 1998)

We can distinguish games also in another way (Simons, 2009): entertainment games, multiplayer online games, serious games and epistemic games. Furthermore, students may learn from designing games. We will give examples of each of these.

We will also relate these five categories of games to the metaphors of learning described. The results of these analyses can be summarized as follows: Entertainment games will generally trigger kinds of learning in the exercising or acquisition metaphors. Multiplayer- online games are mostly related to the participation and discovery metaphors. Serious games exist in all 5 kinds of metaphors. Epistemic games focus on participation and discovery: students are immersed in a practice and discover new knowledge about themselves (identity) and the content of the game. In designing games we mainly see the participation and discovery metaphors.

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**Keywords:** metaphors of learning, computer gaming



# Serious Games: a proposal of taxonomy based on the relationship between game and simulation

Giada Marinensi

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Serious Games have been studied for several years, nonetheless this is still an experimental field. Serious Games, in fact, have different application areas and they are used with a variety of aims, so, in order to gain a clearer view of the theme, the research group of LABeL (which is the e-learning laboratory of CATTID, the ICT Research Center of Sapienza University of Rome) carried out, over the last few years, a study whose results will be presented in this paper. To better understand and categorize Serious Games, we have considered that the concept of game could be a basilar element of definition to give a systematic order to the numerous typologies of Serious Games. There are, in fact, many researches that support the connection between gaming and learning: Jean Piaget, Jerome Bruner, John Dewey, Lev Semyonovich Vygotsky, for instance, have demonstrated how we can learn first of all thanks to the experience and how the game is a particular form of experience. The development of those theories has allowed, in recent days, the birth of the learning by doing paradigm, in which simulations are an important support to make experience. With simulations we have the possibility to create and repeat any kind of experiences, and we can widen the potentiality of experience in learning field.

But is there a structured relationship between simulations and games?

To answer this question, we will start describing the game as presented on the writings of Johan Huizinga and Roger Caillois and analyzing the ambiguous field of simulations from the lexical lecture of the subject.

After identifying the respective domains of game and simulation, we will see how these two sets, suitably intersected, give rise to a third set, that of Serious Games, defined as interactive experiences with the same characteristics of a game, different possible aims (such as business training, educational or social campaigns, and promotional activities) and the capability of reproducing real situations in which, using knowledge and acting with strategy, the user can reach a final goal.

Starting from the definitions and relationships so obtained, we will present our proposal of taxonomy of different kind of Serious Games.

Our proposal of taxonomy could be considered as a starting point to define a shared background aiming to identify what Serious Games are, and to research their best application context.

At the present time, in spite of all the studies and experiences that have already been done, even at design level, we don't have an accepted definition nor a widely shared vision able to allow the clear and unequivocal definition of Serious Games and their distinct features compared to other learning solutions.

The indistinct use of the terms Serious Game and simulation could generate further confusion and also lead to offer learning solutions not always proper to real needs and to application contexts.

Our taxonomy represents a first step toward a more concise Serious Games' classification, in order to create a widely shared starting point for further research in this field.

**Keywords:** Simulation, Game, Serious Games, Learning by doing



# Serious games: applications in the medical domain

Carl Robert Blesius, M.D.

Director of Knowledge and Learning Technologies  
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Traditionally clinical training has been based on the master-apprentice system, but medical simulation is quickly gaining wide-spread acceptance as a key component of modern day medical education. Simulations can help inexperienced trainees test and achieve proficiency. Simulators are well suited for rehearsing procedures that may be unfamiliar or infrequently performed. Simulation training augments existing training curricula rather than replacing more traditional methods. But usually the focus is on high-end 3D virtual/augmented reality simulations, high-fidelity physics-based simulations or haptics system that implies a very high development cost (e.g. medium-capability simulators cost up to \$50,000). They are new initiatives, such as the MGH Learning Laboratory, that are beginning to use simulation as a central element in the training and certification of all medical personnel.

But there are still some open issues about using simulations in the medical domain that need to be addressed, such as the high production cost, how to assess their learning efficacy or how to integrate simulations into the learning flow. Also, although the potential of Game-Based Learning is now accepted by the community, it is not clear the role that game-like simulations and serious games can play in the medical simulation world. We think that serious games will help not only to produce better low-cost educational simulations but also to provide insight into how to better formalize medical knowledge. The detailed representation of the medical knowledge needed to create a game-like simulation allows for the expert testing of the correction of the medical procedure. By playing the simulations experts can check if the procedural knowledge represented there is correct and complete or if these knowledge should be improved (e.g. tacit knowledge not represented in the procedure). Also, this allows for the introduction of new information about common errors or the representation of infrequent situations that need to be learnt by doctor trainees. However, they are not enough practical experiences or widely accepted methodologies about how to create low-cost game-like educational simulations in the medical domain. At MGH in collaboration with Complutense University we have been evaluating the possibilities offered by serious games development platforms such as <e-Adventure> (<http://e-adventure.e-ucm.es>).

Also, E-Learning systems have been proposed as a way to improve medical education in general and continuing medical education in particular. Several studies have demonstrated that this approach is effective and efficient. But one of the key elements of successful e-learning systems is the availability of high-quality e-learning materials. We consider that e-learning has a great potential for deploying and integrating highly-interactive contents (e.g. game-like simulations) into the learning flow.

In the last years, the MGH has acquired experience in the development and deployment of serious games in the medical domain. HazMat is an <e-Adventure> game-like simulation that was developed and integrated in the MGH training programme that qualifies new staff in the hospital for appropriate hazardous materials handling. This course is mandatory for all personnel that will be packing and shipping these materials. In this case the serious game is used not directly to teach but to better evaluate the procedural knowledge of the staff about the packing. HazMat has been actively integrated and deployed in the MGH open e-learning platform (called The Hub) as a highly interactive content.

In a more research oriented perspective in collaboration with Universidad de Chile and Complutense University we have created two examples of game-like simulations that can be used in neuropsychological assessment. Neuropsychological assessment in general and executive function in particular is a challenging area with many open issues such as the cost of developing and validating new evaluation tools and reproducibility of previous results. There is an increasing interest in computer-based neuropsychological assessments to simplify clinical administration and to improve the accuracy of evaluation. However, the development of computer-based simulation of naturalistic assessments for executive function continues to be a costly and complex task that usually requires specific software or hardware, hindering test sharing and reuse. Now we are researching the potential of serious game development platforms such as <e-Adventure> to develop low-cost easy to create an deploy neuropsychological assessments.

**Keywords:** medical education; game-like simulations; serious games; e-Learning; medical simulation



## Full Papers



# GBL to support Professional Distance Education

Anisoara Dumitrache, Bogdan Logofatu, Beatrice Almasan

*Abstract*— The aim of this paper is to present UNIBUC experience during the ProActive project<sup>1</sup>, activities carried out together with our target group – professional training.

The process of games design and integration in learning scenarios was supervised by UNIBUC in three pilot sites selected and is described. This paper contains also the results obtained during the implementation phase and an analysis about the impact of introducing educational games in trainers' current educational practices, in increasing creativity in teaching as well as students' reaction to this new pedagogical approach.

*Index Terms*— GBL, distance education, ICT, professional training

## I. INTRODUCTION

TEACHING AND LEARNING has become a challenge for contemporary school, and for any other education system. Technology development brings new paradigms in learning and teaching, creating new bridges between teacher and student, between the person who offers the information and the receiver of the information. It has been demonstrated that in learning process teachers/trainers have to be creative in order to maintain students' interest for the class and to facilitate learning.

Within ProActive, three pilot sites representing centers, associations, institutions that offer courses in different fields: from computer skills and advanced computer networks to personal development and outdoor education were selected to be part of implementation phase. The selection process was made according with specific criteria related to their experience in the field and institutions' interests to use Game Based Learning in their current practice.

Through Game Based Learning, trainers will improve their teaching methods, transforming classes in spaces for collaborative work, participation, problem solving. Game Based Learning will encourage students to continue their work at home and to communicate with other colleagues and trainer from the same virtual classroom.

## II. PROFESSIONAL TRAINING THROUGH DISTANCE EDUCATION

Distance education is closely related to the development of technology, especially communication technologies. Being characterized by flexibility (removal of constraints related to time and space), individuality (through tutorial, counseling and personal advice), focused on student's training needs, Distance Education can insure a faster adaptation to labor market's requests, which itself is found in a fast and permanent change.

This new form of education is based on the Internet and uses it as the main platform for distributing materials, assessments and homework to students. Different terms have been assigned to this method: e-learning, technology-advanced learning, web-based learning etc. In our modern society, ICT has led to the development of new instructional technologies, offering instruments that enable access to knowledge overcoming the space and time limitations that are inherently associated to traditional learning environments.

The use of computers and computer networks allows us to present knowledge digitally and therefore to increase the speed that information can be accessed and processed at. Communications technologies enable the accumulation, transfer and dissemination of information over great distances and different time zones.

There are several differences between face to face education and distance education: communication between students and students – teacher (which is technology mediated, and a small percent through face to face communication), study materials (structure, content, quantity and quality), way of delivering materials, tutorial meetings, students' particularities (age, background).

Applying the concepts of distance education to professional learning is meant to offer programs designed in order to respond to the labour market requests, and, in the same time, to offer flexibility to participants and these to be able to successfully combine an adequate proportion of social obligations, job and educational requirements.

These programs are developed for employees or for persons who are trying to improve their employment chances. The main mission of training programs is to answer specific educational and professional needs both at individual level

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<sup>1</sup> ProActive: Fostering Teachers Creativity through GBL is a European project (Lifelong Learning programme, KA3), Project Number: 505469-LLP-1-2009-1-ES-KA3-KA3MP

but also at community levels (local, regional, national). The fulfillment of this mission is looking at the way that individuals and society perform in an ever changing competitive environment.

Distance education has many advantages for learners, but, using distance learning system in a training program is also a risk to be assumed: for example, the drop-out rate, which is increased if we compare it with traditional learning, in which learners have the opportunity to meet colleagues, trainers much often than in distance learning. There are many studies related to this issues, even so drop-out couldn't be eradicated but only reduced.

Even if the learners have access to communication tools (both synchronous and asynchronous), to online courses and other resources, often students feel isolated in the learning system and they cannot integrate in a specific learning group, and are not able to take advantage of the flexibility offered. Trainers have, in this case an important role to maintain students' interest and to keep them motivated during the training.

### III. TRAINING AND CO-DESIGN SESSIONS

#### *A. Pilot sites*

The University of Bucharest has identified three pilot sites and end users related to Leonardo da Vinci sub program. In order to select the people who will be involved in this activity, there were discussions with the interested ones, taking into account their opinion about GBL, experience with ICT, interest and availability in introducing games in their courses. Another important aspect which should be considered was the support from their institution and training resources: laboratory with computers, Internet connection, LCD projector, technical support.

The final decision was for the following pilot sites:

1. "European Computer Driving Licence Centre" - ECDL Credis testing centre was established since 2002, as a certified testing centre for ICT competencies. It has eight years of experience in training activities for using Microsoft Office applications and certification process, having more than 1,600 students, 6,000 exams organized and 600 certificated students. The courses are addressed to a large number of persons regardless the age (the youngest student had 13 years and the oldest 57 years), profession and social status.
2. "CISCO CREDIS Academy" - CISCO CREDIS Academy has more than 10 years of experience in the IT courses being among first CISCO Academy in Romania. In the next years, the activity was continuously developed as training offer, number of trainers and through increasing the competences of trainers. In 2007 CREDIS ACADEMY won the "Best Local Academy of the Year" for the Europe & Emerging Markets regions, competing with 130 countries and more than 4000 academies from Europe, Middle Orient, Africa, Russia and Latin America.
3. "Centre of excellence - Entrepreneur CEEX" a centre established in 2009 in order to provide courses focused on Entrepreneurial Education (EE) and Outdoor Education (OE). Also, in this centre operates a department for Entrepreneurial counselling, CSA-Entrepreneur. The main target group of this centre is formed by young people who wish to start and develop their own business or are interested in personal development. 80% of the courses that are taught here are focused on acquiring business knowledge and practical skills and 20% on the outdoor education.

Each pilot site has experience in distance learning, already offering courses through this system. A very important task for distance learning is keeping the student engaged throughout the course. Students generally tend to forget having to study for their final exams and postpone everything until the last minute. In distance learning this is due to the lack of teacher - student interaction.

#### *B. Training workshop*

This session was organized in February, when, for two days participants from three pilot sites were introduced in Pro-Active's concepts, GBL and creativity, adding also technical training. The training workshop was developed around needs of participants, to acquire the necessary knowledge and skills in order to be able, after the training, to design their own educational game based scenarios. In the workshop were included objectives that help learners acquire specific skills. The two days of intensive training were designed to explore the participants' impressions, learning experiences, ways to use and develop creativity. Also, an intensive technical training for using the two platforms was included.

<e-Adventure> an educational game authoring tool. It allows for creating 2D educational computer games and simulations.

Eutopia a platform for creating, managing and delivering Online Role Playing Games (ORPG) with a set of tools that enables to play and analyze the social interactions that take place during the online sessions.

The structure of the workshop was designed for two intensive days, and agenda was established based on the final aim of the training: creation of Game Based Learning Scenarios. Also, for the training a workplan was prepared, detailing the subjects presented, discussed and analyzed during the meeting. First day of training was dedicated to the presentations and discussions on psycho-pedagogical aspects, and short presentation on the two game editors. In the second day participants were trained to use Eutopia and <e-Adventure> platforms, and to create game scenarios.

Subjects that were covered by the training:



- ✓ Game Based Learning
- ✓ The five metaphors of learning
- ✓ Creativity and flexibility in learning and teaching
- ✓ Technical training for Eutopia and <e-Adventure>
- ✓ Developing first educational scenarios using the two game editors.

A summary of participation per pilot site, participants and disciplines is provided in Table 1.

TABLE I  
PARTICIPANTS' FIELD OF STUDY

Participants	Pilot site	Disciplines/Courses
P1		
P2	Pilot site 1	Courses related to ECDL certification <sup>1</sup> , courses from Microsoft Office suite.
P3		All the trainers (participants) from this pilot site have certification for these courses.
P4		
P5	Pilot site 2	Computer network courses <sup>2</sup> (different levels, from Fundamental Levels to Associate level and Professional level),
P6		Other courses: Adobe Photoshop, Operating Systems, Microsoft.
P7		
P8	Pilot site 3	Courses focused on Entrepreneurial Education <sup>3</sup> (EE), Outdoor Education <sup>4</sup> (OE), and
P9		Personal development.
P10		

Participants field of expertise.

1. ECDL curricula:

- MS Word,
- MS Power Point,
- MS Access,
- MS Excel,
- Internet Explorer,
- Concepts of Information and Communication Technology (ICT),
- Using the Computer and Managing Files.

2. CISCO curricula:

- IT Essentials: PC Hardware and Software – Fundamentals
- IT Essentials: PC Hardware and Software – Advanced
- Cisco Certified Network Associate Discovery
- Cisco Certified Network Professional

3. Entrepreneurial education:

- Starting a business
- Business communication
- Operation and management
- Finance
- Marketing
- ICT management in business
- Growing a business
- Entrepreneurial mindset
- Business plan
- Project management
- Customer management

4. Outdoor education

- Train the trainers for outdoor activities

At the end of the training sessions, there were already planned actions meant to be the base of the future creation of games and integration in innovative Game Based Learning Scenarios.

Until June, the pilot sites were monitored and continuous support (technical, pedagogical and motivational) was provided.

### C. Co-design and support

UNIBUC has been supervised the whole process, organizing the work, establishing way of communication, face to face meetings (short, concise, and frequent) in which game designers presented their creation.

The process of creating games was very productive and full of unexpected events. The ProActive project offered to our participants (trainers) new opportunities, questions and answers. The opportunity was to improve creativity for them as practitioners, but also to bring something new and innovative in their classes, to work with powerful tools for creating games and also a chance to meet people sharing same vision and same preoccupation for their students.

For some of them, that was the moment where an analysis of their activity has become necessary: How are my students? How is my lesson seen by the students? Is there enough interactivity and interaction in my classes? What can

I do to keep them to be motivated? What motivates them? What is the mean of creating games? How can I integrate a game in my class? Is the game appropriate for my groups? These were only few questions which the project has triggered.

But also for UNIBUC it has been a new experience and we had also questions, answers, plans related to the participants. Trainers are usually busy people and each problem encountered required an immediate solution. In previous phase (training session), the interest for this new approach was very high. People were enthusiastic, optimist and confident. In this moment they are not able to perceive the obstacles during the design process. They had clear ideas about “what” but they were pretty unclear about “how”. Motivation was a key factor in the success of this activity.

In their experience as trainers they are using new technologies (computers, multimedia files, technical equipments, Internet connection) to transmit information, encourage students to participate in teaching and learning, explore and practice, and to exercise in order to validate known results. We had participants that are using, in their current practice games or free game platforms. The main disadvantage in this case is that the game does not fit all the time in the curricula.

Creativity, for example, as one trainer stated is “to offer tools to students for make them able to find answers, facts and results. In teaching, you should be flexible enough to add new learning resources but also to learn how to use them”, but every time close enough to students to know their needs and learning habits.

Working together with each pilot site helped in establishing a partnership between pilot sites and the coordinator of the pilot sites. In this partnership they brought learning experiences/techniques, information about learners and plans for introducing games. We offered pedagogical concepts, information about game editors.

#### D. Game Based Learning scenarios

At the end of the design process, the results arrived demonstrating the interest for this new teaching method. The entire team worked for successful games integrated in learning scenarios.

There were nine educational games created, using the two game editors (EUTOPIA and <e-Adventure>) to be used in professional training, games created by each trainer to support learning objectives:

1. “Buying a computer” a point and click game in which the player has to assemble a computer with all the components so that it becomes functional (Fig.1);
2. “Installing computers” – here, the player is an employee at a company which provides IT service, on probation period. He has to go to a client to install a computer, and he is supervised by his boss.
3. “First step with Photoshop” – is a trip in Photoshop world, in which player will be familiarized with Photoshop environment. Interaction is point and click. He is permanently assisted by the characters – specialists in Photoshop.
4. “Photoshop – photo editing” – in which players will learn how to use Photoshop, to create/edit new pictures.
5. “Diagnosing an Internet connectivity problem” or “Connectivity troubleshooting” - the player is a network administrator, and it has to identify and solve a connectivity problem
6. “Board meeting” – a role playing game, in which the players are employees in a big company and they have to elaborate and decide a strategy for further development of the company.
7. “Binary conversion”- players are connected into a session, in groups of 8 persons. Each student is a “byte”.
8. “Job interview” – a job interview simulation, where, three candidates (players) are competing for the same job.
9. “Surviving in the desert” - role play game, each participant will assume the role of shipwrecked, fighting for his life.

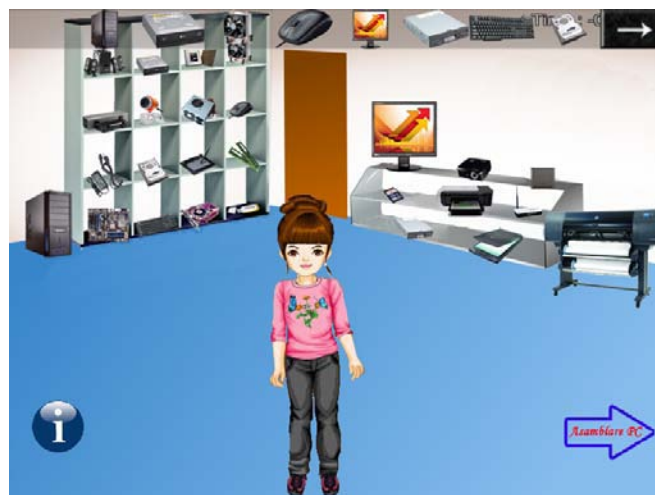


Fig. 1. Screen shot of “Buying a computer” game. The costumer (player) already bought few computer components and stored in the inventory. Now he is prepared to enter in the assemble room.

Each game has been included in learning scenarios to be used by trainers in their courses. These scenarios are meant to be applied in face to face meeting but also in online sessions.

The games were reviewed by each trainer during the design sessions, in order to respond to quality criteria related to: learning, gaming and technical aspects. Starting with game adaptation to students' profile, with objectives, players' immersion during the game, and finishing with graphical aspects, everything was analyzed and evaluated by trainers and external evaluators.

#### IV. IMPLEMENTATION IN REAL SETTINGS - RESULTS

Implementation in real learning scenario was the most difficult part from this process. The games were to be played by the students, which are very demanding. The end users are adults, enrolled in different training programs developed by our pilot sites.

##### A. Settings

For integrating GBL scenarios in real settings must be taken into account specific peculiarities of the groups: age (a wide average age from 16 – 18 to 50 years old); background (previous experience in the field), expectation about the course (adults are more demanding with the information received and are focused on objectives), and number of learners (usually a group of 20 – 25 students). Students tend to analyze in detail each element of the game, practical aspects, level of interactivity, time for accomplishing objectives and disapprove any malfunction of the system. For a high and positive impact the game should work perfect, without any interruption or system crashes. The students are excited to replay the game at home, with the stated aim of achieving better results (no mistakes, best time, best score).

##### B. Learning scenarios and games implemented in real settings

Most of the GBL scenarios have been implemented in training sessions, and the students had the opportunity to test the game. Some of these actions had as result new releases for the games or changes in learning scenarios.

One learning scenario which has been tested on many groups is "Buying a computer". One training group cannot have more than 20-25 students. This game had been accessed by more than 150 students, and among these, more than 80 players have accessed the game online.

This learning scenario was integrated in a course students enrolled in ECDL certification (Module 1 - Concepts of Information and Communication Technology (ICT)). The Module 1 contains 4 or 5 courses. This module enables candidates to gain an understanding of the different parts of a computer, as well as some of the key concepts of Information and Communication Technology (ICT), such as those relating to networks and security.

Usually, the courses consist in transmitting theoretical information to the students which are in a position of passive receivers. The students are writing down all information and memorize it. For individual study, students have access to one online course.

The game designer wanted to bring interactivity in class, which was not possible with the current curricula full of theoretical information. He was aware that his course could become boring, or with too much theory, being hard to keep students' attention for a long time.

Following the learning scenario, the game has been presented to students: how to work with the interface, what are the rule, the scope and the objectives. He recommends the students to pay attention at the resources and the interface (interaction with objects). The game was available online (on Moodle platform) and also, as a backup solution, stored in students' computers. During the game play, the trainer observed students' reaction and attitudes to game and to obtained results.

##### C. Questionnaire and results

In order to evaluate the impact of the learning scenario and the game on end users (students) a research has been conducted for each group included in this experiment. The research methodology contained: trainers' observation on the group, interview with students and questionnaire in order to collect their impressions immediately after the session.

After the game, students were invited to fill in an online questionnaire (<http://activare.credis.ro/moodle>) containing 10 questions, for a quantitative research. In this questionnaire were included open questions, but also multiple choice questions related to the game aspects, learning scenario and to this new experience. Also, the participants' age was required.

In this research we had 86 participants and in the following paragraphs the students' answers are quantified.

A first question (Q1) is presenting *participants' distribution by age group* (Fig. 2). Most of the students (30.59%) are between 30-34 years old. Still we had three participants (3.53%) over 50 years old.

In second question, the students were invited to characterize this experience.

Q2: *How would you characterize this learning experience?* They could choose between four options. Most of the respondents evaluate the learning session as "Fruitful – learning without realizing that you do it" (64.3%),

“Stimulating” (35.6 %) and only 1 user (1.1%) considered this lesson boring. No one checked the fourth option: “Waste of time”. Even for older people this was not

Q3: *Please describe this experience using three words.* This question has been an open question, letting students to write their opinion regarding the learning experience. Not all the answers contained exactly three words, but the balance was ensured through the answers containing more than three words. At this question, more often the following key words (or similar words) were: attractive, interesting, useful, efficient, exciting, stimulating, educational, very creative, entertaining, challenging, encouraging, relaxing, new, and motivating.

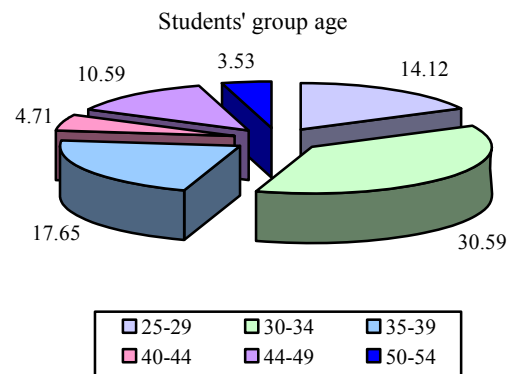


Fig. 2. Students' distribution by age group (in percentages).

In the Figure 3 the key words are graphically represented depending on the frequency in students' answers. There were also identified another 22 words, which were considered not relevant for the purpose of the question so, were not included in this graphic.

Q4. *Is this game appropriate for this lesson?* 54% consider the games appropriate responding to the learning objectives. 37% appreciated the game is appropriate and offers them the opportunity to apply the theoretical information gained during the course and 5% appreciated that the game was not appropriate. 4% of the students did not answer on this question.

Q5. *In your opinion, why is this lesson different?* Most of the answers were concentrate on the introducing the game, seeing it as a central piece of this activity: “Because of introducing the game” Other students indicated: the fast feedback received, practical activity, lesson's diversity, or “the lesson was more animated, and the environment friendlier”, “for the self evaluation”, “I learned and I had fun”, “I was much focused”.

Next questions are related to the game, especially graphical interface, challenge, and technical issues.

Q6. *Has this game a friendly and easy to use interface?* The possible answers were Yes and No. 89% of students have a positive appreciation on the game, instead of negative appreciation (11%)

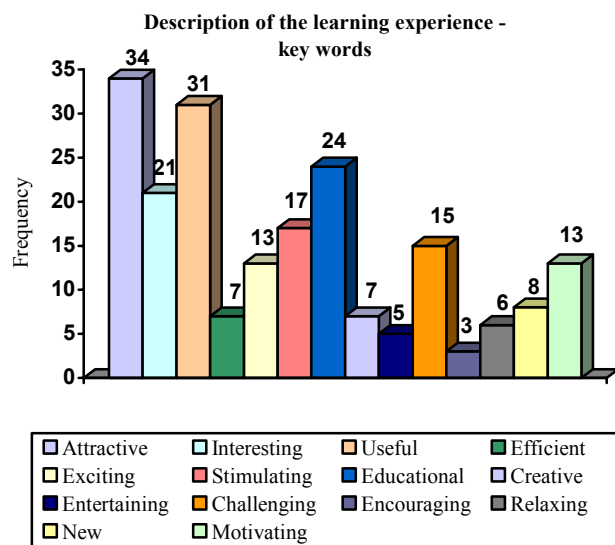


Fig. 3. Most frequent words used by students to describe Game Based Learning experience.

The improvement suggestions (Q7.) offered by the students are related especially to game complexity (adding new elements to increase the challenge level - for example an amount of money to purchase the hardware components, keeping also the time limit, connecting cables, or improving the reward system offering as a prize a virtual computer). There are also comments about the character or the game environment.

Q8. *Did you enjoy the experience?*

Q9. *Would you like to attend to similar experiences?*

These two questions had an overwhelming majority of Yes answers. (Q6. 99% - "Yes", Q7. 89% "Yes"), which confirm the importance of this didactical approach and positive impact on the students.

Q10. *Do you feel the need to repeat the game for practicing even in your free time (home)?*

97% of the respondents indicated that they will repeat the game even if in their free time or at home.

This question was very important keeping in mind the fact that in distance education, individual study is crucial. Students are receiving training materials, online courses, and a study plan. There are also face to face meeting (with a much lower frequency than traditional learning) in which practical aspects are covered, and permanent access to laboratories for technical trainings.

In distance learning students usually spent time to learn from their home. They can use these games in order to practice, play and replay games until they learn or discover how to solve different problems. Using games creates a pleasant environment for learning, making learning more fun and more engaging.

Except students' answers, other evaluation tools used in phase, can offer more answers to the question "Are the game useful?" or "What good are games for?" Of course, this research is only a piece from a puzzle which is taking shape more and more.

## V.CONCLUSION

The feedback received from our students was validating the research conducted during the project, and for game designers a signal that they are on the right way. These games are not replacing theoretical concepts related to the taught subject, but are a solid base for applying them in a virtual environment. Also can be successfully used in self evaluation, which is very important in individual study.

Games offer flexible environment to test and re-test hypothesis, increasing motivation for learning, opportunity to explore new environments using the experiences in real life.

It is very important to differentiate games as source of fun from games as source of learning. Taking into account that in distance learning most of the students are adult, usually the word "game" is replaced with the term "application", "exercise" or "simulation".

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# GBL Design for Enhancing Creativity in the Classroom

F. Frossard, M. Barajas, S. Alcaraz-Domínguez, A. Trifonova and J. Quintana

**Abstract**—This paper presents a study in which a GBL design approach is used to promote creative teaching methodologies. In the context of the ProActive project, 21 Spanish primary and secondary school teachers designed their own educational games, especially tailored to their specific educational contexts, and put them into practice. First results enabled to explore and evaluate creativity at different stages, namely the process of GBL design, the product, i.e. a GBL scenario, and the game-based teaching and learning processes.

**Index Terms**—Game-Based Learning, Creativity.

## I. INTRODUCTION

Creativity has been seen, during the last part of the 20th century and early 21st, to be increasingly significant as a skill to be covered in formal education [1]. Indeed, several authors [2], [3] suggest that creativity should be explicitly included as an educational objective. Nevertheless, creativity still does not seem to play a central role in the curriculum and learning objectives that teachers are asked to follow in European countries [4]. Our work aims towards promoting creative teaching and learning in the classroom.

Recent literature makes a distinction between teaching creatively and teaching for creativity [5]. The former refers to teachers using imaginative approaches to make learning more interesting, exciting and effective, which has a direct impact on the latter, as students' creative abilities are most likely to be developed when the teacher's creative abilities are engaged.

Creative teaching might be achieved through the use of various imaginative approaches. One of them is Game-Based Learning (GBL). Nowadays, GBL catches the attention of educators at all levels. The Horizon Report [6] states that the “*greatest potential of games for learning lies in their ability to foster collaboration, problem-solving, and procedural thinking*” (p.5). Literature also shows that games have qualities that can facilitate student learning, such as providing challenging experiences that promote intrinsic satisfaction and offer opportunities for authentic learning [7], [8]. Furthermore, they have proven to increase personal fulfillment and to lead to higher performance (Blunt, 2007). They also support “learning by doing” processes [9], and meaningful learning experiences. In this light, GBL is considered as a powerful teaching method, which can promote creative teaching practices that make learning experience engaging for learners, and improve learning achievements while matching the curricular objectives.

However, some barriers to the implementation of GBL in formal learning settings by using commercial off-the-shelf games have been identified [10], such as the lack of integration of most games with the current curriculum and assessment framework, and teachers and parents concerns over the content of some games. In this context, games created by educators may be easier to integrate in the official curricula. Easy-to-use and game editors allow for not only professionals, but also teachers to design educational games.

In this context, the ProActive<sup>2</sup> project aims to engage teachers in a creative process through which they create a plan and the materials for a GBL session that they can carry out in their classrooms. ProActive project allowed practitioners at various educational levels to become game designers by developing GBL scenarios for themselves that have direct relevance to their teaching practices. GBL scenarios for themselves that have direct relevance to their teaching practices. They used two game editors for designing their learning games: <e-Adventure>, an open source software for creating adaptable 2D point-and-click adventure games for educational applications; and EUTOPIA, a free of charge tool for designing multiplayer educational scenarios in a 3D environment. The GBL scenarios were tested in real settings with students involved in hands on sessions.

The present paper reports the results of the study conducted in Spanish primary and secondary schools. In section II, the ProActive approach towards GBL and creativity is presented. Section III describes the activities carried out with teachers and students. Finally, data collection procedures are explained and first results are exposed.

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<sup>2</sup> ProActive: Fostering Teachers Creativity through GBL is a European project (Lifelong Learning programme, KA3), Project Number: 505469-LLP-1-2009-1-ES-KA3-KA3MP

## II. THE PROACTIVE APPROACH TO GBL AND CREATIVITY

In this study, GBL design is carried out as a circular process with three stages, as shown in Figure 1. During the creative GBL design stage, teachers design an educational game (stage 1 on the figure). They also plan a learning scenario, which is a more comprehensive unit that considers the context of use of the game. The scenario includes, among other things, the characteristics of the learning audience, the learning objectives, the evaluation approach, and the time-space resources. As a result of the design process, teachers obtain a GBL scenario (see figure 1, stage 2). Then, teachers put into practice the scenario and students experienced it (see figure 1, stage 3). The GBL design process can start again when teachers redesign their GBL scenarios according to feedback from students and the experience.

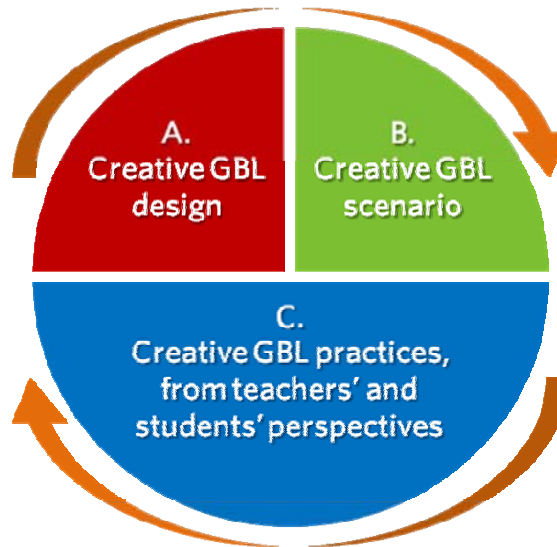


Fig. 1. The creative circle of GBL

The following sub-sections provide a short discussion around each of the stages of creativity described above, in order to establish the theoretical framework of the study.

### A. A comparison of models of the creative process

Different authors describe the creative process as an iterative sequence of steps or stages [11], [12], [13]. Models vary according to the number and characteristics of stages. A comprehensive review of these models can be found in [14]. By examining 19 different models, the authors make three groupings which represent the major phases of a creative process:

- **Analysis:** This phase consists of defining and setting the problem to develop an understanding of what is required in order to generate an acceptable solution. The individual becomes familiar with the content area by building or recalling relevant domain knowledge, and learning from previous works stored in libraries, on the web, etc. Task motivation has to be high, so the individual has sufficient interest to pursue solving the problem.
- **Generation:** This is the creative phase of the process, during which the individual searches through available pathways, exploring features of the environment that are relevant to the task at hand, in order to generate adapted ideas and responses.
- **Evaluation:** The novel ideas and solutions produced during *generation* are tested, evaluated and verified regarding their appropriateness and value.

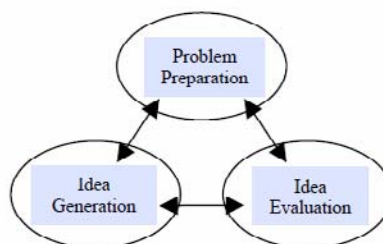


Fig. 2. Generic Creative Process model (source: [15])<sup>3</sup>

<sup>3</sup> Problem preparation refers to the analysis phase.



Figure 2 illustrates the different phases that are common to the different creative process models.

In this study, we engage teachers in a creative process of GBL design which involves the three phases. In section V-A of this article, we report our first results of the analysis on the creative process.

### **B. The creative product: effective novelty**

According to Cropley [16], creativity is seen as a property of products, which might be a tangible (e.g. documents, works of art, etc.) or intangible (e.g. ideas, strategies, systems) result of the creative process. According to Amabile [17], “*a product of response will be judged as creative to the extent that it is both a novel and appropriate, useful, correct, or valuable response to the task at hand*”. Furthermore, Plucker and Beghetto [18] describe the creative outcome as “*a perceptible product that is both novel and useful as defined within a social context*”. Based on these and on other studies, Villalba [19] concludes that there is a commonly accepted view of creativity involving the creation of something new and useful. In educational context, NACCCE [20] defines the creative outcome as being original with value that is related to the purpose of the product.

Based on this, our study considers a learning artifact (i.e. the GBL scenario and playable game) to be creative when new and appropriate to the teaching contexts at stake.

In order to define appropriateness of GBL, a review of successful serious games has been performed<sup>4</sup>, which enabled to define a set of key features of good educational games. These features have been grouped into three dimensions, namely gaming, learning and technical aspects. Gaming aspects include goals, rules, challenge, feedback, immersion, adaptability, replayability, good competition and entertainment. Learning aspects include educational objectives, students’ profiles, earning resources, evaluation methodology, comprehensive learning scenario, progressive acquisition of knowledge, personalized learning process, autonomy, and motivation. Finally, technical aspects include usability, graphics and reusability in different contexts.

Results from the analysis of the products, i.e. GBL scenarios are provided in section V-B.

### **C. Creative teaching and learning**

As seen in previous work, teaching creatively occurs “*when a teacher combines existing knowledge in some novel form to get useful results in terms of facilitating student learning*” [21]. Furthermore, Sawyer [22] provides a list of behaviors in order to give advice for creative teaching. We highlight those that are relevant to a GBL session carried out in the context of a classroom. Trust and safety refer to maintaining a psychologically safe classroom environment. Problem finding consists of encouraging questions and different responses. Encouraging surprise, humor, risk taking and allowing mistakes are also recommended. Finally, an inclusive approach must be adopted, where students and teachers collaborate to identify problems and issues.

In our study we look at the implementation of the GBL scenarios in the classroom focusing on these behaviors associated with creative teaching (see sub-section V-C). The goal is to see how the GBL sessions using the games developed by teachers support creative teaching and impact on learning.

## **III. CONTEXT**

The ProActive project started in January, 2010. It involves six partners from four EU countries and covers various educational levels, school education, university level and vocational training. This article concentrates on the pilot implementation carried out in Spanish primary and secondary schools by the University of Barcelona.

As a first step, a preliminary study was conducted in order to explore teachers’ attitude, interests and needs towards GBL and creativity. To do so, two focus groups were organized by the University of Barcelona research team with 15 teachers from Spanish primary and secondary schools.

On the basis of the focus group results, a training program was designed according to blended learning methodologies, including face-to-face and virtual training. Twenty-one teachers from seven primary and secondary schools have been introduced to the ProActive approach and have learnt how to use the game editors. None of the teachers had previous experience with GBL.

Afterwards, an ongoing collaboration process took place during three months, in which the UB research team provided support to the participating teachers in the GBL design process. Support was given through regular meetings (co-design sessions) and online (Moodle, e-mails, etc.), and was related to pedagogical aspects (definition of learning objectives), game design strategies (writing of game storyboards, definition of game dynamics and mechanisms) and technical guidance (help on the usage of the game editors).

<sup>4</sup> The complete literature review is part of an internal deliverable (ProActive D3.1 - Success factors for GBL) which can be provided upon request.

In total, 13 GBL scenarios have been created by teachers, covering a wide range of learning subjects (e.g. History, Physics, and Language Learning) and addressing different educational levels within primary and secondary education.



Fig. 2. Screenshots of games created by teachers on History (left) and soft skills (right)

Pilot implementation was organized in two sites near La Coruña, a city in the North-West of Spain. During two classroom sessions (one in a primary and another in a secondary school) four games were tested in secondary school level, and one in primary education. In total, four teachers and 47 students were involved. One teacher performed a pilot implementation with 25 students of fifth year of primary school, age 10 and 11 years old. Three other teachers did so with a group of 21 students from first year of post-compulsory secondary school, age 16.

All sessions had similar settings. Each student had a laptop on which s/he played the game. Each game session lasted between 10 and 15 minutes.



Fig. 3. Pilot implementation of the GBL sessions in primary school (left) and secondary school (right)

This pilot implementation served as testing the created games and allowed the UB researchers to perform first observations in the classroom. A second, larger scale implementation cycle is ongoing. Final evaluation results are expected by the 2012.

#### IV. DATA COLLECTION AND PROCEDURES

This section describes the data collection methodology adopted for studying the creativity at different levels: a) the process of the GBL design, b) the GBL scenario created, and c) the game-based teaching and learning processes.

In order to explore creativity in depth, a set of data collection tools was designed and are being used at different stages.

To evaluate the creative process (i.e. stage 1, see figure 1), an open ended questionnaire was designed, aiming to explore the characteristics of teachers' GBL design within the creative stages identified in the literature. The questionnaire had been validated by recognised experts in the field. It was filled-in by 16 teachers after the GBL design process.

Regarding the creative product (stage 2 on fig. 2), a questionnaire was designed, aiming to assess the appropriateness of the designed GBL scenarios according to three dimensions: gaming, learning and technical aspects. It was given to independent GBL experts who evaluated the games and their scenarios. Three GBL scenarios have been analyzed at this stage. Furthermore, in order to evaluate the novelty of the creative products, teachers who developed the games were asked if they perceived the GBL scenarios as innovative.

Finally, to evaluate the creativity of the teaching/learning processes (stage 3 on Fig.1), in-depth interviews were conducted with teachers and students that participated in the field implementation of the GBL scenarios. In addition, observations were performed in order to examine their behaviours during the GBL sessions, i.e. two researchers gathered data through participant observation. The most relevant findings are presented below.

#### V. RESULTS

This section explores creativity in the three evaluation levels, as described previously: a) the GBL design process, b) the GBL scenario, including the game and the scenario, and c) the teaching and learning processes.

### A. The creative process of GBL design

The results of the questionnaire regarding the creative process of GBL design by teachers (stage 1 of Fig. 1) are summed up below.

#### 1) Analysis

During the analysis stage, teachers engaged in the process of GBL design. Furthermore, they prepared for the task by acquiring different types of knowledge and skills. Results showed that teachers considered different activities as useful.

- *Definition of the task*: Teachers defined their specific teaching objectives (i.e. students' profiles, concepts to be taught, etc.) and became aware of the resources available, i.e. time, material, etc. Some of them decided to work collaboratively and established work groups.

- *Exploration of the game editors*: This activity started during the training workshops, in which teachers were introduced to the affordances offered by each editor, and continued after the training.

- *Consulting examples of others*: For 13 out of 16 teachers, examples of similar works provided a clear vision of the editors' functionalities and possibilities, as well as an idea of what was possible to create.

#### 2) Generation

On the basis of the analytical phase of definition and preparation, teachers generated ideas and responses to create their GBL scenarios through several design activities. Results of the questionnaires elicited the following characteristics for each activity.

- *Conceptualization*: Teachers generated ideas of GBL scenarios according to different factors. First, exploring the affordances of the game editors determined and conditioned their ideas. Second, consulting examples of GBL scenarios created by others helped them to generate ideas and to decide on which editor to choose. It was mentioned that examples helped teachers understanding what they wanted, and more importantly what they did not want to develop. Teachers who worked collaboratively stated that sharing opinions enhanced the generation of ideas. Finally, in most cases, ideas were determined by external constraints, such as the time they could dedicate to the design process and the editors' limitations.

- *Prototyping*: 14 of 16 teachers felt more confident writing a storyboard for their game, than working directly with the editors. Indeed, answers showed that it enabled them to effectively expand their ideas into the plan of a full consistent game by planning details about the game dynamics, the forms of gameplay, the content of scenes, and the progression of the narrative.

- *Implementation with the editors*: Teachers' ideas were turned into a working game, within a process of development which was done through the functionalities offered by the editors.

#### 3) Evaluation

Teachers' ideas, GBL scenarios and games were continuously evaluated and adjusted by teachers through an iterative process.

- *Peer review*: Teachers often involved peers or experts in the evaluation at different moments of the design process. Furthermore, in some cases, teachers involved their students in order to evaluate the adequacy of their games for the targeted audience.

- *Testing and redesign*: The work with the editors was interwoven with cycles of testing and redesign. Problems or gaps sometimes became apparent, prompting revision. Continuous adjustments of the game elements were necessary before the achievement of a working game.

In some cases, the initial idea was kept and adjusted along the process. On the other hand, 11 teachers out of 16 adapted their game ideas and objectives all along the design process according to two different criteria, feasibility and appropriateness. The former refers to time constraints and editors' affordances. In a teacher's words, "*I had to discard my first idea because the editor did not enable me to easily develop it*". The latter looks at the value of the GBL scenarios regarding the teaching objectives. In a teacher words, "*my classes and my students were the context in which I always thought to review my game*".

### B. The creative product, i.e. the GBL scenario created

Following the definition given in section I:B, to evaluate the creativity of the GBL scenarios created by teachers, two aspects were analysed, i.e. novelty and appropriateness.

#### 1) Perceived novelty

15 out of 16 teachers considered their GBL scenarios as innovative. Some argued that the created resources are different from the ones existing on the educational market, which are normally used in similar contexts. Others

compared them against their usual teaching practices. In a teacher's words, "*the GBL scenario is innovative in comparison to what I saw before, and to what students usually do with the computer*".

## 2) Appropriateness

Evaluation on appropriateness of the GBL scenarios and games to their contexts of use was performed for the three dimensions mentioned in section II:B, i.e. gaming, learning and technical aspects.

Results suggested that gaming aspects are appropriate. Within those, goals, objectives and rules obtained the most positive results. Generally, it was clear what the player has to accomplish and how in order to complete the game. In contrast, feedback was well considered to a certain extent. Most games allow the player to perceive the impact and consequences of his / her actions on the game world. However, all experts believe that it can be enhanced. As an example, one expert stated that "*the impact of incorrect answers is not clear*" and another noted that "*sometimes, characters make actions without feedback*".

Other items within the gaming aspects dimension obtained lower scores, such as challenge, immersion, adaptability, replayability, promotion of "good" competition, and entertainment. As an example, replayability can be improved in the games and scenarios that were evaluated. Indeed, one expert stated that the game evaluated is not replayable, as the narrative has only one path.

Overall, learning aspects were more positively evaluated than gaming ones. Learning aspects include the educational objectives, the resources provided to progress through the game, and the evaluation methodology. In general, experts considered that the learning objectives in the games can be achieved "*easily*" and "*satisfactorily*". In addition, games include sufficient resources to successfully achieve the learning goals. In contrast, experts considered that the evaluation methodology should be given more importance.

As for the technical aspects, usability concerns regarding the use of icons and frequent interactions have been expressed. For instance, one observed that "*there is no explicit indication that the right button of the mouse must be used to talk to a character*". Another evaluator suggested enhancing usability with "*tutorials, menus and showing how to play correctly*". Graphics and the possibility to use the game in different contexts have been considered average.

## C. Game-based teaching and learning processes

Data collected provided insight regarding creative teaching and learning as defined in the framework of the project.

The GBL sessions seem to have been effective considering the educational goals set by teachers in their scenarios, as it was revealed during interviews with students: *I learnt how to use the right tools for repairing the bicycle, I learnt new words in Galician, I learnt the names of the trees' leaves*.

Moreover, both teachers and students believe that the learning outcomes of the GBL activity have been achieved more effectively than with the methods they usually use. Indeed, the game activity was considered more motivating. As one teacher puts it, "*it was more fun for the students to learn with the game, as it was engaging and the contents will stay in their minds*". About their own learning, students report: "*I have the impression that I am more attentive with the game. The information is easier to remember with the game*". In addition, several students stated that games enabled them to "*learn without realizing it*".

Some events in the sessions can be related to the creative behaviors as recommended by Sawyer [22]. Generally, teachers worked to maintain a psychologically safe class environment. They spent most of the game session walking around the classroom checking whether students are finding their way through the GBL activity. In this context, a high level of autonomy for learning was achieved.

Educators encouraged questions and different responses when they gave feedback to students within the game session. As an example, one teacher stimulated students by asking "*What do you think this image represents?*" When necessary, educators played the game on the student's computer. Teachers appeared confident in their role as facilitators during the sessions.

Teachers included humorous elements in the games they had created such as characters that made jokes. In the GBL sessions, most students participated of them by smiling, laughing or sharing them with their peers. Students between 10 and 11 years old especially enjoyed the humorous elements.

Situations of collaboration among students and teachers were observed, in which they identified and solved technical problems together. Furthermore, collaboration among students was also frequent during all GBL sessions. When a student did not know what to do within the game, he/she usually looked at another student's. Sometimes, learners engaged in short discussions, to arrive at an agreement before deciding what to do. Alternatively, students gave the right answers to the others or played the game of a partner.

## VI. CONCLUSIONS

This paper presented an innovative pedagogical approach in which teachers designed and implemented their own GBL scenarios. Initial results enabled to explore creativity at different levels, i.e. the GBL design process, the GBL scenario and the teaching and learning processes at stake.

Different factors appeared as critical during the GBL design process. First, collaboration positively impacted on this process. Indeed, sharing opinions among teachers enhanced the processes of generation and evaluation of ideas. Furthermore, the involvement of students in the evaluation process enabled teachers to validate the adequacy of their games for the targeted audience. Thus, collaboration acted in the form of inspiration and feedback. Second, time conditioned the GBL design process, as teachers had to adapt (or in some cases discard) their ideas and strategies according to the time available. Finally, game editors' affordances appeared to have two roles in the design process. On one hand, they acted as mediators, by shaping the game dynamics and profiling its mechanisms, as well as facilitating the production of ideas. On the other hand, they acted as constraints, since scenarios are conditioned by the characteristics of the software.

The GBL scenarios and games were considered as innovative by their authors. Through an expert evaluation, these creative products have proven to be appropriate mostly regarding learning aspects. However, gaming and technical aspects are still away from the standards of commercial games as design contexts (budget, time, teachers' experience in games, etc.) are not equal.

Regarding teaching and learning processes, the GBL activities have been reported by teachers and students as effective in terms of learning outcomes. They have also supported creative behaviors, such as providing an open educational environment in which questions and humor are encouraged and that supports student-teacher collaboration.

The next steps of the study will consist in a wider implementation in educational settings, which will enable to complement these preliminary results, and to arrive to a comprehensive model of creative GBL, which could be applied to various educational context and sectors.

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# Game Guru: Using a Narrative Videogame to Learn About Narratives and Videogames

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*Abstract*—Innovation in Computer Game Education often focuses in new approaches to teach Programming, 3D Graphics or Digital Art. However, other aspects such as specific techniques on Game Design or practical issues on Videogame Production do not receive as much focus. It is usually assumed that students will “eventually” get to know these aspects, so instructors and students devote less time to this knowledge. In order to provide students with a richer and deeper background on these topics without sacrificing instruction time, we have developed Game Guru, an educational adventure game that exposes aspiring game developers to the inner workings of the videogame business, while serving as a testbed for exploring the fundamentals of interactive narrative design. The game is created as a complement to the regular instruction in the ongoing Master Degree in Game Development currently offered at Complutense University of Madrid. Game Guru is a story-driven game, developed with an intuitive and open authoring platform: resources are provided to the students not only for playing but also for developing (modifying its content), offering a multiple-purpose experience that is a counterpoint to the technology-intensive aspects of the course.

*Index Terms*— Adventure Game, Authoring Environment, Game Production, Game Design, Game Development Toolkit.

## I. INTRODUCTION

The videogame development industry has grown into one of the most demanding and competitive fields in terms of the talent required to outstand as a professional of the area. This has lead to an increasing demand of instruction programs. These programs, in turn, are becoming more focused on the technological aspects, incrementing the chances that the students have to compete for a job position in the industry.

While this is desirable and serves to a very specific market demand, it also distracts from other aspects that are also relevant. One of these often overlooked aspects is the art of storytelling. The design of a good story was a key feature in some of the most classic videogames (e.g. point & click adventure games), although nowadays free-form playability, or even eye-candy and marketing have become predominant in many cases.

Surprisingly, another topic that is barely covered in game education programs is the understanding of the inner workings of the videogame industry. Regardless of whether the students will enter the industry hired by an established studio or will create their own independent company, future game developers will eventually need to learn and understand how the extremely hard and competitive business of videogames really works if they aim to succeed. This topic has not been traditionally covered neither in basic computer education nor in specific videogames design education.

In an attempt to deal with both limitations, we have developed Game Guru as a complement to the technology-intensive instruction received by the students enrolled in the Master Degree on Game Development currently offered by Complutense University of Madrid since 2004 [1].

Game Guru is a point & click adventure game developed with <e-Adventure>, a programming-free authoring platform for educational games. The story and its puzzles were created for exposing the students to typical situations of the videogame developer profession through a series of scenarios, including “How to get a job in the industry”, “Working as a member of a game development studio”, “Establishing a working relationship with the publisher” and so on. But the game serves for a dual purpose: it does not only illustrate the full production cycle of a videogame, but also promotes that students think about the importance of storytelling in games. The students are invited to modify the game as well as to play it, and for this purpose they can use <e-Adventure>, a tool more focused on narrative and pedagogical design than in programming.

In this paper we detail the shortcomings of using this game to teach both Interactive Storytelling and Game Production. The article is structured as follows. In Section 2, we briefly address the importance of narrative in games. In Section 3 we describe the aspects of <e-Adventure> that are more relevant to this project. Then, in Section 4, we present our game, highlighting its educational features. Finally, in Section 5 we present the conclusions of our experience with Game Guru and outline some future lines of work.

## II. FOCUS ON INTERACTIVE STORYTELLING

Interactive Storytelling is the art of making stories that exploit their potential to involve the audience as co-authors in the creative process. Videogame developers have sought this objective in genres with strong focus on narrative such as the classic adventure games or computer role-playing games. Some of these videogames are reasonable approaches to the concept of “interactive story”, but there is still a long way to go for fully interactive experiences with non-linear open-ended overarching plots [2].

There are several aspects that should be specially cared when teaching narrative design: issues such as plot structure, characterization, motivation and conflict. Most of this knowledge is common to what is studied in other fields (e.g. Literary Studies), but in the specific field of Interactive Storytelling, the authoring process has become a main research topic during the last years [3].

It can be argued that, in order to improve the experiences that current videogames offer as “narrative technology”, new development tools are required to focus specifically in the purpose of telling a story. Although this argument is valid, it is also true that existing game technology is still very useful for developing interactive stories, as well as for teaching fundamental techniques for the field of game design.

Game engines are usually assumed as the common ground layer of more complex systems [4] and standalone game toolsets have been used to build prototypes and perform interesting experiments [5] that make us think of a new wave of narrative games can emerge from the impact of these projects in the near future. In Game Guru we focus on the creation of story-based puzzles, using mainly dialogues between characters, but also considering basic interaction with objects.

For the creation of these puzzles we have chosen the domain of classic adventure games and an authoring platform that has a clear focus on narrative design aspects (some of them quite advanced) but not on programming aspects.

## III. ADVENTURE GAMES AND THE <E-ADVENTURE> PLATFORM

Adventure games are a genre in which the main goal of the player, who typically assumes the role of the protagonist, is to solve a sequence of story-driven puzzles, finding the right combinations of a set of predefined actions with the objects and characters that are present in several graphical interactive scenarios that are linked, compounding the in-game world [6, 7]. The golden age of this genre started in the 1980s and ended to the mid 1990s, including emblematic series as Monkey Island™, King's Quest™ and Myst™, although even today the genre keeps an important market quota and attracts attention from numerous users.

Due to the homogeneity and low technical requirements of this genre, at least for old-style interfaces, there are many development toolkits that are freely available.

One of the most mature toolkits is Adventure Game Studio (AGS) [8]. Although the game basics can be configured with a drag-and-drop editor, authoring is strongly based on a scripting language similar to Java and C#. It makes this tool particularly oriented towards users with programming skills.

Wintermute [9] entered more recently onto the scene. It consists in a set of tools for creating 2D adventures with either 2D or 3D characters (the so called 2.5D games). Each component of the toolkit is devised for a specific purpose, but the overall system complexity makes it more appropriate for advanced users. However, its development seems to be on hold during the last years.

Finally, <e-Adventure> [10] is an editor for the production of adventure games. It has similar features to AGS and Wintermute, but focusing on the application domain of education and enriching the typical repertory with some interesting features.

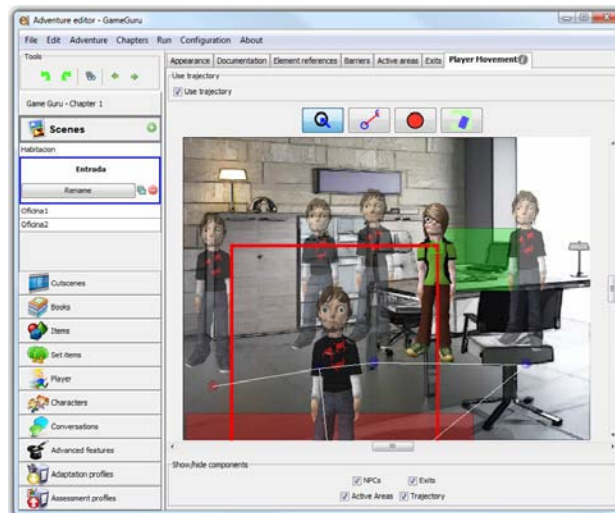
The <e-Adventure> editor, as shown in Figure 1, allows people without a programming background to create their own adventure games, using only *drag-and-drop* interactions that simplify the authoring process.

The authoring process follows the metaphor of a theater play, determining the elements that will compose the game [11]. Therefore the author is entrusted to configure the typical elements of a script, such as the scenarios where the action will take place, the characters and objects that will take part on it, the conversations and interactions for each character or object, or the cut-scenes of the game. The overall plot of the game is elaborated by linking all the elements and composing the narrative flow using a mechanism based on preconditions and effects that are based on the game state.

The platform also supports timers, triggered events, random effects, and complex interactive graph-like conversations, which can also be adapted dynamically depending on the actions of the player. These narrative mechanisms are enough flexible for complex narrations with multiple branches, but still rely on simple actions in a graphical user interface, as opposed to the scripting languages or complex configurations of other toolkits [12].

<e-Adventure> also supports the definition of adaptation profiles, allowing the same game to exhibit different behaviors on each execution [13]. Finally, games created with <e-Adventure> can be easily deployed in the Web, easing distribution and deployment, and allows the integration of the games in the new generation of e-Learning systems like Moodle™ or Sakai™.





**Fig. 1.** Screenshot of the <e-Adventure> adventure editor. The author drags and drops characters and items in a scene, easily setting up their position, aspect and behavior.

#### IV. GAME GURU

Game Guru [14] is a point-and-click pedagogical adventure game developed with <e-Adventure>. The plot is a first-person parody of the game developer career structured in three chapters. We have tried to introduce the basic agents and professional relations involved on the production of videogames while immersing the player into a compelling narrative with a simple and attractive interface<sup>6</sup> (see Figure 2).

In the first chapter, Mario (the protagonist) starts as a newbie in the game industry, visiting an old friend (Alex) who works in a small development studio. Through its friend, Mario comes in contact with the game development industry and its early phases in game development. In the second chapter, some years after the first one, Mario is working as a senior game designer, dealing with new colleagues, including a lovely girl who works for a big publishing company. The steps in this chapter are more complex, and are mainly targeted to connections and relationships between the different agents of the industry (e.g. publishers vs. developers). Finally, in the third chapter, the couple has married and they are both working for the same publishing company. Now Mario has become a renowned producer who is releasing the title of his dreams. When everything points out to a great success, Alex reappears as a resentful competitor who is willing to do anything to thwart the protagonist's plans. This last chapter emphasizes more on the relationship with external customers and final production phases of the game (e.g. marketing and the problems that usually arise at the very last stage). There are also multiple in-game puzzles and explicit questions for the player that aim to assess the actual learning gain.

Apart from these well-known mechanics, we use other advanced features of <e-Adventure> for monitoring the player activity and dynamically modify some elements of the narrative (like some characters' reactions and conversations), accordingly. In the critical points of the plot, usually the climax of the three chapters, we calculate an assessment indicator of the player for deciding if the following contents and dialogues should be modified. This indicator is represented as an in-game evolution in order to enhance the experience in a more meaningful and immersive way. The job position and salary of the protagonist is used to inform the player about his performance and achievements in the game, based on its previous responses and acts regarding different situations in the game. Depending on the chapter, there are different promotion opportunities requiring different background knowledge. For example, in the second chapter the player should get familiarized with the different departments of a development studio, show his talents to the boss and finally get a job offer. In contrast, in the third chapter the protagonist works for a publisher and has to deal successfully with funding, marketing and distribution issues of an AAA-quality game (very simplified, for learning purposes).

The advanced features present in <e-Adventure> allow the authors to create games that can dynamically adapt to the preferences of its players. For example, content adaptation profiles have been used in Game Guru as reports of previous performance and critical decisions taken by the player. This feedback is used to modify the execution of following game sessions, e.g. avoiding the activation of a puzzle about a topic that has been proved obvious for the player. Dynamically adaptable conversation graphs is another feature that we have used to conduct conversations to the topics

<sup>6</sup> Avatars' sprites have been captured from Meez Maker™ (<http://www.meez.com>), a web application that allows the creation of highly customized 3D cartoon-style animated avatars. The rest of the artistic resources (i.e. sound tracks, backgrounds, etc.) are free assets licensed under the Creative Commons terms.

that seems more interesting to the player, according to the valuable information he implicitly provides when choosing options in previous dialogues.



**Fig. 2.** Screenshot of Game Guru (dialogues are in Spanish). The story unfolds as the player interacts, via contextual menus, with the characters and elements that populate the scenarios.

## V. CONCLUSION

This paper presents the experience of developing Game Guru, a pedagogical point-and-click adventure game about the game developer career. Students can play the game in order to get in touch with general issues about the game business, but they can also edit the game as part of the exercises for learning more about how to design a story-based puzzles or a dialogue of an adventure game. While designing new puzzles about relevant topics on Game Production, or criticizing the already implemented scenarios of the game, we have found that students practice lessons on game design at the same time that motivated questions about the industry arise.

The <e-Adventure> toolkit was chosen aiming to focus more on the educational potential of Game Guru, but not only because of the game design features. Although constrained to a concrete game genre, this platform offers education-specific advanced features; being an accessible and powerful authoring environment for creating adaptive interactive stories. Some useful mechanisms have been identified in the authoring process of <e-Adventure>, such as content adaptation profiles and dynamically adaptable conversation graphs that have a great potential to further exploitation for pedagogical purposes. Although not detailed here, the possibility of formal evaluation seems feasible, assessing students via the deployment of the game in a LMS supported by the tool.

We hope this project will encourage the research community to perform similar teaching experiences with available game technology, as it is the case of <e-Adventure>, and to try dealing with topics (e.g. Videogame Production) that are usually overlooked in typical instruction programs.

Future work includes adding more resources to Game Guru, allowing more variation when editing the original chapters, e.g. creating a new plot from scratch instead of doing only minor changes to the current dialogues and puzzles, as well as taking advantage of the integration with e-Learning systems that <e-Adventure> offers. A formal assessment through students from the Master Degree in Game Development at the Complutense University is intended to be performed.

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# GBL at school: A challenge between pedagogical potential and organizational boundaries

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*Abstract*— The paper analyzes the design and implementation of Game-Based Learning scenarios with Italian school teachers. Data gathered during the whole process reveal that teachers who are open to include innovative practices at school demonstrate specific skills to cope with organisational boundaries and stay focused on the potential of the pedagogical approach, thus suggesting new strategies for innovating at school.

*Index Terms*— Discourse Analysis, Game-Based Learning, Innovation, School

## I. INTRODUCTION

Game-based Learning (GBL) has been threatened as one of the most promising experiences of learning through ICT. GBL is a trend which analyses the good characteristics of digital games together with their relation with learning, and proposes strategies and paradigms to take advantage of them for education.

It has been proved that digital games can provide challenging experiences that promote the intrinsic satisfaction of the players, thus keeping them engaged and motivated [3], and also that fun is a stimulus for learning [5]. The ProActive project<sup>7</sup> assumes that allowing teachers to create their own educational games for their students may be a rich and meaningful experience that fosters creativity and promote a new pedagogical model for learning. By the way, the main challenge for research projects devoted to experimental pedagogical uses of GBL is not only the development of good practices in themselves, rather the development of practices that are valuable under the stakeholders' eyes. In fact, research projects become valuable first of all when they produce evidence that experimental concepts can be implemented into practice and when this implementation has an added value for the practitioners.

In fact, when we deal with the development of pedagogical use of ICT, we cannot infer that innovation only refers to the technological aspects of the communication tools. We are certainly dealing with a complex activity system that involves actors that use tools in complex processes, within specific organisational contexts.

In schools, transformations in the use of new technologies which put teachers at the centre of innovative processes and regard them as active producers of new ways of conveying knowledge are rather sophisticated. They put teachers themselves into a new situation of teaching as that of creating conditions for “a cognitive apprenticeship” [1], whereby learning is a localised process that takes place in a specific context, it is performed through interaction with other people and with cultural artifacts that are related to it.

Assuming this, we can claim in line with Gaudin [2] that it is not the technical development that promotes or refrains innovative processes, but rather the behaviour of organisations, which have to be considered in function of their own missions, their own evolutionary paths and their specific ways of functioning.

The potentialities of innovation, according to Gaudin, are not provided by the development of sophisticated tools; the process of change rather relies on the capability of technical arrangements to “suggest” innovation to an audience of potential innovators. It relies on the encounter of technological solutions with “listeners” who are looking for them. Innovation is then considered as the meeting point of technological factors and human actors.

In this paper researchers decided to give voice to the teachers who have been directly involved in the ProActive

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project in order to analyse strengths and weaknesses of the introduction of innovation at schools as they are recognized by participants.

## II. CONTEXT OF THE RESEARCH: THE PROACTIVE PROJECT

The research presented in this paper has been carried out within the framework of a KA3 project: “ProActive – Fostering teachers’ creativity through game-based learning”. ProActive aim is to promote an innovative pedagogical approach where teachers and trainers belonging to different LLP sub-programmes can design and experiment the use of educational games created through two game editors: Eutopia, a free of charge tool for designing multiplayer educational 3D simulations, and <e-Adventure>, an open source software for creating 2D point-and-click adventure games with a focus on educational applications. The project proposed and validated a four stages methodology (game design – game check – game based teaching – game based learning) that embeds the game design and delivery process within an integrated framework for fostering teachers creativity and flexibility through the use of different game-based teaching/learning strategies (the five metaphors for learning). The five learning metaphors model [7] allowed teachers to adopt a game-based approach within different learning perspectives, since each metaphor describes a different way of learning (acquisition, imitation, experimentation, participation and discovery) and represents a preference that is not exclusive, but that can be used as a stimulus in the GBL design and testing process for increasing the pedagogical value of the learning experience.

## III. DATA CORPUS

The data presented in this paper have been collected through video-taped work sessions and interviews that involved Italian school teachers of the Comenius programme during the following activities.

*Focus Groups:* two focus groups have been organized in order to identify teachers needs, opportunities and constraints for the creation of game based learning scenarios in their own practices. The focus groups involved 7 high school teachers in total.

*Workshops:* The specific aim of the workshops was to support teachers in the initial phase of the creation of a learning scenario with one of the game editors. The training and co-design workshops involved 16 teachers from primary, middle and secondary schools.

*Game Design sessions:* Six teachers carried out design sessions (of about 2-3 hours each) with the aim of developing educational game scenarios for their students.

*Interviews:* Teachers who developed their games have been interviewed in order to obtain a meaningful description of their experience in the project.

The data corpus is of about 20 hours of videotaped interactions.

## IV. DATA ANALYSIS

For the data analysis, methods developed from social psychology in the frame of Discourse Analysis (DA) have been adopted. More precisely we took in consideration the recommendations by that particular area of DA which includes methods for studying how discourse constitute practices [7]. As Potter [4] defines it, Discourse Analysis: “*has an analytic commitment to studying discourse as texts and talk in social practices. That is, the focus is not on language as an abstract entity [...]. Instead is the medium for interaction: analysis of discourse becomes, then, the analysis of what people do*” (p. 146). Coherently with the theoretical background in which this paper takes place, DA method relies on an important assumption: language is not a description, rather is action and talk is constitutive of contingent reality.

Following the indications by DA, we run Discourse Analysis on the transcriptions of interactions. In what follows we resume the basic concepts that were identified in teachers’ talks with researchers with three specific focus: a) specific organizational conditions and their impact on GBL implementation; b) relationship between the implementation of GBL and teachers’ pedagogical assumptions; c) possible strategies for promoting GBL at school.

These areas were selected as they provide relevant insights on the activity systems that empower or stuck innovative practice at school: actors in contexts using tools.

## V. INNOVATING AT SCHOOL: TECHNICAL CONSTRAINTS AND ORGANIZATIONAL BOUNDARIES

In this paragraph the focus is on the difficulties in fostering innovation related to the challenge of introducing practices at school that have not been envisaged at an organizational layer, and for whom the school is not adequately equipped. These act as boundaries that are difficult to be forced.

### **Skill centered learning strategies versus content centered evaluations**

GBL arise a request for change in teaching practices that mainly relies in a shift from a traditional learning strategy centered on contents to a new one centered on skills. This is a change that may be difficult for schools to copy with.

This is because institutional paths are deeply related to a content centered model, not only in the teaching practice, where the effort is mostly required to teachers in order to re-invent their lessons, but also in the official evaluations (i.e. reports or final exams) where this shift has to be promoted by the stakeholders.

In fact, teachers stated that *"It's really hard to try to contextualize the school subjects in real life, because we have lots of contents to teach and making this work for everything is impossible, and then it is not even required. In fact at the end of the school what is required is the content, not even the rest"*. (Marta: Focus group 2).

As this teacher suggest, to innovate teaching practices at school requires a double effort that is the one needed for learning how to teach with games in itself and the one necessary to make these games fit with the steps required by the institutional system they have been developed for.

### **The equipment for leading innovation**

The adequacy of the technological equipment for delivering a game session is another relevant issue that has to be considered while interjecting with schools.

Schools are often not adequately equipped for delivering this kind of tasks, and even if they are, the multimedia rooms management at school has some peculiarities. Software installation and management at school requires administrator permissions that teachers often don't have, and for whom they have to ask for technical staff support.

Moreover, computer settings, at least in Italian schools, strictly follow the setup recommended by the Ministry of Education, and permissions from the Ministry are required for making the changes that allow the software to run. These may cause delays and hinder the experimentation of GBL sessions.

Furthermore, on the game editors side, software have their own constraints that have to be taken into consideration while they are used for educational purposes, since some features of the tools may not fit with classrooms needs and characteristics. For example, Eutopia is playable by a maximum number of six students, while classrooms are of about thirty, as a teacher pointed out: *"There is the problem that [...] there are only six characters [to adequately play on the platform], but... in a class of thirty... only six play and..."* [Carla, workshop 3].

These issues may cause difficulties in planning the learning activities, since an involvement of third parties has to be anticipated, thus forcing teachers to take into consideration, within the game-based teaching process, matters that use to be collateral in traditional learning.

### **The lack of support in introducing innovation**

The time required for developing and testing a game is another aspect to be considered. In fact, schools have scheduled commitments for teachers and students that can't be disregarded. Testing the game with the classroom needs time and preparation and may become impossible in a certain period of the school year. During ProActive activities, teachers started thinking to propose their games apart from the school hours, but it would have required an effort that teachers and students were not able to guarantee while they were engaged in other meaningful activities, such, for example, the final exams.

*"[To propose the game] apart from the school hours... A thing like this could be really nice, but I don't think that they [= students] will spend time with me... we are at the end of the year [= school year]... and it is quite difficult that I could do this... there is no time... it could have been really nice... but in a week the school finishes... it would need an energy that I really don't have... the energy that remains is needed to bring them to the final exam... really!"* (Marzia, Design session 1).

Moreover, to adopt a game-based teaching methodology is a time consuming task and the support provided by schools is often perceived as inadequate in relation with the effort needed. This perceived gap between support and effort is considered by the teachers that participated to the experimentation the main reason why it is difficult to engage *"the other teachers"* in a game design activity, as shown in the example below.

*"I'm sorry that these initiatives don't go forward with other teachers... I mean... I don't know... I don't think that teachers don't participate to these initiatives because... maybe a little... we can say that some of them may consider this as a loss of time, but... not, the main reason is that it is required an afternoon commitment and there is already an afternoon commitment at school, I mean... we should find a formula for engaging them more, I say, a return... now the refresher courses are not needed anymore... don't... a return in something, I don't know... having the possibility of doing this in the hours of lesson, so that one can engage his classrooms so that... otherwise it becomes something for whom it is difficult that teachers participate. Or not?"*

*We saw that... at least in our small group... we go... day by day... eh... because I mean... there is not so much availability..* (Marzia, Design session 2).

This sentence, on one hand, highlights how to introduce innovation is perceived as a personal activity that has to be carried out alone and without support at an institutional level, on the other hand establishes a perceived difference between those teachers call with the *"us"* pronoun, the innovators [6], that don't need to be stimulated in their personal pedagogical challenge, and those they consider as *"them"*, the other teachers, that are potential users but that need to be supported from their schools. For reaching their audience and disseminating game-based activities at school, support is considered a relevant issue to be pointed out.

## VI. GBL: A PERSONAL PEDAGOGICAL CHALLENGE

Data gathered show that teachers' pedagogical assumptions and personal visions are key factors for "listening" to the "voice" of technological innovation.

In fact, there are some pedagogical ideas and personal attitudes toward education that may make GBL an interesting chance for those who want to re-invent traditional educational practices and foster their teaching potential despite organizational and technological boundaries. In this section innovators [6] reveal an idea of education as something that should be tailored on students needs, and where teachers act not only for copying with change, but also for bringing it. Given these, technological artifacts can be useful tools for exploiting innovative ideas and widening the potential of alternative practices.

### Games do work

These teachers recognize that students are changing and this makes it necessary to adapt their teaching strategies to a different audience. This is one of the reason why they recognize the value of implementing games in education. As Prensky [5] highlighted, *"Our students have changed radically. Today's students are no longer the people our educational system was designed to teach"*. Static tools, such as books, are no more adapt to capture the attention of pupils that usually utilise complex technologies that foster multitasking and active involvement.

On the contrary, the use of games in education seems to be a viable path for encouraging their participation and widening the learning experience in order to make it more suitable with the rest of their daily life experiences.

*"It's to make [the subject] almost a game to make students get it better"* (Patrizia: Focus Group 1). Teachers say that "games do work", so if educational practice can be delivered through games, it will become more efficient.

### Education has to be flexible and creative

These teachers are aware of the challenge required by these changes to their educational role and they recognize the importance of being creative and constantly reshape the learning contents in order to achieve students attention. A teacher says that *"in school you can work with creativity, or you can go out. You have no alternatives. You can invent infinite scenarios or, if you go there mechanically, you can change job immediately"* (Beatrice: Focus Group 1).

In this direction the use of games can widen the learning experience, since it offers the possibility of providing students with learning keys that can be experienced and tested through the game: *"I think it is extremely important to give students the sense of what they do, and to wire the transmission of traditional contents to experiences that are accessible to them in their daily experience. [...] The idea of giving students learning keys through the experimentation, the participation, or the simulation, in this GBL gives more possibilities"* (Alessia: Focus group 1).

### The need for connections between school subjects and real world applications

The decision of using new teaching tools, such as games, also relies in teachers' idea that learning can become more fluent if students will be able of finding a continuity between school subjects and experience out of school.

*"Games... It's something they [students] know very well... I mean... all our students play games at home. The problem is that those games are realistic but have no connection at all with reality..."* [Teresa: Focus group 1]

For promoting a more "authentic" learning process, teachers have already developed some strategies, i.e. simulations and public competitions. *"One thing to know the bike, one thing to know how to cycle"* (Marta: Focus group 2). In their opinion GBL may create a continuity between what students learn at school and what they do outside school, thus stimulating the reflection on how the concepts learnt in a safe environment can be used in real life situations: *"We brought with us a teaching idea that has been influenced by the teaching style of our own teachers, so when this old model was substituted by a model of learning centered on skills development rather than on contents, we did a lot of effort, but we realized that it is a way of teaching that is different, but certainly also very exciting."* (Anna: Focus group 2).

## VII. HOW TO SUPPORT INNOVATION AT SCHOOL: PRACTITIONERS POINT OF VIEW

The experience with teachers that participated to the ProActive project highlighted key factors that make it possible to introduce GBL at school. These are mainly related to the chance of engaging teachers in activities that they recognize meaningful for their professional change and for whom they accept to overcome uncertainties related to the use of new technologies and to search for new paths in order to involve their institutions.

### Pushing professional change through meaningful activities

Innovators outline that not only students are invested by changes, and that teachers are changing themselves. The awareness of being involved in change fosters the willingness of founding new educational paths that can engage themselves before their students. For this reason, they're interested in games, in simulations and in experimentation and they acknowledge that innovating in education is difficult but also stimulating.



Teachers that participated in the ProActive project came for improving their teaching skills both for students and for themselves. They recognized the meaningfulness of learning a new teaching strategy, and envisaged the possibility of sharing the game design activity with their colleagues.

*"I'm really having fun! Because I love to learn for myself, so I'm having so much fun... what a pity that we are always so few..."* (Marta: Workshop 3)

This feeling related to the improvement of teaching skills motivated them to attend the workshops and the design sessions and was considered a reward in itself, even if the school didn't recognize an added value in it (cfr. Par. V).

As stated in the following interaction between a teacher and the researcher that gives her the certificate of attendance, it is clear that teachers perceive the meaningfulness of designing games for educational purposes.

Researcher: *"This is the certificate of attendance... that worths no credit [means formative credit for professional update]"*

Marta: *"It doesn't mean, it worths for me however"* (Workshop 3)

Teachers are willing to be engaged in learning activities nevertheless they need an extra effort, but these activities has to be perceived as meaningful and professionally effective: *"Absolutely, each new stimulus is welcome, so that our already trained creativity could be fostered, so that we could put it and ourselves in with new ideas and new examples during our educational practices"* (Rita: Workshop 1).

### **Finding a way for overcoming uncertainties related to the use of new technologies**

A key feature highlighted by innovators during the experimentation is their capability in overcoming the uncertainties related to their competence in the use of new technologies. A personal attitude that the mood created within the work group contributed to amplify.

Carla: *"Us... I this morning had an instant of panic, I say: <<Oh my God, what are we talking about?!>> Then I think... wait... because the first thing that... I'm not able to do this, the first thing I say is... I'm not able to do this... then I say... Mhh... why?"*

Marta: *In life there are so much things that we don't know and that we learn on the way, c'mon...*

Despite teachers may have a positive attitude toward the experimentation of new technologies, the experience within the project proved that to work in group offers a space for supporting teachers' capability of overcoming uncertainties related to being beginners of a new software that should support them in a practice in which they are experts: the teaching one.

### **Searching for new paths**

Innovators are aware of the complexity that effects the introduction of GBL at school, especially in relation to the constraints highlighted in the previous paragraphs. This awareness instead of discouraging teachers, stimulates the thinking on alternative ways for making possible the application of the proposed model in their institutions, as the example below shows.

*"I mean one comes for curiosity... for seeing... but, then... for diffusing this in schools maybe we have to find a formula... going into the schools... maybe to promote it as a course in the schools... so that teachers can touch with their hands... no? Maybe this way they are more stimulated"* (Marzia, Design session 2).

Innovators suggest that game design sessions would be more effective if teachers could access these game design courses through their schools and if game design sessions could be planned with the involvement of their students. They also envisage how to integrate the use of games in the school programmes:

- Stressing the relevance of the integration of practical modules in the curriculum: where games can be used as a subject application space, thus promoting interdisciplinarity, and supporting the continuity between school education and real life contexts;
- Asking for more flexible evaluation methodologies: where games can be used as a testing tool that doesn't refer to the traditional model of learning and that allows the exploitation of students' aptitudes that are difficult to merge within institutional learning paths.

## **CONCLUSIONS**

The introduction of GBL practices at school is a complex task that implies reflections at several levels. In fact, despite game based practices can bring an added value in school education, stakeholders are far away from assume that this value worths the radical change in organizational practices required from them. In fact, during our experimentation, often institutions stated they couldn't put themselves into new practices due to lack of resources and time pressure. However, despite this mismatch between the pedagogical value of GBL and the frost from institutions, some practitioners proved that innovation at school is possible. They worked as potential innovators [7], overcoming personal resistances, forcing organizational boundaries and suggesting alternative paths for facilitating the introduction of GBL at school, thus building a bridge between pedagogical research and educational practice. Furthermore, this experience shows that the introduction of new educational practices can require teachers to act as test drivers, that is, to conceive ways of work, to try new technologies, to design non-traditional experiences and to spend an effort that someone can

consider an overburden in respect of the final output. These activities are deeply related with the assumption from teachers that GBL can be a real alternative to traditional practices and, saying it with a teacher's words, "*not a waste of time, because in the end they [= students] are more involved and satisfied*" [Marzia, Interview 1].

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# “Learn to Lead” a Web Based Game to Teach Leadership Theories in Vocational Courses

Andrea Di Ferdinando, Massimiliano Schembri, Maria Luisa Nigrelli, Conor Linehan, Orazio Miglino<sup>8</sup>

**Abstract**—Learn to Lead (L2L) is a “virtual laboratory” (2D web based game) where an user (the leader) learns psychological leadership theories by governing a team of artificial agents (the followers). The game is based on the “Full-Range Leadership Theory”, a scientific well known theory about leadership dynamics in small groups. The game mechanics is developed by using Artificial Intelligence techniques (agents based modeling and artificial neural networks). The L2L first version was used in several European vocational courses about Leadership and Human Resources Management.

**Index Terms** — Serious Games, Vocational Courses, Leadership, Agents Based Modeling, Artificial Neural Networks

## I. INTRODUCTION

The effectiveness and efficiency of a team is an emergent property of the dynamics that develop within the team in a continuous cycle of “forming - storming- norming and performing”. Effective team leaders manage these dynamics in ways that help the team to meet its objectives. As well as technical skills related to their area of business, leaders thus require competencies in “people management”, resource management and organization. Effective training in these areas is scarce and is usually available only in high quality MBA programs or in major corporations. In this setting, Learn to Lead (L2L), a project funded by European Commission, is an attempt to implement, and test a novel, online approach to training in team leadership, suitable for use in SMEs, small government offices, NGOs etc. The training provided by L2L is based on an online serious game. In the game, each learner manages a simulated team of employees (e.g. a team of workers in a bank agency, a post-office or a local government office) which competes against other teams to maximize its objectives (e.g. profit, volume of services delivered, customer satisfaction). The game is designed as a virtual laboratory where an user can modify the (artificial) agents behaviors manipulating psychological and environmental variables. From a theoretical point of view L2L is based on a well-known Leadership scientific theory named “Full-Range Leadership Model” (FRL, [1]). From a programming point of view, L2L embeds our previous on-line platform for serious gaming [2],[3] and uses artificial intelligence techniques to control the artificial agents behaviors [4] [5].

The paper briefly presents the underlying psychological theory about leadership (section II), the game scenario (section III), and the modeling techniques used to develop L2L game (section IV). The conclusions will report some initial results obtained by first pilot studies.

## II. SOME HINTS ON “FULL RANGE LEADERSHIP MODEL”

The Full Range Leadership Model encompasses both transactional and charismatic/transformational dimensions in addition to laissez-faire (non leadership) behavior. Fundamental to the FRL model is that every leader displays each style to some amount. Laissez-faire (non leadership) behavior is more passive and “reactive”: it does not respond to situations and problems systematically. Passive leaders avoid specifying agreements, clarifying expectations, and providing goals and standards to be achieved by followers. The leader takes no responsibility, makes no decisions, and gives no feedback or support to followers. It represents the avoidance or absence of leadership and is, by definition, the most inactive, as well as the most ineffective leadership style. This style has a negative effect on desired outcomes — opposite to what is intended by the leader-manager.

As many authors pointed out, transformational leadership does not replace transactional leadership, it augments transactional leadership in achieving the goals of the leader, associate, group, and organization. Although transformational leaders can be transactional when appropriate, transactional leadership is often a prescription for lower levels of performance or non-significant change, according to a number of large scale surveys of industrial, military, governmental, and religious leaders. Within the FRL three important outcomes can be achieved as an effect of

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leadership: extra effort, group effectiveness and satisfaction. FRL model can be easily integrated with other models or theories pointing to personal characteristics of the leader (such as McClelland motives [6]) as well as to situational factors and their interaction with leaders and followers characteristics.

### III. L2L GAME SCENARIO

In the L2L game, the player is hired to work in a large corporation. The CEO has picked the player out as a future leader and has organized for him to follow a programme of on-the-job training, where he will learn all of the knowledge necessary to become a great leader. The game is played across a number of levels. Across those levels the player will lead teams in a number of different departments of the corporation, from the catering department to the research and development department. During the game, the player has two goals: A) to ensure that the company runs efficiently and productively; an B) to ensure that his followers develop appropriately, as outlined by the Full-Range Leadership (FRL) model (see above).

The day-to-day running of the department involves dealing with jobs that have specified deadlines and workloads, and assigning staff to work on those jobs. Through astute management, it is possible to finish a respectable number of jobs within their deadlines. However, leadership is more than management, and if the player employs a strategy for developing his followers he will get a real advantage in the game. If the player considers his followers workload, ability, stress levels and personality while doing the typical management tasks of assigning players to jobs, he will perform better than a leader that simply manages. In addition, the player has the option of running workshops, organizing team-building events, performing one-to-one coaching, getting involved in the day-to-day work, sending memos, among other things in order to help develop his follower's ability and their intrinsic motivation. More developed followers can complete more jobs, thus, spending time on developing staff helps the player to reach both goals of efficiency and development.



Figure 1. An example of game scene

L2L is playable on-line and the player interacts with a 2D interface. The figure 1 shows an example of what the game interface looks like. At the center is the game scene representing the office where the (artificial) followers work. It varies across all game levels looking nicer and nicer as the player advances in his career. The player acts on the work environment and team dynamics by setting the working plan of each follower (figure 2). Each follower has an own "psychological state" that the player has to monitor carefully, if he wants to successfully advance in the game. The followers (artificial) psychology is composed by three variables taken from McClelland theory: a) Achievement: followers have a disposition for excellence in performance, a continuing concern for doing better all the time. This motive concerns achieving excellence through one's individual efforts; b) Affiliation: followers have a concern for establishing, maintaining, and restoring close personal relationships with others; b) Power: followers have a concern for acquiring status and having an impact on others. High power motivation induces highly competitive behavior.

It is important to stress that followers with different personalities should be managed in a different way to obtain optimal results.

The player receives feedback from his team by statistics, graphs (see figures 2 and 3) and the follower info and animations (figure 4).



Figure 2. The player has to assign jobs to the member of his team based on their ability

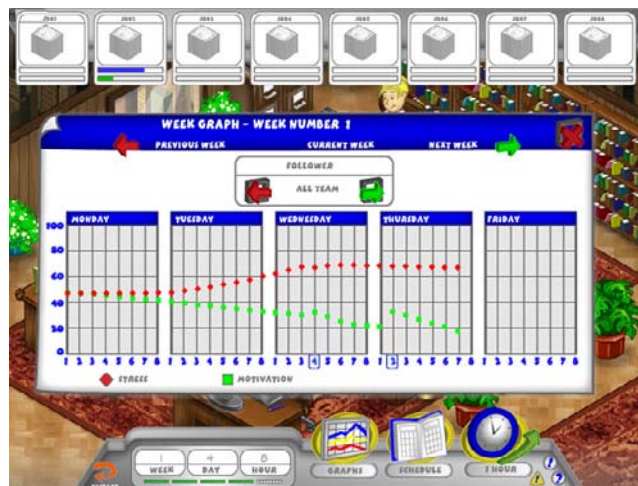


Figure 3. Graphs representing the varying levels of stress and motivation of the team members.



Figure 4. Monitoring the followers' "psychological" state

#### IV. GAME MECHANICS AND MODELING TECHNIQUES

In educational game design, the game mechanics should replicate, as closely as possible, the processes the player should carry out in the 'real world.' Designing educational game mechanics is essentially creating a context in which

examples of the theory that you are intending to teach can be performed and practiced. One of the requirements that we identified earlier was that the player is in a leadership role in an organization, and has a number of followers. This is a useful starting point upon which mechanics can be built. Another requirement for the game is that the leader must be able to apply appropriate leadership processes over the course of game play, and that these processes should have an effect on followers development and work output.

We have identified, from review of the FRL model, that during play, the goals that players should be aiming for are both the development of followers and the efficiency of the organization. So, it seems essential that the followers should work on jobs, and that these jobs should last over a period of time in which development can be observed. The third outcome of leadership – satisfaction of followers – has not been implemented, as this requires a value judgment, something we do not feel it would be appropriate for a game to make.

The solution to these requirements include the following:

In each level, there are jobs that need to be completed. Each job has a deadline and a specific workload. The basic challenge is to ensure that followers finish all jobs in time.

The leader is in control of assigning followers to work on jobs. Each follower has an ability level and a motivation level. These two variables combined define the amount of work the follower can do in any given day.

In addition to assigning followers to work on jobs, the player can carry out actions that have effects on followers' motivation and ability. For example, the follower can be sent on a training course, can be lectured about poor performance and can be inspired through evocative speeches at staff meetings.

Followers experience stress, which affects their ability to work. Stress can be caused by demanding more work of the follower than their level of ability allows, and is also naturally increased by imminent deadlines.

The score obtained for a level is not based purely on the number of jobs finished, but also on the development of staff ability and motivation.

A turn-based structure to play is implemented, so that players always have an unlimited amount of time to carefully consider their actions, and consult reference material about FRL if necessary before making a decision.

Each level has a specified length in time; for example, a week. Each hour in that week, the player will have the opportunity to view the performance and progress of their team, make any changes to job assignments and perform any leadership tasks they feel necessary. Once satisfied, the player will press a button to advance the game one hour, whereupon the game engine will calculate what happened in that hour.

In order to recreate the dynamics that occur in real teams, we simulated the way in which interactions among team members and managerial actions combine to create the outcomes (e.g. profit, production, customer satisfaction), used to "score" the player's performance. First of all, the creation of the model involved the creation of a formal framework for the definition of the personalities, motivations and skills of team members (and the team leader), based on concepts and tools already recognized in the literature. In particular, we focused on the Transformational Leadership Theory as a framework for our project, and specifically the Full-Range Leadership Model. Moreover, we adopted an agent based approach, in which every agent is modeled by a connectionist network, or controlled by a human being. In particular, the user takes the role of one of the agents, more specifically the leader, whereas the followers are controlled by artificial agents. The idea underlying this general framework, is that in some given conditions, the leader agent (i.e. the user) has to take some decision about one or more followers. These decisions are then encoded in the follower's network as some combination of inputs. Based on the inputs received from the leader, and the ones coming from the environment, the agent's internal states will change and influence his contribution to the team job. The followers' network represents the way the Full Range Leadership is implemented inside the Learn2Lead game. Indeed, a simulation-based model is just a way to express a scientific theory, and we used such a model to implement the FRL theory. Of course, as usually happens when creating a model, we had to simplify many aspects, and selecting only the principles that are, according to us, the most important ones. Finally, the interactions between the followers and the leader are monitored by an artificial evaluator that, based on the user's behavior and decisions, creates an user's profile, according to the leadership literature.

The game scenario above described requires a method for simulating the behaviour of followers. The player must feel as if their actions have reliable and realistic consequences on the behaviour and development of their followers. For a number of reasons, it seems that the most flexible way of simulating follower dynamics is through agent-based modeling techniques. Agent based simulations are extensively used in many branches of natural and social sciences to study complex phenomena that are not safely reducible to a set of mathematical equations. These phenomena typically emerge from the interaction among individual entities. Examples are organisms living in an ecosystem or human beings acting in a society.

Using computer simulations to express scientific knowledge is particularly advantageous for educational purposes. The aim of a computer simulation is to represent a scientific theory in a sort of "working version" that reproduces the underlying phenomena. In a sense, computer simulation allows players to play with the scientific knowledge. Indeed, computer allow for the contextualization of knowledge. It is important to create a context in which examples of the theory that you are intending to teach can be performed and practiced. In that respect, an agent based simulation of the

FRL theory allows us the ability to create an infinite number of specific contexts in which the knowledge can be experienced and practiced.

To build an agent based simulation of the FRL theory we started modeling followers as artificial agents. Artificial Agents are essentially input-output systems with an internal state that changes over time depending on the external input and some internal variables. Every follower has some internal variables that affect the final contribution in getting through the jobs assigned. The most relevant to the FRL theory is the motivation. The motivation level is affected by three subcomponents: intrinsic, reward and fear. The intrinsic component models the dynamics of intrinsic motivation and it's related to the transformational leadership style, while the reward and fear components model extrinsic motivation and are related to the transactional leadership style. What differs among the three is the time dynamics, and specifically their decay. For example, the intrinsic component has a slower decay than the reward and fear, but can be activated only by appropriate leader behaviours (typically pertaining transformational style).

The stress variable is linked to some external inputs like social interaction, workload and deadlines. It affects the contribution and is an important aspect to keep under control during the game. Stress also has a modulator effect on the leader motivation oriented behaviours. Personality and ability try to capture what the FRL theory says about individual consideration. Ability level is linked to follower performance. Personality is conceived as a modulator for the leader behaviour so that the same leader action may have a different impact on followers with different personality. On the contrary the leader that aims at raising the motivation of the team as high as possible needs to perform some individualized consideration.

## V. L2L CURRENT STATE OF THE ART

The first L2L beta version runs on project website ([www.learn2lead.unina.it](http://www.learn2lead.unina.it)) and it has been tested in three trial sessions in France, Italy and Spain with approximately 10 “friendly users”/site. User feedbacks are used to refine the methodology and the software which will then be subjected to a large scale “summative evaluation” (approx 30 users/site). In the 2012 will be released a freeware version and a commercial version. The commercial version will belong to the “Learn to Lead” partnership that will use the game to offer tutor-supported training to their customers. The partnership is constituted by: Institute of Cognitive Sciences and Technologies, National Research Council, Italy; Entropy KN, Italy; Università degli Studi di Napoli Federico II, Italy; Universitat Jaume de Castellon, Spain; MF & Partners Consulting, France, Lincoln University, England.

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# The Implementation of DGBL Approach in Primary School across Renfrewshire, Scotland

A. Razak, T. Connolly, T. Hainey

**Abstract**—This paper presents the trend of using digital games-based learning (DGBL) technology in primary schools in Renfrewshire, Scotland under the new curriculum known as the Curriculum for Excellence (CfE). The CfE is introduced to transform education towards a fresh approach to what, how and where young people learn. One of the teaching and learning approaches emphasised under the CfE is the use of DGBL technologies in classroom education. The finding is based on an online survey distributed to 49 primary schools across Renfrewshire, Scotland and also a series of interviews with some selected teachers identified from the survey. The survey was intended to gauge the current use of computer games for learning at primary schools in Scotland from the teachers' perspective as well as to identify games that are currently being used in the classroom and subjects where this approach would be most advantageous. In general, the findings indicated that the application of DGBL is still limited and requires in-depth study on how to make this approach more popular and effective for primary school teachers. Based on the output from the interview, an illustration of how DGBL approach has been used in one of the primary school in Renfrewshire is presented. The game used for this purpose was the MarioKart game from Nintendo Wii and the approach has been used with the Primary 2 children.

**Index Terms**— digital games-based learning (DGBL), Curriculum for Excellence(CfE), primary school children, games in education

## I. INTRODUCTION

THE CURRENT generation of children have changed in the way they think and process information as the results of exposure to technology from an early age. The hours of exposure to the digital world, composed of cell phones, MP3 players, computers, internet and video gaming etc, that became pervasive at the end of the twentieth century have profoundly affecting and changing this generation's learning styles and abilities. Prensky [1] called this generation "digital natives" and identified 10 main cognitive styles of this generation that have changed from the previous generation. Among them are: the digital natives can process information very fast, like to parallel process and multi-task, prefer random access than step-by-step linear access, sharp visual sensitivity compared to textual, enjoys networking, active role, fantasy, using technologies. These changes on cognitive styles are such that this new generation can no longer fit with the traditional learning approaches and are sometimes mistakenly labeled with specific learning disabilities[2]. There is a growing body of research suggesting that to teach or even engage the youth of today, the teaching methodology and content needs to be changed to be more game-like, as opposed to traditional classroom instruction [3-6].

In Scotland, the Scottish Government has made radical changes in its education policy by introducing a new curriculum known as Curriculum for Excellence (CfE). This transformation in education in Scotland aims to provide a coherent, more flexible and enriched curriculum from 3 to 18. To help make teaching and learning experiences within CfE challenging, demanding and appealing, it is claimed that a range of games-based technologies are now being used in classrooms throughout Scotland [7].

This research intends to investigate the use of digital games-based learning (DGBL) within the CfE at primary schools in Scotland. For this research, we have adapted the definition given by [8] who defines games-based learning as an innovative learning approach derived from the use of computer games that possess educational value or different kinds of software applications that use games for learning and education purposes such as learning support, teaching enhancement, assessment and evaluation of learners. To highlight the use of digital games, we used the term DGBL as suggested by [1].

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## II. OVERVIEW OF THE CURRICULUM FOR EXCELLENCE (CfE)

CfE has emerged in response to the concerns that have been raised in the 2002 “National Debate on Education” set up by an earlier Scottish Executive to develop its long term education policy [9]. This new curriculum was introduced in November 2004; however, it was only fully implemented across all Scottish schools in Autumn 2010. The current S1s will be first to take the new qualifications under the new curriculum from 2013-14.

### A. The purpose of the curriculum

CfE has been introduced to raise the standards of learning and teaching by providing the children with an education that is relevant, inspiring and engaging whilst laying down the firmest of foundations that will help improve the children's life chances in the future. It aims to prepare young people for an ever changing world and helps them to be successful learners, confident individuals, responsible citizens and effective contributors.

### B. Curriculum structure and assessment

To facilitate the four capacities, the CfE emphasises the development of a set of abilities for learners such as core literacy, numeracy and communication skills; the ability to use technology for learning, to think creatively and independently, to learn independently or in a group, to make reasoned evaluations and the more general ability of applying learning to new situations. This is done by promoting active learning, which means encouraging young people to think, question, research and work together rather than regurgitating information using traditional learning approaches. In general, this is an example of a constructivist approach to learning, which emphasises the concept of an active, experiencing student in a situation where knowledge is not transmitted to the student, but constructed through activities or social interaction. Constructivist learning emphasises the five different attributes of meaningful learning, which are: (i) intentional learning, (ii) active learning, (iii) constructive learning, (iv) cooperative learning, and (v) authentic learning [10].

Aligned with the constructivist approach, CfE focuses on bringing life to learning and learning to life [11]. Under the CfE, children will still study subjects from the following curriculum areas – expressive arts, languages and literacy, health and wellbeing, math and numeracy, religious and moral education, sciences, social studies, technologies. However, instead of treating the subject individually, the subject will be linked together just as they are linked in real life with an increased focus on literacy and numeracy. The driving force of CfE is to focus on learners' needs, including offering personalisation and choice. Teachers and other practitioners prepare the teaching plans based on the national guidance called Experiences and Outcomes – a rigorous framework for progression. It is then up to professionals to plan and deliver effective learning in a way that works best for their local context.

A range of assessment approaches will be adopted to assess the different types of achievement across the curriculum from a variety of evidence. Evidence will come from day-to-day learning such as through interactive teaching as well as from specific assessment tasks, activities, tests and examinations depending on the level of progress. In practice, the teachers will decide their own approach to assessment with guidance from the Framework for Assessment provided by LTS for support. The Framework for Assessment is developed through Assessment is for Learning (AifL) and National Qualifications (NQ) and also included the good practice and expertise in assessment that exists across all sectors of education. Assessment will focus on the application of standards and expectations of each learner's progress and achievement in knowledge and understanding, skills and attributes and capabilities as detailed in the experiences and outcomes within curriculum areas and subjects and in the curriculum guidance and specifications for qualifications and awards in the senior phase.

### C. The Consolarium

In line with principles of the CfE to promote challenge and enjoyment in children's learning, Learning and Teaching Scotland (LTS) has set up a DGBL initiative called *The Consolarium*. Since 2006, it has become the platform for the teachers across Scotland to explore a range of computer games and game making tools and share their experience on how the appropriate use of computer games can have a positive impact on teaching and learning. In addition, it can also offer training and technical support and loan a range of game based resources that include games and consoles for example, Nintendo Wii, Nintendo DS, Sony PS3 and Xbox360.

## III. PREVIOUS RESEARCH ON DIGITAL GAMES USED AT SCHOOL

Initially, most computer games prominently used at school were not collaborative, such as single-player drill-and-practice games that can be played in 30 to 45-minute periods and include explicit educational content, like Reader Rabbit, Math Blaster, Alga-Blaster or Knowledge Munchers. These educational games are popular because they can easily be integrated into a traditional, didactic curriculum as ‘enrichment exercises’ during independent study time [12]. Due to their engaging nature, they make a good learning aid as children will often willingly play them much longer than they would spend the time to study the corresponding material. Although drill-and-practice games can have an important role in student-centred learning environments such as problem-based learning [13], it has been argued that

these tools have achieved only limited success in helping students to develop advanced knowledge and skills [4, 14]. This is because most of these games are poorly designed, simplistic, boring and repetitious, and do not allow users any possibilities for active exploration compared to a non-educational game.

With the recent information technology and Internet boom educators and researchers have started to introduce full-fledged video games to support traditional curriculum [1, 15]. These full-fledged video games differ from the previous drill-and-practice in two aspects. Firstly, they create intrinsic motivation through fantasy, control, challenge, curiosity and competition [16, 17]. Secondly, they immerse players in complex and rich environments, allow them to explore numerous strategies for action and decision, and require them to complete demanding tasks with increasingly difficult objectives [18]. Most full-fledged video games are collaborative and multiplayer. A simple way of using full-fledged video games as supportive tools in schools is to use commercial of the shelf (COTS) games in formal teaching, for instance, history or geography lessons. Studies of COTS games at school, such as *The Sims 2*, *Roller Coaster Tycoon 3*, *Knights of Honor* [19], *Civilization III* [20], *Europa Universalis* [21] and *Dr Kawashima Brain Training* [22], have demonstrated some positive learning effects. However, some studies also point out a significant incompatibility of most commercial games with school environments and suggest the need to have a more theoretically grounded approach for the development of games that are to be implemented in schools.

In the attempts to address the challenge of making games for education enjoyable and yet effective, researchers and educational practitioners are increasingly turning their attention towards so-called serious games for education. These games differ (1) from COTS games by having education as the primary goal rather than entertainment [23] and (2) from the drill-and-practice games in that their complexity approaches that of their commercial counterparts. Several serious games have been developed recently for primary and secondary education. For example, *Global Conflicts: Palestine* is a 3D role-playing game (RPG) that deals with the Israeli-Palestinian conflict and is based on real personal stories [24] and *Europe 2045*, which is designed to be a supportive educational tool for social science courses in secondary schools, attempting to familiarise players with political, economic and social issues in a united Europe and the present-day world [25].

Another example of serious games for education is the Alternate Reality Game (ARG), an open-ended, collaborative game where players find clues and solve puzzles in experiences that blur the boundary between the game and real life. Recent examples of large-scale ARGs include the educational games *World Without Oil* and *Superstruct*. *The Tower of Babel*, an ARG designed by the European ARGuing Project, was used in schools as well as by learners of all ages. It was developed to engage students in learning languages other than their own [26].

#### *A. Game creation tools*

As the games industry is becoming more advanced, users are given more control over the game they are playing such as the opportunity to modify or re-create the virtual environment to suit their own fantasy within the game. This process, known as modding by the open-source software movement, allows the players to create new games or alter the game content with the intention to share it online. One advantage of this process towards the development of serious educational games is that games-based learning content can easily be created using open source or royalty-free game engines and 'modding' (modifying) COTS games by utilising a game editor application to create customised game objects and levels. Examples of open source game authoring toolsets available are the *Unreal Editor*, *The Half Life 2 editor*, *Game maker*, *Mission Maker* and *Alice*. Initially, it is evident that there are very few tools available to support development of games-based learning content for the non-developer user group as almost all options available require technical knowledge [8]. However, following the promising result in research for game design by students as suggested in various researches (e.g. [27-31]), more programming-free and user-friendly development tools are emerging to encourage adoption by non-game practitioners. Resnick [32] developed a technology called 'Scratch', which supports creative thinking by allowing the user to imagine what they want to do, create a project based on their ideas, play with their creations, share their ideas and creations with others and reflect on their experiences.

Game creation is another way to bring games into the curriculum, which is highly emphasized under the Curriculum for Excellence [33]. Good game design involves research, creative thinking, the ability to envision both problems and solutions, and many other learning skills.

## IV. METHODOLOGY

The focus of this paper is to investigate the use of DGBL within the CfE at primary school across Scotland. To achieve this, two methodologies have been adopted which are survey and interview.

#### *A. Teacher's survey on the use of DGBL at primary school*

This survey intends to gauge the current use of computer games for learning at primary schools in Scotland as well as to identify games that are currently being used in the classroom and subjects where this approach would be most advantageous. To achieve this, an online survey was set up using the online survey system, SurveyMonkey. The link was distributed through email to the head teachers of 49 primary schools across Renfrewshire, Scotland and the head

teachers were requested to distribute the survey to the teachers. Participation was on a voluntary basis and the participants could fill in the survey at their convenience between January 2011 to March 2011.

### B. Teacher's Interview

The aim of this interview is to get further understanding on how teachers have used DGBL approach to enhance teaching and learning. Among the issues that are explored are how the teaching plan is done, how the students are assessed and how the students have responded. A series of interviews has been conducted with the teachers identified from the survey.

## V. FINDINGS

### A. Teacher's survey on the use of DGBL at primary school

Fig. 3 shows the percentage of teachers using the DGBL technologies for teaching in primary schools in Renfrewshire. In general, the result shows that teachers that use both game play and game design approach is very small which is only 8%. Quite a number of teachers are familiar with using computer games for teaching (39%) as compared to games creation tool (3%). However, half of the respondents (50%) have never used DGBL technologies for teaching.

Table IV categorized the responses based on the games type. Based on the findings, the most widely used games at primary schools are *Drill and Practice* type (76%). The benefits that the teachers listed for these types of games were reinforcement through fun, good drill and practice, they are free, engaging and there are so many sources with good quality games. Next is the use of COTS game (24%). The benefits were these games can fit with many areas of the curriculum and provide stimulus for cross-curricular learning and teaching. However, the major drawback was that they required an expensive game console. There was no example of serious games which was used in primary schools across Renfrewshire. One of the reasons for this would be the difficulty to find a serious game which could easily fit into primary school students.

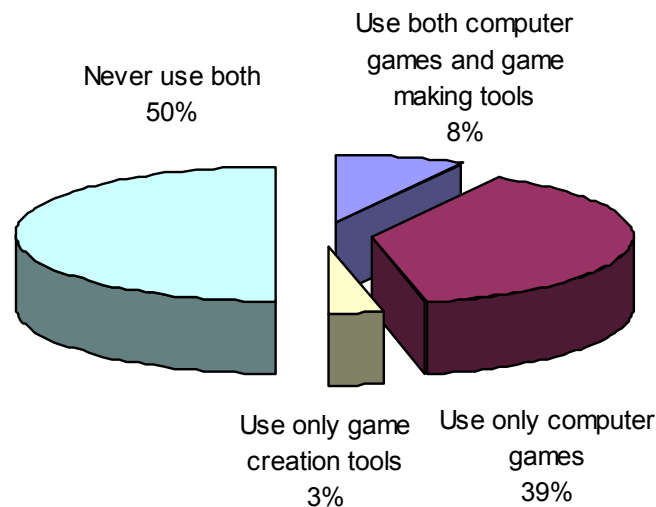


Fig. 3 Teacher's use of DGBL technologies for teaching

TABLE IV:  
COMPUTER GAMES USED IN TERMS OF GAME TYPE

Type	Example	Response
Drill & Practice	Free online games for Math and Language	76%
Full-fledged video games, commercial-of-the-shelf (COTS) game	Various Nintendo games	24%
Serious games	None	0%

Fig. 4 shows the curriculum area which is suitable for using the DGBL approach. Based on the findings, Math is the most suitable subject while RME is the least.

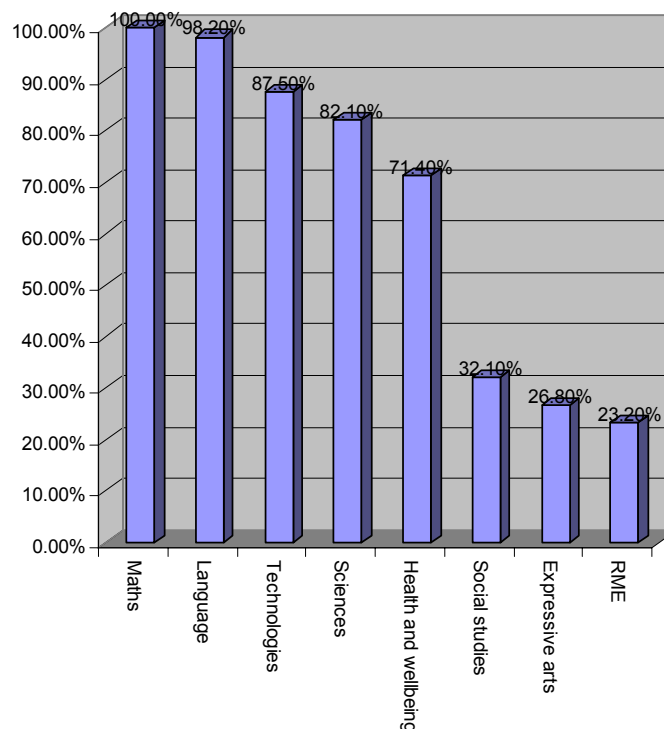


Fig. 4 Curriculum areas suitable for using DGBL approach

### B. Teacher's Interview

In this paper, we presented an approach which was used at one of the selected primary schools namely Bargarran Primary School. The teacher involved was a member of the Wii Games-based learning initiative in Renfrewshire Scotland.

#### 1) Overview

At this school, games-based learning approach was used in one out of four teaching plans prepared for the whole school session in 2010/2011. The selected plan was run from January 2011 to March 2011 involving Primary 2 class. The game used was the MarioKart game from Nintendo Wii.

#### 2) Teaching plan

Table V illustrates some of the real life activities which have been designed to fit across the curriculum areas. Some of the activities have been suggested by pupil during pupil consultation.

TABLE V:  
ILLUSTRATION OF SOME REAL LIFE ACTIVITIES TO FIT ACROSS THE CURRICULUM AREAS

Curriculum Area	Activities
Numeracy and Maths	Use stopwatches/ game times to measure race time Measure distances using trundle wheels(Outdoor learning) Symmetrical flags of the world Design car race using repeating pattern Measures how many meters in a lap Collect and count coins

Literacy and English writing	What's in the box Why should I open the box? Letter to Mario F1 racing driver facts card Eco anti pollution poster Thank you letters to visitor New character description
Social studies	Cars Past-Present picture ordering Make individual driving licence Plan and organize a 'Grand Prix' topic finale Traffic survey
Science	Ramp experiment-speed, forces and friction What shape/size of cars travel faster? Petrol and electrical cars Design healthy menu for F1 drivers
Technology	Use Google Earth to look at racing circuits around the World Race car junk modelling Design and construct a winners crown/trophy Using Apple works drawing application to design an invitation to our Open Afternoon for Mario Kart project
Health & Wellbeing	Examine the importance of seatbelts in both racing and passenger cars Discuss the risk of speeding
Expressive Art & Design	Design a Formula 1 race car using pattern Driver's safety suit design Design crash helmet Design new race track Turn our classroom into Mario Kart land.

## VI. CONCLUSION AND FUTURE WORKS

The results indicate that DGBL, especially the game making approach, has not been widely used at primary schools across Renfrewshire, Scotland. In general, the most suitable area of curriculum for using this approach is Maths and Languages, while the least suitable areas are RME followed by Expressive Arts. One reason for the wide use of this approach in Maths is because there are many free games available online related to this subject and the games can be easily fitted into the curriculum. The type of game which is widely used at primary schools is Drill and Practice because it easily fit into the curriculum and widely available for free. COTS games such as the Nintendo game series are also popular for use at primary school. However, the drawback is that this type of games is expensive. In the next stage, this research will explore the possibilities of this approach to offer deep learning through an exploratory study and attempt to compare the efficiency of this approach compared to non-DGBL approach such as lecture and tutorial.

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## Contributions in the Round Table “GBL Nowadays”



# Contribution in the Round Table: GBL Nowadays

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Game based learning is not new. It has a long history that pre-dates the widespread use of computers particularly in the case of business simulations in management education. In the earliest days of microcomputers in education there were many drill and quiz programs were dressed with play-like attributes. How far have we come? Today we have diversity. Some educators explore the use of consumer off-the shelf game products that have been "curricularized". Some make learning claims for drill and quiz programmes on the Nintendo DS. Some educators design and use sophisticated authoring tools for creating learning encounters in 3D screen environments. Some utilise computer software designed for recreation or play for educational use. Yet others are developing gaming ideas that involve aspects of computer interaction with physical world and other media. However examples of widespread implementations are rare.

Each in its own way is exploring the interactivity of computers and a recognition of the power of play in learning. This session will discuss the reality of game based learning today.

## **Playing with computational things (Martin Owen)**

A major feature of the next phase of development of computer applications are activities that focus on *ubiquity* and *pervasiveness*. The computer becomes invisible, wearable, and embedded. This is as true of things we learn with as it is for automobiles, smart buildings or manufacturing plants. We can design and make playful objects with built-in computer power that can have applications in learning. iTiles™ are one example of this new generation of technologies applied to learning. They were inspired by great educators like Froebel, Montessori and Diennes who showed how play with manipulable structural apparatus could lead to profound learning. iTiles™ and future devices can create opportunities for learning with interactive tangible games.

## **Discussions and Reflection on Theory and Practice (Pablo Moreno-Ger)**

The origins of using games as learning tools can be traced back to seminal works by Malone in the early 80s, and some later works in the 90s by Leutner, Porter or Amory. Their ideas and theories remained mostly underground until the beginning of the century, when works by Prensky, Gee or Aldrich made a big impact in the collective mind of (mostly young) academic researchers.

In the last five years we have experienced a dramatic growth of the academic field that argues for the application of GBL approaches in education. The argument is no longer about whether we should be using games, but about how we should be using them, how we should design them and how we should integrate them with the existing curriculum.

As such, the discussion is no longer merely pedagogical: Game designers are studying specific game mechanics for improved learning. Instructors are studying how to measure the effectiveness of GBL approaches. Technicians are studying how to reduce the costs and provide an infrastructure to integrate games in the curriculum. Researchers from disparate fields, such as artificial intelligence (AI), neuroscience, psychology, sociology or engineering are looking at educational games from different perspectives. GBL has thus become a rapidly changing and divergent field, with exciting opportunities and potential pitfalls.

**Transmedia practices in education (José Luis Rodríguez Illera)**

Narrative Transmedia<sup>1</sup> can be seen as another step to integrate game and multimodal approaches into education. Different from more traditional GBL, without the compulsory need of a computer based game (although they may integrate one), its interest to education, even in formal settings, has not been really started. We will present a short experience done in 2010-11 that throws some light, and also some problems, to the way it can be used.

**Serious Games for drug prevention (L. Zamboni)**

Serious games are privileged tools to address young adults with educational messages. They borrow the communication register of videogames, which is close to young people's taste and habits. They also exploit game strategies to attract users, challenging them over topics of interest, and offering upgrades to higher levels to keep the user interested after several game sessions. Here we will focus on serious games aiming at promoting healthy behaviors in young people's nightlife, which is still a rather unexplored terrain. The discussion will gravitate around four key issues to bear in mind during the design and evaluation process of serious games in this area, e.g., social realism, iterative in-field validation, sociability, and knowledge layers. We will mention some strategies to tackle these issues, rooted into our own experience with past and ongoing projects.

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<sup>1</sup> Transmedia storytelling is a narrative technique where interactive stories are build by combining various media (both digital and analogical) and platforms, integrating in this way different experiences for the user. Each media shows a different part of the story and makes a different contribution to the narrative world.

## Field Experiences



# The trip of Alice

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The videogame “The Trip of Alice” is based fully on the philosophy of ProActive, a project on educational videogames in which creative teaching is built around the fundamental premise that videogames are valuable teaching tools because they are fun and can boost student’s attention and interest. Following this premise, videogames may promote learning when the student is assigned a role inside a narrative structure and required to give creative answers to questions of increasing difficulty.

The ultimate purpose of this videogame is to promote learning. In order to achieve this goal, we have tried to set clear learning goals and combine challenges with information on the student’s own progress inside the educational process.

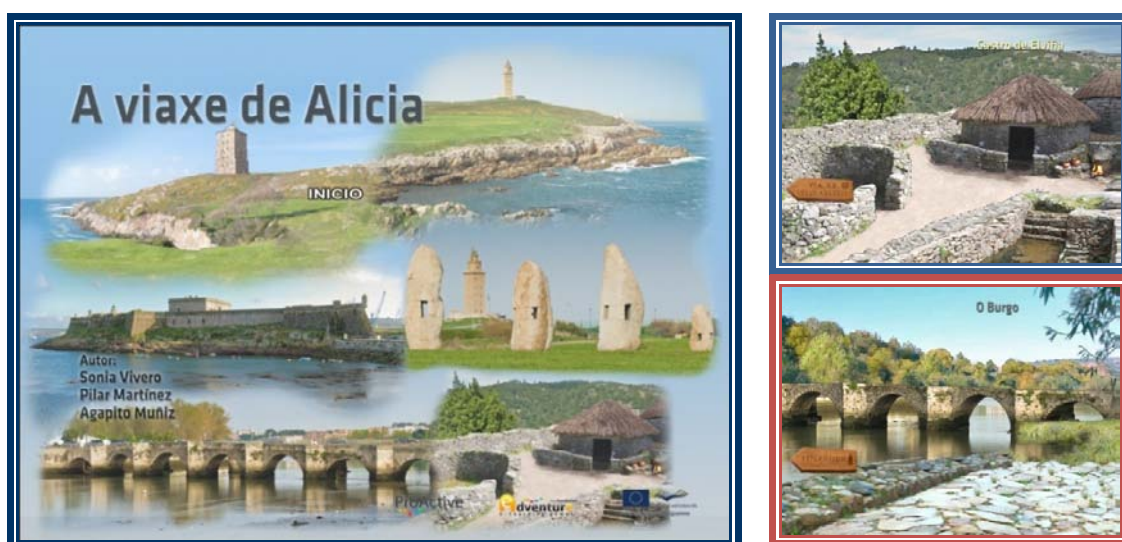


Fig. 1: Screenshot of starting screen of the educational videogame "The trip of Alice" (left) and screenshots of two scenes (right)

In the game, the student’s mission is to help Alice, who is a teenager, like the students who play it, to return to her house in the city that A Coruña is nowadays. The game starts when, in the present, Alicia goes out to visit a museum and continues to the “Tower of Hercules” by the “Walk of Tip Herminia”. There she stops to rest and, like the character of Lewis Carroll, she starts travelling through different periods (current, Castroan, roman...) of the history of the city.

During her trip, Alice talks to several characters and uses different objects that she takes or gets from the characters. In this way Alice learns more and more about the origins of her city. The game ends when the player manages to bring Alice back to the period from which she comes.

All conversations, as well as the situations that Alice finds herself in, are based on mythology, legends, popular tales, archaeological traces, etc. In this context, her answers are fundamental to arrive at the end of the adventure successfully.

In each stage there are characters with whom Alice can speak. If the player clicks on the characters with the mouse (right button), he/she will be able to speak with him or her, thus getting hints and ideas. If the player clicks on the objects that appear in some stages, he/she will be able to examine, take and use them.

In this way, students get to know about the art, ethnography, geography and names of places of each period of A Coruña in a transparent and fun way. “The trip of Alice” is a game of investigation since students will have to look for terms, historical situations, and traces that will help them to the resolution of this situation in an entertaining way.

In order to advance in the game, the student has to pay attention and answer the questions that the characters formulate. Each question has three possible answers and only one is correct. If the correct answer is not chosen, the character will

go back to reformulate the question. These questions will allow evaluating the knowledge of the student through an evaluation report.

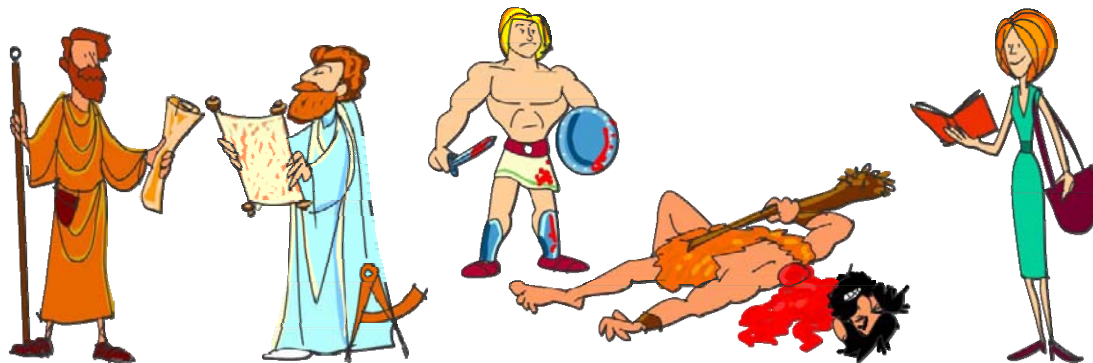


Fig. 2: Some characters of the educational game "The trip of Alice"

To help with the task, the student has a book divided into four volumes that Alicia carries in her bag. The player can use the book by moving the mouse cursor towards the top or the bottom of the screen. If the student uses the book too often, the mark will decrease accordingly.



Fig. 3: The book (right) and other objects available in the game

The motivation behind this videogame follows Prensky's approach of teaching students to be proactive and to assume careful risks, to think on a long-term basis, laterally and strategically. In addition, this videogame tries to deal with the constraints of the official curriculum and create a system of quality learning that interests and stimulates.

**Keywords:** history; mythology; legends; A Coruña.



# Collective negotiation

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## 1. SCENARIO

The firm SABON s.a. is in a turmoil; the time has come to substitute the former agreement on how to update yearly the salary/wage increase of its employees. The firm and the workers have to negotiate a new one.

Each party has taken a position and the aims they wish to achieve are clear, but neither can forget the interests they represent, nor their own private interests or the present economic situation. These are difficult times for all; SABON s.a. has to compete against other companies in the domestic and overseas market and the employees want to keep their standard of living, but at same time they need each other. All have to sit at the negotiation table to reach an agreement. What would happen if the company stopped its activities due to a strike or if the workers lost a part of their wages, or even if they lose their jobs? These concerns force them to find a meeting point. It may be that all have to surrender some of their aspirations, since all sail in the same ship.

In the game “Collective Bargaining”, an executive and an advisor are the characters who represent the firm; the employees are represented by a worker and a trade unionist. There is another character acting as a mediator who is agreed to by both company and employees.

This is the scenario of “Collective Bargaining”. The players, through avatars, move in a 3D environment (EUTOPIA), in rooms, meeting rooms, libraries and open spaces and interact with each other by means of written messages, or they can greet, nod, deny or show some emotions through gestures, all activated according to the player’s desires.

## 2. CHARACTERS

Before each game, players are assigned to certain roles they have to represent. The characters are accompanied by a brief description, with a few brushstrokes about their characteristics, experiences and interests. In this way the player can put him or herself in the character’s shoes and at the same time contribute with something of him or herself. Furthermore, each character is assigned some goals to achieve during the game. As in real life, some of them are public (known by all other players) and others are private (only known by the player), any of which may be incompatible with the public objectives.



## 3. FOR WHOM AND FOR WHAT IS THE GAME INTENDED?

The game is addressed to students of “Training and Vocational Guidance”, which is a subject of Professional Training Schools. The goal is to guide the students in adapting and integrating in work environments. In this context the game’s objectives are: a) Interpret and bring into effect certain terms provided in legislation currently in force about worker’s rights and responsibilities; b) Deal with a collective bargaining in a company; c) Show the relationships and mutual dependencies between the parties of this kind of negotiation; d) Reveal and debate subjects or questions from the work world. Currently, a burning issue is to decide in what way the wages should be updated, taking into account the productivity or the year to year inflation; e) Assume different roles so the students will acquire practice regarding all the parties participating in such a negotiation.



#### 4. ARRANGEMENTS, PROCEEDING AND ANALYSIS OF THE GAME

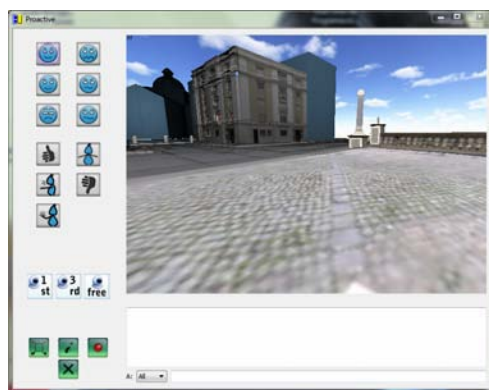
Before playing and getting into the scene, students have to read some legislation currently in force regarding worker's rights and responsibilities, read some opinion pieces about productivity and inflation, and search the Internet for real wage tables and real cases about wage update criteria, to be analyzed later.

Once the game has begun, the worker's representatives must discuss how to set up the negotiation strategy with the firm representatives. After this, the first meeting among all participants can take place, each party stating their demands and/or conditions to each other. The second meeting is just for each party separately to set up future strategies. An agreement should be reached in consecutive meetings. During the game the teacher can observe, take notes, interact with the characters, and record the game proceeding.

When the game is finished the teacher and students/players will analyze the discussions of each character; everyone can talk about what they think they did well, what could be done in another way, and the findings they have reached.

#### 5. EUTOPIA

The game "Collective Bargaining" has been developed by means of EUTOPIA, which makes possible creating pedagogical scenarios based on role-playing games. The platform allows multiple players to play online in a virtual 3D environment. EUTOPIA is made up of two programmes: the EDITOR, which allows the teacher (tutor) to create graphic storyboards based on his or her own educational scenario; and the CLIENT, which is used by the tutor and students to interact in the formerly created 3D environment.



EUTOPIA has been developed within the framework of projects funded by Lifelong Learning Program (EACEA) of the European Community; for this reason its use is free of charge.

**Keywords:** negotiation; agreement; productivity.

# Videogaming: a chance for a change

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Creativity is essential to achieving didactic objectives successfully. However, teachers often do not have the time to make creative learning objects. Spain's compulsory educational system does not consider teacher's creative role as important, so the potential of an innovation such as gamification is basically ignored. However, many educators have the necessary skills and invest hours to produce e-contents that suit digital natives' expectations, and their projects remain isolated without a big impact in the system. In this context, the ProActive project aims to use these individual efforts to reach an upper stage in new teaching methodologies.

In the last three years, I have been involved in research, training and teaching with digital resources and methodologies. From the very beginning, I considered video games as a powerful tool. Video games are a cultural product that has been growing and reaching new users in the last decade. The birth of portable consoles, the new generation of video games which are "suitable for everyone", and the online games market should be kept in mind to understand the social impact of videogames.

Regarding education, it is known that digital natives do not need to make any effort to understand video games' mechanics. In other words, our students do not need to spend much time learning their structure and rules because this learning has become an automatic process. This is a reason to incorporate gaming structures into education.

Though video game console companies and game developers are not interested in producing educational material to improve learning processes and develop specific competences, electronic games' global reach has allowed researchers, pedagogical designers, teachers and even software programmers to apply video game principles in learning scenarios.

In addition, the web is offering to teachers all kind of new applications and easy-to-use tools to create interactive activities, such as crossword puzzles, word searches, matching exercises, visual maps and tests. The production of these teaching materials fosters the adoption of digital resources in learning environments. However, in most of these cases, gaming aspects are left aside.

In this context, ProActive allows educators to transfer the playability principles to learning objects by giving them training in Game-Based Learning and two game editors which have been developed for education. I used <E-Adventure> editor, which gives teachers the possibility to rethink educational content as a playable learning object through a creative process that fosters active teaching methodologies.

Games developed with this editor enable children and teenagers to achieve complex learning goals through a videogame. <E-Adventure> does not allow students to develop competences by disintegrating spaceships, knocking out sinister zombies, or winning the Champions League. Instead, the software allows the user to create a video game of a specific genre, based on some particular dynamics that requires a basic experience in this kind of game. With this software, one must know that it is challenging to integrate some syllabus designs.

In fact, <E-Adventure> may be considered as a learning objective itself, understood as a developing tool. Secondary and professional training students have the possibility to design a videogame, integrating creative actions carried out through different software tools (sound, photo and video editors) and managing relevant information. The introduction of those learning acts will promote development of digital competence. The following are recommendations from my experience designing and developing a Game-Based Learning scenario and educational game within ProActive:

First, teachers and instructors involved in the design of a game with E-Adventure must take into account that this software does not have an interactive appearance. In addition, users should know the basic software functions if they do not want to get lost in the production stage. Before starting the creative process, designers should concentrate on the training stage. Once they have learnt the main software functions to develop basic game mechanics, teachers-designers should begin to work with two fundamental aspects to set up the video game: first, the adventure's educational contents and, second, the video game's structural design.

Obviously, teachers involved in the project are more familiar with the introduction of educational contents rather than game mechanics. In this sense, the playability elements and game structures must be checked continuously in order to maintain the motivational power of the game. There is a big difference between playing and thinking about how to play, even though I believe teachers' experience as players will determine the playable value of the learning object. These new designers need to manage the following principles to guarantee an efficient playability:

- Plot and goal's game must be easy to understand;
- The system of rules ought to allow for interaction with game objects and characters;
- Media resources should be introduced to enrich game's dynamics;
- Player's interaction with all video game elements has to be intuitive;
- Game based learning educational projects offer the chance to consider failure as a necessary part of learning, as players are able to learn through active experimentation and discovery.

**Keywords:** video game; playability; ludology.

# The Holy Torc: study on the educational possibilities of a videogame

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## 1. CONTEXT

This experience has been carried out in the Ponte dos Brozos Elementary School in Arteixo, near A Coruña, Spain. The school participates in the Ponte dos Brozos project, whose goal is to introduce ICT in education. This experience was conducted thanks to the support of the CEFORÉ<sup>1</sup> of Coruña and the training provided by the University of Barcelona.

## 2. THE GAME

The main characters, Icia (a girl) and Brais (a boy), go on a trip in search of the holy torc of King Breogán and a plant to cure their friend Keltói. In order to achieve their goal, they get help from the book of plants, the golden sickle of the druids and a sword.



Image 1: One scene of the educational game "The Holy Torc"

The project started from the desire of a group of teachers to bring the school closer to students. It is well known that there is a wide range of educational, commercial videogames. However, very often they don't meet the needs of teaching contexts, for instance regarding students' particular characteristics and the teaching conditions. The games available usually have too long introductions, and their methodology doesn't consider what each student already knows. For these reasons, when we, i.e. the group of teachers, learnt about the research project on the creation of educational videogames with <e-Adventure> editor, we decided to create our own game.

Our goal was to allow our students from third level of Primary Education (10 to 12 years old) to learn about their cultural heritage, their history and the natural environment that surrounds them. However, we didn't want to be transmitters of content but spectators waiting for the students' reactions of curiosity to a game. The game design and development required technical work, creative thinking and personal time, and it took place in two phases:

**Phase 1:** The focus was on working on transversal skills through participation, i.e. the creation of the game with the help of students with special needs from the section on Hearing and Speech. These students had problems in the area of language, in their self-esteem and in their relation with their peers. Moreover, they were from different cultural backgrounds (Arabic, Romanian, gypsy...) and had various learning challenges (dyslexia, attention deficit...). Given this context, we decided that the speeches of the young characters in the game would be suggested, recorded and corrected by these students. In this way, they could also see how the videogame evolved as the teachers were working on it. We all worked together. The teachers were also learners, we made mistakes, and we didn't succeed in the first attempts. Instead, we had to persist and keep working. The participation of the students helped to lift their self-esteem. They felt that their work was important as they were collaborating in the development of a game that their fellow students would play later and in which they would be the characters' voices.

**Phase 2:** It was aimed at students from the ordinary classroom for building their own knowledge of their cultural environment (customs, culture, history...) and of the Galician Language (reading, comprehension, vocabulary). Students would learn through observation, curiosity and communication with their peers through the game. More

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<sup>1</sup> Centro de Formación y Recursos (Center of Training and Resources)

specifically, we expected that they would have many questions that would inspire them to investigate and learn the appropriate content.

<p><b>Our goals were:</b></p> <ul style="list-style-type: none"> <li>•Bring back and experience the Galician tradition and culture;</li> <li>•Appreciate their cultural heritage;</li> <li>•Broaden the vocabulary on the topic;</li> <li>•Become familiar with life in the Castros;</li> <li>•Link the current activities to the old ones;</li> <li>•Promote active and constructivist learning;</li> <li>•Use the play activity to develop the appropriate skills.</li> </ul>	<p><b>We had the following materials:</b></p> <ul style="list-style-type: none"> <li>•An environment that allows for communication;</li> <li>•One laptop per student;</li> <li>•One interactive whiteboard;</li> <li>•Internet connection;</li> <li>•Audio.</li> </ul>
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### 3. THE EXPERIENCE

We presented the game to the students of 3rd cycle of Primary Education and let them experiment with it. The story is engaging because the characters are similar to them, both in behavior and use of language. The game keeps the students focused as they want to complete the mission. Their observations generate many questions, such as “why don’t the huts have windows?”, “with a thatched roof, didn’t the rain go through?”, “what did these people do for a living?”, “is there any Castro close by?” These questions lead to research and individual learning, which will later be shared in the classroom. After the session, the game travels to the students’ homes to involve parents in the learning process. To sum up, in this situation, teachers, students and parents (the learning community) learn with the game.



Image 2: Student playing "The Holy Torc"

We want to outline the following aspects of the experience:

- It is appropriate to carry out the game activity before starting the topic;
- There is powerful motivational context;
- There is easy and feasible use of the game, both at school and at home;
- It develops new ways of understanding;
- It allows for a higher level of memorization;
- It gives immediate feedback;
- The student learns at his/her own pace;
- It fosters co-education;
- It allows for cross-discipline teaching;
- It sharpens observation and visual and spatial discrimination;
- It develops logical thinking: problem solving skills and strategy building.

**Acknowledgements:** Illustrations for the game have been done by Sixto Ramos (Spain), [sixtum@gmail.com](mailto:sixtum@gmail.com). We would like to acknowledge the contribution of the students of Hearing and Speech, who recorded the voices for the young characters in the game.

**Keywords:** history; castros; celtics; druids; torc; dolmen; tower of Hercules; native plants.

# Contest for Ambassadors

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**Abstract:** This contribution presents the GBL scenario *Contest for ambassadors* developed within the ProActive project. It describes the structure, the characters, the stages, the goals of the game and its possible application in real learning contexts.

**Keywords:** GBL scenario; peace talks; negotiation; social skills; EUTOPIA game

During the involvement in the ProActive project as participant, I developed the GBL scenario *Contest for ambassadors* with EUTOPIA editor. The game engages the players in the simulation of peace talks between the ambassadors of Melo and Athens that happened in the 416b.c.

The characters/roles to be played are the general and the admiral on behalf of Athens, the governor and the general of Melo. The game goal is the negotiation, made in order to prevent the conflict between the two cities through different phases: 1) to analyse the origins and roots of the conflicts; to foresee the possible outcomes of a failed agreement; to identify a set of questions to ask during the meeting for the confirmation or confutation of the hypothesis on the reasons and the goals of the other ambassadors; 2) to understand the reasons, troubles and goals of the others through the discussion; 3) to identify the key points of the discussion; 4) to find possible solutions that can be alternative to the violence, 5) to carry out a negotiation for coming to an agreement.

The subject/field at the base of the learning scenario is connected to the curriculum of history, social studies and transversal skills. For this reason the game can be applied in different contexts with several target groups: high school courses of study in psychological and pedagogical sciences, university courses on political science or training courses for adult people in social and community mediation.

The learning objectives are connected with both knowledge and skills: in fact they are related to the acquisition of knowledge about historical and social concepts, to the exploration of the practices connected to active listening, to the understanding of the interests and the values of others people, to the learning of how to handle a conflict in a nonviolent way, thus learning also how to be a part of the social community.

The game is included in a wider learning scenario with planned activities before and after the game: before the game session the players should study the historical context, set up the atmosphere, have knowledge of roles and responsibilities assigned; also it can be useful plan informal meetings between groups of roles in preparation for the game. During the game session, the tutor/teacher takes note of some questions to ask in the feedback phase. As the game is complex and includes several stages, it can be foreseen that the negotiation goes on for more than one session, and in this case students should note down significant topics in a diary. When the game is definitively concluded, players will be involved in the discussion and reflection on the experience and in the research of present examples of the same dynamics as further development of the GBL scenario.

# Proactive agency

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**Abstract:** This contribution presents the GBL scenario *Proactive agency* designed and implemented for highschool students, within the ProActive project. It describes the structure, the characters and the goals of the game as well as the added value of proposing a game session at school.

**Keywords:** GBL scenario; advertising art; EUTOPIA game

*Proactive agency* is a GBL scenario development with the EUTOPIA editor within the ProActive project framework. The game is a role play in which students can play complementary roles of professionals belonging to an advertising agency: *the art director* which defines the visual and graphic aspects, *the copy writer* that writes the texts for the advertising campaign and *the media planner* that identifies tools and media to spread it.

*Jiminy Cricket* is a character taken from the Collodi's fairy tale *The Adventures of Pinocchio*; within the game, he has the role of supervisor and responsible in charge of the team work. Players can refer to Jiminy cricket for having support or suggestions.

Through collaboration, players should attain the game goal that is the creation of an advertising campaign on the theme *alcohol abuse among adolescence*.

The game structure includes different steps, such as the definition of the target group, the elaboration of the concept, the choice of the appropriate tone and style for the communication, the definition of the copy strategy and the development of the final product. The learning objectives of this GBL scenario are connected with the development of both knowledge and skills: to foster the students' creativity, to develop cognitive skills related to problem solving and decision making process, to encourage team spirit, to put the knowledge acquired into practice, to improve abilities connected with advertising art.

The decision to create a game arose for the willing of widening the learning experience reached during the school year to a game-like simulation context where students could experiment their abilities.

The learning metaphors that underlie this GBL scenario are mainly discovery, participation and experimentation. These metaphors were chosen because they are well adapted to the learning objectives to be attained through the game and also because they support the usual teaching activities for this subject. In fact, the game was mainly designed as a tool that can improve the students' creativity: the teacher set the goals to be achieved and the players are free to find resources (both material and personal) and use them in an alternative way for developing a creative and original result.

The motivation on the basis of the involvement in the ProActive project is a personal interest in new resources that can enrich and improve teaching practice. Although during the design process difficulties have been encountered in the attempt to make the game more involving and attractive and also some technical problems occurred, the experience in the project was positive and the creation of the game was reach and funny.

After a negotiation, the school (I.I.S.S. Via Sarandi high school) decided to give the approval for testing the game with students, that felt engaged by this new possibility.



# Scratch the surface!

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**Abstract:** This contribution contains a brief description of the GBL scenario *Scratch the surface!* developed for middle school students within the ProActive project context, and some information about the game design process and the teacher's involvement in the project as game designer.

**Keywords:** GBL scenario; EUTOPIA game; Mathematics; Science; quiz game

*Scratch the surface!* is the title of the GBL scenario developed during my involvement in the ProActive project. It is a digital educational game created with the EUTOPIA editor and it consists in a quiz with growing difficulty levels during which students face different challenges (such as calculation and problem solving, team works and online researches) connected to the subjects of Mathematics and Science. The reward system include the assignment of scores after every challenge by the teacher-tutor. During the game session, the teacher-tutor has a directive role: she/he issues the challenge, evaluates the results and assigns the score, while the players are involved as students and they don't play specific roles.

This type of game (quiz game) was chosen for different reasons: first of all it is simple to play and well-known by the students; it also embeds a good competition between players in order to win a prize or a reward.

The game is included in a wider scenario that envisages learning activities before and after the game: it requires a set of previous contents and abilities in order to correctly play the game that can be learnt during school lessons, and an evaluation of the game session through feedback from the students and group discussion.

The learning objectives of "Scratch the surface!" are: to gain new knowledge and get familiar with specific notions and contents connected with Mathematics and Science, learn the use of the online research with the main search engines, to learn to be a part of the community they learn in, to gain expertise and to enhance the knowledge acquired through communication and collaboration between classmates.

Concerning the Five learning metaphors, players' participation is required for the group works during which students are allowed to interact and collaborate for achieving the learning goals; discovery is required for the challenge that demands the search of information, while experimentation is the metaphor of the exercises in which students solve calculation and problems, putting mathematics knowledge in practice.

This GBL scenario was developed for the specific learning context and target group of the school where I work in: eleven-years students from middle school within a course of study including mathematics and science as school subject. Nevertheless, the game structure can be used in different contexts, adapted to others learning goals, students' profiles and learning contents. In fact, the game is very flexible as it allows teachers/trainers to decide the contents to be learnt, the challenge to be faced and the reward system.

The game design process required more time than expected at the beginning, especially when new ideas to be implement in the game came out.

EUTOPIA is considered as a game editor that allows the game creation in an easy and intuitive way. However, it can be improved through improvements to the graphics.

# Trial for Mobbing

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**Abstract:** This contribution presents the GBL scenario *Trial for mobbing* within the ProActive project. It describes the structure, the characters, the stages, the goals of the game and its possible application in the learning contexts.

**Keywords:** GBL scenario; mobbing; trial; EUTOPIA game

The motivation forward the project and the game design came from the personal interest in alternative teaching approaches, in the use of educational tools and simulations with the purpose of fostering students' learning process and making it easy, enjoyable and interesting. In fact, when the DPPSS team proposed the involvement in the ProActive project, the proposal was immediately accepted because the use of games in the learning activities is considered as a way to improve students learning achievements.

Regarding the personal experience in the project, it is regretted the lack of collaboration and support from the institution and the co-workers, who were afraid to attempt the game development.

During the game design process, some difficulties occurred concerning the organization of the time for the design process, the use of the EUTOPIA platform and putting the idea for the game in practice on the basis of the editor functionalities.

I've worked for a long time as teacher of economic and legal discipline in a high school in the province of Rome. During the involvement in the ProActive project, the GBL scenario *Trial for mobbing* has been developed with the EUTOPIA editor. The game is a simulation of a trial for mobbing during which seven characters interact among them in 3D environment playing different role, each of them with specific goals to attain: lawyers, judge, plaintiff party and witnesses.

The game subject (connected with Social science, Psychology and Legal discipline) was chosen because the mobbing is a diffused phenomenon in the workplaces and also because it is linked to the bullying in educational contexts. So besides the specific learning objectives that will be following described, the GBL scenario was created with the aim of engaging students in the reflection and discussion about the mobbing in connection with the bullying and the students' personal behaviour and attitude towards other people.

The learning objectives to be attained through the game are connected with both knowledge and skills: to acquire knowledge about mobbing (regulations in force, clinical aspect, prevention methods, protection and monitoring measures); to interact with peers for attaining a common goal; to develop a "team spirit" and a "good" competition among peers; to develop the ability to understand, analyze, formulate hypothesis and take shared decisions.

# Parents Advice Service reaches out

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The Parent Advice Centre in Tower Hamlets works with a large number of parents who need help and advice concerning the ways in which they relate to their children. The knowledge and expertise accrued by the centre is perceived by many to be extremely valuable, the result of years of research and built on first hand experience of the field. But how is that information to be transmitted to the parents? There are a number of immediate problems:

- The parents often lead chaotic, dysfunctional lives
- Attendance at advisory sessions at the Centre is often sporadic
- The parents who actually attend sessions are a small proportion of those who need to
- Many who do attend only do so because of court orders

These factors demand the delivery of much needed information in flexible ways, ways that are relevant and well targeted. The information has to be packaged to make it attractive and engaging. It must appeal to a wider audience to gain the attention of the many. It must be supplied when and where needed.

To respond to these challenges, Ian Findlay, formerly an officer but now a volunteer with the Parent Advice Centre (cuts in local government have caused widespread redundancies), turned to game-based learning. He has some experience in promoting the concept. He has worked with CAST (The Centre for Advanced Software Technology based in North Wales) to design a number of packages that use software for innovative educational interventions. He commissioned in 2007 a 3D video game that explored anti-social behaviour. Part funded with money for inter-generational learning, it features a granny from Tower Hamlets on her walk to the doctor's surgery finding all sorts of objects that are dumped on her streets and asks the user to guess how she reacts to them. The project included important elements of user-centred design, a technique promoted in the ProActive project, and the involvement of six institutions.

His vision of game-based learning for his target group prescribed short, sharp messages delivered over the web that could be picked up and explored by parents when they needed to turn to them wherever they were. This required hosting on a free website (there is no budget for the project) and this is provided by a related set of parents meeting in the Parent Advice Centre: the parents of children with special needs.

Ian worked with a small team to produce scenarios that have short, sharp messages that do not patronize the users of the site. So far he has implemented three. The feedback so far is good.

**Keywords:** Parent, advice, user-centred

# Applied Science Training: scene of crime officers in the making

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The Welsh Government is concerned that young students do not all respond well to the provision of academic courses. Many are put off education and vote with their feet. In order to combat this apathy, the Government has encouraged the setting up of courses that are vocational in form and content, that seek to train as well as educate. These courses can be delivered in places of work, colleges of further education and schools.

John Whittaker and his team have developed a BTEC Applied Science course at Ysgol Friars that trains young people in forensic science. This is a vocational course, taking a highly practical approach. Following examination board guidelines, BTEC Applied Science learners are rewarded along the way for consistent hard work and demonstration of their knowledge, without the added pressure of exams at the end. They are offered active learning in a vocational context that builds confidence, competence and motivation in learners. The Applied Science course is the first of a number of courses that are currently being planned in the institution. It is hoped that game-based learning will become a feature too of these courses. The package and evaluation results are to be made available to other BTEC Science trainers in other institutions, itself a form of professional development.

This Science course is designed for lower ability 16-18 year olds. This is traditionally a group that has been under-resourced and current teaching and learning materials are trainer generated. This is also a group whose performance is often adversely affected by poor attendance, behavioural difficulties and low attention spans.

The team's task was to develop a package that would appeal to this group and comply with the BTEC guidelines. Clear, unambiguous content needed to be created that offered students ways to demonstrate knowledge of procedures and equipment used in forensic science investigation.

Forensic science is an area that normally precludes the involvement of younger students in real life investigations. But John's computer game offers users the chance to go seek clues at a murder scene, to analyse them and even to offer theories as to 'whodunit.' All along the way users pick up the skills and knowledge needed by real life investigators.

The very subject of the 'House of Cain', a puzzling case where any one suspect of six could be the perpetrator, is seen to engage the user through the drama and televisual graphics. Because of the nature of the learner and the often sporadic attendance of many of them, the facility to access the package over the web was an added attraction.

**Keywords:** vocation, science, training

# Three experiences with <e-Adventure> games in Aragon

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The CATEDU (in Spanish Centro Aragonés de Tecnología para la Educación) is a centre specialized in educational technology that operates in the Spanish region of Aragon. During the last year (2011), CATEDU has developed three <e-Adventure> games in collaboration with the e-Learning group from Complutense University of Madrid (UCM) as a pilot experience: *First Aid* (Primeros Auxilios in Spanish), *Business trip to London* and *Visit to the hospital*. *First Aid* is a game-like simulation, developed with photos of a real scenario, where students have to rehearse different procedures to help a person in trouble. *Business trip to London* and *Visit to the hospital* are cartoon games aimed at improving kids' English vocabulary in two situations of daily life: planning a trip by plane and asking for health care. *First Aid* was tested with more than 300 students achieving promising results, both in terms of improvement of the learning outcomes and student acceptance. All these games have been released under the terms of the Creative Commons license, and can be downloaded from CATEDU's official website for free (<http://catedu.es/webcatedu/index.php/descargas/e-adventures>). The development of three more games has been scheduled for 2012. During this demo, attendees could approach members of this project, try the games out and share their experiences. In this manner attendees will have the chance to compare two different types of games (game-like simulations composed by photos and cartoon-like games) developed with <e-Adventure> and gather ideas for future Game-Based Learning scenarios.

**Keywords:** <e-Adventure>, CATEDU, UCM, language learning, first aid, educational game

# Development of a Game-like Simulation for Introduction to Clinical Surgery

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Medical training is based on master-apprentice model so, as part of their education, students in health sciences need to spend a considerable amount of time observing professionals in their real work environments. In medicine, and especially in clinical surgery, the presence of inexperienced students in the surgery room is a challenge because it can be disruptive for the staff and patient (e.g. inappropriate actions from students could cause occasional delays in the intervention). *Clinical Surgery* ("El juego del quirófano" in Spanish) is an <e-Adventure> game-like simulation developed by professors of medicine from Complutense University and members from the e-UCM e-learning research group. The game allows to rehearse the first visit to the operating room in the aim of reducing students' stress and, at the same time, improving students' performance in the surgery room. The final goal is to avoid common errors and interferences during the intervention. *Clinical Surgery* has been developed using photorealistic scenarios created with photos of the actual teaching hospital and including surgery professionals in duty. The game exposes students to common situations they can face to learn to react including the most common mistakes done by first-time students to the operating room. Some of these situations are related with dealing with anxious patients or handling sterile equipment, for instance. The game was iteratively improved using the feedback of experts in the field (e.g. surgeons) and students in the last course that have already had their first experience in surgery room. At this moment, the game is being evaluated by students of medical school to identify the actual potential of the game to reduce the identified stress and errors. During this demo, attendees could approach members of this project, try the game-like simulation out and share their experiences.

**Keywords:** <e-Adventure>, clinical surgery, educational game

# Using GBL in ECDL courses

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ECDL - European Computer Driving License is the world largest IT certification program for basic computer skills for end-users and it is recognized worldwide in over 148 countries (outside Europe as ICDL, International Computer Driving License). The ECDL certificate offers their holders the guarantee of having the necessary basic IT knowledge for assuming an active role in e-Society.

During ten years of activity in the ECDL training and testing Center we tested different educational strategies in order to be able to provide the best training experience for our students. From the beginning of our activity we were aware about our students' needs. They spent time and money to learn in addition with their basic activity. For facilitating learning, we have developed ICT learning resources such as eLearning courses and a platform for virtual communication. The aim of ECDL program is to develop IT skills so we have identified the appropriate methods to provide them.

Target group for these programs are wide: persons interested in improving their skills in networking, programming and the effective use of computer applications: high schools students, higher education students, employees from different companies.

ProActive project has come in our attention at the right moment when we realized that we have to improve the learning resources in our educational plan and for that we adopted GBL as a new learning paradigm. During the training sessions for the two game editors (Eutopia and <e-Adventure>), we start thinking about some ideas of game based learning scenarios for ECDL training. The decision to choose a specific scenario was based on current situation. ECDL first module - Concepts of Information Technology (IT), provide theoretical information about IT concepts and for our trainers but especially for trainees this module always has been a big challenge. This comes from the large amount of information that must be transmitted and learnt.

The ProActive project had a serious contribution to rethink the strategy applied during the course. Through training sessions, we discovered new concepts of teaching and learning, and also the game editors. With the help of these powerful tools, we thought that some games could help us to speed up the learning process. In software development we use the 5 steps Waterfall model: Analysis, Design, Testing, Production/Implementation and Maintenance, with a greater flexibility in order to assure that the final game will have a great educational value.

At the beginning I had a misconception about <e-Adventure> editor. Trying to design a complex game I've reached the conclusion that the editor doesn't had enough functions and graphical elements, but how Edward Teller the nuclear physicist said "*The main purpose of science is simplicity and as we understand more things, everything is becoming simpler*", I've realized that the editor was a perfect tool and with a good educational scenario, one game can be simple, fun and an unique learning experience.



Screenshot 1: IT shop entering



Screenshot 2: Taking hardware components

"Hardware components" game will help the trainees to learn about physical parts of a Computer, and it was designed using e-Adventure editor. In this game learners have to go to an IT shop and buy all necessary hardware components for

a personal computer and in the last scene they have to assemble the components in order to obtain a functional PC. In this game I had to add some funny lines and feedback to the actions, in order to keep students engaged and relaxed during the game (e.g. after turning on the computer, if CPU cooler is missing, the seller character line is “*I have to call the fire department! You forgot the CPU cooler*” and the computer is on fire). The hardest part of designing this game was to collect images, to take pictures to cover all possible steps in assembling scene. Working in Photoshop was again a challenging part because of the large number of pictures to be edited.



Screenshot 3: Assembling scene



Screenshot 1: Not the best end...

The game has been implemented on a Moodle platform where the students had online access with secure accounts provided by trainers and in the same time was installed on IT lab computers as a backup solution. I actually use two different GBL scenarios modifying the moment of introducing the game.

First learning scenario starts with trainer's presentation about hardware components, explaining how the computer works, what are the basic hardware components. After that, students start playing the game in the purpose of consolidating knowledge.

In the second GBL scenario I've introduced the game to the students at the beginning of the course. In this case students become more responsive and open minded, it had been their first experience in a course which start with a game. Even this experience look surprisingly the students' reaction was very positive, they declared that the game increased their interest for the entire length of the course and most of them found that in this situation, learning by doing is more interesting because they discover information in a dynamic and attractive mode. Over 100 people had played the game and their reaction and interest was clearly for me as a trainer that I should design more games (at least one for each chapter of curricula). Students characterized this activity as: interesting, useful, engaging, innovative, educational, funny / entertaining and fascinating.

Introducing GBL as new educational method in ECDL training center activity it can be said that our results had been improved especially in theoretical courses. In the near future we will design more games which could be integrated in current curricula. <e-Adventure> editor can be used successfully to design any type of game, starting from simple ones to more complex. The trainees learn about theoretical stuff in a better and fun way.

**Keywords:** ICT; GBL; ECDL; Life Long Learning



# Photoshop

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The aim of this paper is to offer brief information about the activity conducted during the game design session, about the phases of creating such game, and ideas of further improvement. This game has been created using the <e-Adventure> platform, which offered me the tool to create a virtual world of Photoshop.

The ProActive project was an opportunity to revise my teaching methods, and to be more careful about what is needed for me to be creative in classes and for my students to be interested in what I teach. Teaching and learning, both in traditional system and computer mediated has become to some extent boring. Even if we are working all the time using computers, the base of teaching and learning is for me to transmit the theoretical information and to exemplify different action on a screen, and for the students to reproduce the action and retain the information. This course could be more attractive, fun, resulting in students becoming more active in class.

I analyzed the resources offered into the project, and I decided to work with <e-Adventure> platform which seem to be suitable on what do I want to teach and responds to my objectives about an educational game. Through the training session I've learned to work with this game editor, I've read the user manual and also I searched for new information on the web. Of course, during the design process difficulties appeared, there were some unknown quantities, but I tried to solve each problem as it appears. I established the learning objectives for the course and I tried to create a game to respond to these.

First step in creating the game was to underline the main ideas of the game: what do I want to teach?, what are the game objectives, how could these be reached, rules, what are the scenes, characters, how the interaction with object will be, conversations, and more, how can I evaluate students after the game. During the game I improved many times the initial plan, adding new ideas in the editor, according with its affordances.

In this game I wanted to include aspects related by: Installing the Photoshop application, familiarization with applications' menu and buttons, opening an image, how to unblock image, and edit an image. Also I found it useful to introduce, at the end of the game, an evaluation session, with few questions, to help the players for self evaluation. If the students cannot obtain a good result in the evaluation session, they will be re-directed to the game.



Fig.1 Start scene, with characters



Fig. 2 Games' objectives and rules

I decided to organize the game on two levels:

First level is learning— here, the player will be assisted by Photoshop specialists; it was designed as a trip, in which the player will be familiarized with the application. The Photoshop specialists show the player how to work with the application, asking him in the same time to perform specific tasks.

Second level is evaluation – is the last level of the game. The player has available a set of six multiple choice questions with one correct answer and one for 4 minutes to answer these questions. Once the test is finalized, the player receives an immediate feedback with the results, and if he did not answered correct, the right answers will be displayed. After the test the students have the opportunity to go back in the game in order to revise their information.



*Fig. 3 Accessing the Photoshop scene*



*Fig. 3 Enter in the evaluation session*

Once my plan was ready I prepared the resources: pictures, movie, screen shots, conversations, questions for final evaluation, in order to re-create the Photoshop environment. I wanted to create an animate and interactive game, in which students to learn, discover, investigate their own to find solution and to exercise, to self evaluate. The dialogue lines are appropriate and send useful information, being in the same time funny. If the players needs information they have to ask the Photoshop specialists, and these will offer the information immediately. Also, through the game is ensured an immediate feedback, to warn the users about their actions.

Using this platform, we discovered several bugs that we have reported to the technical team of <e-Adventure> in order to be solved; the answers received helped me to solve and, if necessary, avoid them.

During the time, there more releases, each being tested with the help of colleagues or students. The future plan is to improve the game, adding more interactivity and complexity levels, offering alternative pictures to be edited.

**Keywords:** Photoshop CS4, game, pictures, images, effects.

# Learning through a game: Eutopia to train e-tutors

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**Abstract:** This contribution aims to describe the role of Eutopia platform to train a group of e-tutor belonging to a project of development of a virtual learning environment accessible also to disabled students. E-tutors have been specifically trained in order to sustain and support relational and communicative processes, to animate and support discussion groups; to manage learning contents making it easier to access and use them, to create connections between student and student as well as students and teachers in all the activities offered. This was obtained through the employment of a GBL scenario/game *COPI – Writing lab* developed within the ProActive project activities. The scenario helped the teacher to provide e-tutors with abilities, competences, skills and understandings useful to perform meditative functions within an accessible and interactive learning environment.

## 1. The context

According to a constructivist theoretical framework, the idea is to construct and develop learning environments tailored on the characteristics and potentialities of the single students offering learning contents and activities according in a multimodal format (audio, video, text) according to the norms regulating accessibility for all. This in order to provide each user with equal opportunities and possibilities to access and use learning environments and materials and, at the same time, to be acknowledged and valued in one's own specificity and uniqueness.

In detail, the project Rete@ccessibile - whose main goal is the development of a virtual learning environment totally accessible, "friendly", functional to different learning needs and profiles of university students, with a particular attention to disabled ones - is focused on the possibility to experiment a new way to use technologies as a support to interactive, participatory and collaborative methodologies and strategies to support learning within the university contexts in an inclusive perspective.

Within this environment it is possible to visit different spaces for learning and socialization: a) common entrance area, a sort of virtual "hall" for the students of all the universities involved in the project as well as to the students of the universities collaborating with the project where they can meet each other in the "square", reflect on their own characteristics and potentialities and identify their own learning profile, make a preliminary assessment of competencies, reconstruct their personal educational pathway focusing on the most significant moments, places and spaces, chat, discuss in a forum, view and comment scenes from a selection of movies, construct and discuss a conceptual map focused on inclusion in order to participate to the construction of a more inclusive university culture; b) an area specifically dedicated to university courses, each of which has a dedicated virtual classroom.

## 2. The professional profile of the e-tutor

The above described learning environments has to be animated and managed in order to sustain the processes of interaction and learning involving the students at different levels.

For this purpose, one of the activities has been the selection and training of a group of e-tutor, in order to provide them with abilities, competences, skills and understandings useful to perform meditative functions within an accessible and interactive learning environment.

E-tutors have been specifically trained in order to sustain and support relational and communicative processes, to animate and support discussion groups; to manage learning contents making it easier to access and use them, to create connections between student and student as well as students and teachers in all the activities offered.

According to this framework, the profile of the e-tutor involves the following abilities and competences:

- Establish relationships with the students
- Communicate with the students in an appropriate way
- Provide the students with a technical support
- Encourage and support the students
- Evaluate student's performances
- Apply communication techniques in virtual classrooms and virtual learning environments.
- Manage and monitor learning session in real time.

The above described referential of abilities, competences, skills and understandings which can be certified at a national and international level (Tranining Foundation, 1998-2000) are contextualized curriculum developed on the basis of a pathway of individual and collective reflection regarding specific problematic issues related to different areas of professional competences

According to the constructivist framework which represents the theoretical matrix of the project, e-tutors have been trained not starting from a standard and de-contextualized frame, but through the construction of a professional profile starting from the different background, from the experiences and knowledge of the tutors, in order to valorize the diversity and uniqueness of each one in the reflective construction of a professional profile.

In order to construct a suitable learning environment to train e-tutors a GBL scenario/game has been developed within the ProActive project activities using an open source device (Eutopia) which could be easily adapted and implemented so to be integrated in Rete@ccessibile.

### **3. The use of Eutopia in e-tutor training**

The training curriculum for e –tutor has been developed through on line sessions, in presence sessions and situational stage sessions aimed at developing problem finding and problem solving competences as well as didactical and pedagogical competences.

Some of the stage sessions have been organized using the software Eutopia which is particularly useful to plan and deliver role-games for psycho-pedagogical purposes.

The stage sessions with Eutopia have helped the tutors in learning through games and in developing abilities useful to decide in complex situations and to construct interactive educational tools.

The virtual representation of different situations, the performance of different roles which is possible to experiment with Eutopia are useful to explore new reasons and new perspectives, opening up to multiple different points of view and determining significant changes in individual performances.

In detail, the stage sessions with Eutopia have been articulated in the following steps:

1. Organization of role-playing sessions supported by dedicated scripts and storyboards (GBL scenario development);
2. Guided experiences of role playing in Eutopia;
3. Debriefing;
4. Description of the editor and individual creation of a storyboard;
5. Organization of small working groups with the task to produce a storyboard focused on the management of learning and socialization processes;
6. Use of the storyboards among the group of tutors performing the different roles available in Eutopia;
7. Debriefing.

In the process of guided apprenticeship of the use of Eutopia tutors have been supported in implementing their communication skills as well as their competence in the use of ICT through a web 2.0 learning environment.

The group has acknowledged the educational potentialities of Eutopia taking into account that through motivational and involvement strategies it becomes possible: a) make an informal transfer of knowledge and competences regarding the learning management as well as specific contents referred to inclusion or to a disciplinary area; b) develop transversal abilities and competences functional to the management of relational problems within educational contexts.

Eutopia has also been appreciated as a tool to promote and support self training and self evaluation for e-Tutor.

### **4. Using Eutopia in educational practice**

Once they have developed competences functional to the construction and development of story boards to be used with Eutopia, the e-tutors have planned to use Eutopia to support some of the learning activities offered through Rete@ccessibile, with the proper adaptations and integrations required by the objectives of the project which takes into account all the accessibility parameters imposed by the law (Stanca, 2004).

E-tutors have planned to use dedicated storyboards for the different areas of the learning environment, constructed according to specific learning objectives.

E-tutors believe that Eutopia, as it provides a device to “play” and develop games to support learning, is particularly interesting when referring to contexts and situations that require to be reconstructed, explored in depth, adapted to the needs of each and everyone.

Eutopia offers the possibility to explore the world through multiple and various perspectives and points of view in a virtual environment and therefore supports the development of transversal and specific competences such as negotiation competences, which are an important resource in university contexts.

Guided interaction with other users in the learning environment provided by Eutopia and Rete@ccessibile (in asynchronous as well as synchronous modes) supports also the development of relational competences functional to a process of full inclusion within the contexts of university life.

**Keywords:** GBL scenario; disability; EUTOPIA platform.



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# Editors

## **Mario Barajas Frutos**

Mario Barajas Frutos is Professor at the Faculty of Pedagogy of the University of Barcelona. He leads Future Learning (<http://www.ub.edu/euelearning>) an initiative at the University of Barcelona aimed at developing research in the educational, cultural and socio-economic aspects of the use of digital technologies in learning; the research promotes synergies with different disciplines in rethinking knowledge conceptions and knowledge production in the multidimensional spaces that define the European culture of the XXI century. With a background in Engineering, Philosophy and Education, Dr. Barajas was former secondary education teacher in the area of math and experimental sciences. During the last twenty years he has coordinated and participated in many EU-funded projects in the area of learning technologies, evaluation of learning innovations, and lifelong learning policies. Currently he coordinates the project PROACTIVE - Fostering Teachers' Creativity Through Game-Based Learning, a project funded by the EU-Lifelong Learning Programme. He has published several books and scientific articles, and belongs to different European research networks.

## **Anna Trifonova**

Anna Trifonova has a PhD in Information and Communication Technologies (ICT) from the University of Trento (Italy) focusing on wireless and mobile technologies in education with application on language learning. She is experienced in ICT from both technical and methodological side. Her interests include technology-facilitated learning, creativity and innovation facilitated by ICT, networking tools for support of virtual communities, etc. She has participated in several EU projects and national-level projects in Italy and Norway. Since 2008 she is part of the FutureLearning team at University of Barcelona and was actively involved in ProActive.

## **Alessandra Delli Veneri**

Alessandra Delli Veneri, psychologist psychotherapist, PhD, graduated in Artificial Intelligence Psychology (Seconda Università degli Studi di Napoli - SUN) in 2001. She focuses her interest on the relational aspects of the employment of new technologies in learning and training processes. She gained knowledge on research project management and she now holds a research grant in the Natural and Artificial Cognition Laboratory (NAC) of the University of Naples Federico II where she works on NAC's research projects and on their application in society.

## **Frédérique Frossard**

Frédérique Frossard holds a postgraduate certificate in "Multimedia and education" (University of Barcelona). Moreover, she graduated in social Psychology (University of Franche-Comté, France) and obtained, in 2004, a Post-Graduate Master in "Work Psychology, ICT and Ergonomics" (University of Metz-Nancy, France), specialized in professional training. From 2007, she has been part of the Future Learning research initiative at the University of Barcelona, actively participating in several EU projects related to Technology Enhanced Learning (LLP, FP6, Socrates Minerva). She is now mainly involved in the ProActive project, on which she is doing her PhD. She shows a special interest in the fields of GBL and creativity.

## **Barbara Mellini**

Barbara Mellini is a psychologist. She is PhD student at Sapienza University (Rome) and works as researcher in the IDEaCT Living Lab. Her research activities lie in the introduction of information and communication technologies in everyday life contexts, especially related with users' activity analysis, user experience and co-design.

This book collects the contributions of experts and practitioners to the GACET'11 Conference. The 2011 International Conference on Games and Creativity in Education and Training (GACET'11) is a refereed scientific conference acting as a forum for scientists, teachers / trainers, and practitioners to present their latest research, results, ideas and developments on games and learning. The focus is on the use of educational games in creative teaching methodologies. The conference is organised in the context of **ProActive**, a Lifelong Learning Program project funded by EC that aims to foster creative teaching by designing and using educational games in different training contexts. Through a constructivist approach, the project has created learning environments in which school teachers, university lecturers and professional trainers apply creativity designing Game Based Learning (GBL) scenarios using two game editors, EUTOPIA and <e-Adventure>.



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