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Exploring New Technological Tools for Education: Some Prototypes and Their Pragmatical Classification

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1. Introduction

The aim of this chapter is to introduce at exploring the potential of games in educational sector. More in depth, in this chapter we'll describe: two European projects (*Proactive*[11] and *T3*[1]) with a specific focus on use of technology in formative sector; and a platform (*Eutopia*) experimented in both the projects with which educators can create virtual scenarios where students play a role and simulate a specific situation.

Both *Proactive* and *T3* projects have used an experimental approach in which trainings were implemented in order to test the efficacy of the formation planned.

Preliminary results of the projects will be presented and discussed. The evidence supports the utility of using new technology in non-ordinary contexts, in order to foster learning process.

2. To learn by enjoying oneself

Educational research has generated many methodologies, tools and practices exploiting the potential of technology. Outside the laboratory, however, the advanced techniques employment remains low. Despite technical and methodological progress, the most part of e-learning still consists of video-lessons and page-turning web sites.

The dynamics of teaching/learning through multimedia tools is, instead, an active process that takes into account different general principles of cognitive control (Mayer, 2000): the dual coding (Paivio, 1991); the cognitive load (Chandler & Sweller, 1991); the active processing (Mayer, 2000). This process produces in turn its own specific principles: the integrated mental model (multimedia) rich of clues and recovery (Mayer & Anderson, 1991); the spatial and temporal proximity of stimuli that facilitate learning (Mayer & Anderson, 1992); the relevance or consistency of the material proposed (Harp & Mayer, 1998); the

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different ways of transmitting information (Mayer & Moreno, 1998); the customization of the teaching / learning dynamic (Mayer & Gallini, 1990).

The use of computer games to foster learning process is a new input in the didactic world; the interest in exploiting the educational potential of computer games is increasing as instructional games involve a direct focus on the learner's active participation. Alessi (2000) stresses the importance of game-based learning, clarifying that it is a balance between *conceptual* (teaching about) and *procedural* (teaching how to do) knowledge. Computer games address many of the limitations of traditional instructional methods; games have the ability to motivate learning, increase knowledge and skill acquisition and support traditional teaching methods.

Much attention has been given to the so-called serious gaming (the use of commercial or ad hoc games for serious educational purposes) (Ives & Junglas, 2008). The effectiveness of serious games based approach lies in these words by Van Eck: "*The extent to which these games foil expectations (create cognitive disequilibrium), without exceeding the capacity of the player to succeed, largely determines whether they are engaging. Interacting with a game requires a constant cycle of hypothesis formulation, testing, and revision. This process happens rapidly and frequently while the game is played, with immediate feedback. Games that are too easily solved will not be engaging, so good games constantly require input from the learner and provide feedback*" (Van Eck, 2006, 5).

Moreover, games fill up people's large periods of time (adolescents and adults) and promote those levels of attention and concentration that teachers and trainers imagine people should apply within their own learning process. Therefore, what can the educational sector learn and use from these games in order to enhance the learning process by enjoying oneself?

3. Developing digital games for educational goals

The Game-Based Learning (GBL) is the use of digital games with serious goals (i.e. educational objectives) as tools that support learning processes in a significant way. It is also known as educational gaming. Studies in the field of GBL show a clear relation between playing digital games and learning. There are a number of arguments in favour of digital games as learning tools. It is more often argued that they can enhance students' motivation for learning because of their engaging nature. Indeed, digital games can provide challenging experiences that promote the intrinsic satisfaction of the players, keeping them engaged and motivated.

Moreover, players have fun while playing a game because they have to learn it. Indeed, in games, the challenge usually increases as long as the game goes on. Therefore players need to improve their skills and learn new strategies until the game is completed.

Another feature of digital games, that is remarkably aligned to good learning, is that games provide short feedback cycles. This allows players to explore the game environment freely, trying out their hypotheses, learning by trial-and-error and getting immediate information that they can use to redefine wrong assumptions in a risk-free environment. This characteristic is well aligned with educational requirements, given that most educational approaches require the educator to provide students with feedback about their achievements. Therefore, as digital games set the player in a world that is free to explore

without requiring the intervention of an instructor, video games are an ideal medium to promote authentic learning and "learning by doing" processes, turning the student into the leader of his / her own learning experience. In this sense digital games can provide meaningful learning experiences by simulating highly interactive scenarios that professionals encounter in real-world settings, where they face open-ended, real-world problems.

In consequence, digital games represent a good medium to promote active learning and improve students' problem-solving skills and not only simple fact memorization. It has been demonstrated that for certain target groups (e.g. school students), they can increase personal fulfillment and lead to higher performance.

For the reasons mentioned above, an increasing number of teachers and trainers recognize the value of digital games in education. Most of the successful Game-Based Learning (GBL) experiences have used mainstream games (e.g. The Sims), usually referred to as "Commercial-Off-The-Shelf" (COTS) games, because they are ready to be used.

Thus, what is the point of creating my own educational games, if there are things out there ready to be used? Creating a game is a time-consuming task, so in an already time-constrained curriculum where educators are usually struggling to achieve the goals defined by educational regulators and institutions the question is "It is worth taking the time?".

There are clear benefits that come from using custom games developed directly by educators instead of using COTS. Indeed, some barriers to the implementation of GBL in formal learning settings have been identified. For example, the lack of integration of most games with the current curriculum and the lack of appropriate assessment frameworks inhibits GBL. Indeed, COTS games are developed to be entertaining, not educative. Games like The Age of Empires™ provide contents that are rich and valuable from an educational perspective, but also include errors, misconceptions and inaccuracies to make the games more attractive. This is usually a concern that parents show when they are told that their kids will be using games in the classroom. In addition, COTS games are not always easy to align with current curricula, or do not meet educational standards. Indeed, COTS games can demand last generation computers which are not always present in educational institutions. Or if they exist, educators may not have the adequate privileges or support to install them.

In order to overcome the above mentioned challenges, *ProActive* and *T3* propose a framework in which teachers / trainers would design and implement their own learning games. Or at least, actively contribute to this process.

Indeed, educational games available in the market generally do not meet educators' expectations. Actually the quality of many commercial educational games is low. This could be related to the fact that big gaming companies tend to ignore the educational market because of the difficulties posed by a wide and varied curriculum, a lack of interest on behalf of educational policy makers, the inability of schools to find the sort of money that commercial games tend to require and also the security issues associated with large institutions with small IT budgets.

Thus, educators can profit from developing games *for themselves* that have direct relevance to their teaching objectives / students' profile, and that meet the requirements of their own institutions or educational standards. Nevertheless, the creation of high-quality games is a

hard challenge, with multiple approaches and possibilities. Which is the best option for teachers and educators, who may not have an extensive technical background, or a big budget at their disposal to hire a professional development team?

4. Field experiences: "ProActive" and "T3 -Teaching to Teach with Technology" Projects

Two projects funded by the EU Leonardo Da Vinci Life Long Learning Program, "ProActive" (project website: www.proactive-project.eu) and "Teaching to Teach with Technology - T3" (project website: www.t3.unina.it), are designed to validate an innovative teacher/trainer program, demonstrating realistic ways of exploiting advanced techniques within the real constraints facing teachers in their work. Both projects employ a platform for the creation of educational role-playing game called EUTOPIA, that will be better described below.

This game editor is particularly aimed to train and improve soft skills. In addition to the theoretical and technical education, training agencies are also in charge of transferring to students a set of behavioral skills that are a necessary background to deal with professional communities and society. Examples of such skills are the ability to manage emergencies, the ability to negotiate, to take decisions collectively, the attitude to understand others' view points. In general, the teaching of soft skills is primarily linked to experience, where a teacher organizes, supervises and encourages small groups of learners to take part in role playing and simulation.

Most of these techniques for learning soft skills can be transferred in digital platforms and online technologies. There are many different educational games (serious games) in which the player-learner has a specific role and must pursue a goal assigned by the teacher / trainer. Trainers can find games that are dedicated to the transfer of a particular segment of knowledge/skills (closed systems) and platforms that enable teachers and learners to develop and edit their own educational scenarios with specific goals (open systems).

4.1 ProActive Project

ProActive (Fostering Teachers' Creativity through Game-Based Learning) is a two years project in the EU LLL program (Project Number: 505469-LLP-1-2009-1-ES-KA3-KA3MP) which started on January 2010. The project tackles creativity in the context of lifelong learning by stimulating creative teaching practices through the use of different learning metaphors in various educational levels. Through a constructivist approach, the project is creating learning contexts where teachers and trainers can apply creativity in designing their own game-based learning (GBL) scenarios by using digital tools. ProActive offers to teachers and trainers the possibility to use GBL as an innovative and imaginative approach in their teaching practices, in order to enable them to create learning environments interesting and engaging for their students.

In 2009, the European Year of Creativity and Innovation aimed to raise awareness of the importance of creativity and innovation for personal, social and economic development. The initiative addressed a wide spectrum of related themes such as fostering artistic and other forms of creativity through pre-school, primary and secondary education including

vocational streams, as well as non-formal and informal education, ICT as media for creative self-expression, and promoting innovation as the route to sustainable development.

More specifically, the main objectives of ProActive are:

1. To stimulate the creativity of teachers / trainers working in LLP sub-programmes, developing a conceptual framework for integrating different learning metaphors;
2. To introduce innovative ICT-based experiences in teaching / training practice, adapting and enhancing the game editors, integrating five learning metaphors;
3. To implement co-design creativity sessions and pilot sites for addressing school, university and vocational education scenarios;
4. To validate the proposed approach as a means of learning and evaluate its impact on teachers' creativity and students' outcomes.

As final results, ProActive will produce guidelines on creativity enhanced by Game-Based Learning and disseminate a database of Game-Based Learning scenarios and related active learning culture within EU education.

The project is carried out by a consortium of six partners from four countries in Europe (as shown in Table 1), covering various education and training systems and learning cultures.

Partner N°	Acronym	Organisation Name	City	Country
P1	UB	Universitat de Barcelona	Barcelona	Spain
P2	DPPSS	Sapienza Università di Roma	Roma	Italy
P3	CAST	CAST Limited	Bangor	United Kingdom
P4	UNINA	Università di Napoli Federico II	Naples	Italy
P5	UCM	Universidad Compultense de Madrid	Madrid	Spain
P6	UNIBUC	University of Bucharest	Bucharest	Romania

Table 1.

According to many authors, the educational system in many countries does not promote creative teaching / learning processes (Robinson, 2006; Ferrari et al., 2009). Indeed, formal education does not facilitate creative behaviours and skills from students. Learners most often act as recipient of methods, pedagogies and knowledge (Ferrari, et al. 2009). Teachers tended to give importance to relevance, competence and the need to avoid mistakes (Ferrari, et al, 2009). Indeed, formal education has created a culture that often "*accepts only what is relevant*" (Beghetto, 2007). According to Runco (1999), teachers prefer "*conforming*" and "*considerate*" students. Moreover, Ng and Smith (2004) state that teachers often dislike personality traits associated with creativity, as such persons are often dogmatic and will stand for their own ideas against everything and everyone, are self-confident, ambitious, passionate about their work and have a tough skin.

However, during the last part of the 20th century and early part of the 21st, creativity has been seen to be increasingly significant in education, within cultural policy discussions, starting with the landmark advice of the National Advisory Committee on Creative and

Cultural Education (NACCCE, 1999). Many authors (e.g. Craft, 2005; Sawyer, 2006) suggest that creativity should be an important educational objective: "*in today's knowledge societies, one of the key missions of the schools is to educate for creativity*" (Sawyer, 2006). Current pedagogical discourses attempt to view learners as the centre of teaching and learning processes, with an active role in the production of knowledge and meaning, democratically bringing their expertise, experiences and ideas into the classroom (Williamson & Payton, 2009) and thus stimulating also creativity. Nevertheless, creativity still does not seem to play a central role in the curriculum or learning objectives that teachers are asked to follow in every country (Cachia et al., 2009).

On the basis of Runco (1999), Sharp (2004) and Boghetto (2007), Ferrari et al. (2009) present a model opposing implicit and explicit theories of creativity.

"Implicit theories refer to the tacit and shared knowledge of ordinary people regarding creativity, while explicit theories refer to scientific research findings. This model reflects the change of scope regarding creativity that moves towards a personal approach in which there is a creative potential in all individuals and in different knowledge domains."

ProActive aims at fostering teachers' / trainers' creativity. Thus, the project adopts an approach of personal creativity, in which the creative potential is in all individuals, and can be applied to all domains.

ProActive's psycho-pedagogical framework links the concepts of creativity, Game-Based Learning, game design and the five learning metaphors in an integral whole. Although the term *Game-Based Learning* (GBL) has not been given a precise definition, it has been around for almost two decades. Several authors, such as Prensky, Aldrich, Jenkins or Gee, have been discussing Game-Based Learning definition is and potential in well-known articles and books (Gee, 2003; Prensky, 2001), thus laying the basis of Game-Based Learning concepts. Therefore, we can define Game-Based Learning as *the use of computer or other digital games of any kind as tools that support learning in a meaningful way*. Thus, Game-Based Learning 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.

For the reasons mentioned above, an increasing number of teachers and trainers recognize the value of digital games in education. However, they are not sure how to bring Game-Based Learning approaches into the field. Indeed, some barriers to the implementation of Game-Based Learning in formal learning settings have been identified within a study conducted by BECTA on COTS (BECTA, 2008).

- The lack of integration of most games with the current curriculum and assessment framework.
- Time constraints.
- Technical and logistical issues (cost, licensing, limitations of school computers, technical support) - Game-Based Learning cannot become part of the fabric of the curriculum without the appropriate technology and technical support, which is challenging in some EU countries.
- Lack of teacher skills.
- Not all learners engage with games and many do not see a link between games and learning.
- Teacher and parent concerns over the content of some games (e-safety).

In order to overcome the above mentioned challenges, ProActive proposes a framework in which teachers / trainers would design their own learning games. Indeed, available market games generally do not match curricular objectives. The big companies tend to ignore the educational market because of the difficulties posed by a wide and varied curriculum, a lack of interest on behalf of educational policy makers, the inability of schools to find the sort of money that commercial games tend to command and also the security issues associated with large institutions with small IT budgets. Thus teachers / trainers may benefit from ProActive, by developing games for themselves that have direct relevance to their teaching objectives.

A constructivist approach to Game-Based Learning is adopted, where teachers and trainers will develop innovative learning artefacts that are interesting and engaging for their students. The game design process will foster educator's creativity. The metaphors of learning will work as guidelines for the project participants in the creation of educational games as they raise awareness and promote reflection on different learning models and guide the game construction. Furthermore, as a result of the situated design process, a creative product will be obtained – a learning artifact (i.e. an educational game), tailored to the learning needs, institutional and curricular constraints and which can be shared with students. Such creative product is pedagogically innovative, useful and adapted to a specific teaching / learning context.

The psycho-pedagogical framework has been be central in several tasks in ProActive. First of all, it provides basis for the organisation of the training and implementation that is taking place in eighteen pilot sites in four European countries (Italy, Romania, Spain and UK). Moreover, training materials for the teachers and trainers are being developed to correspond to the proposed approach. Finally, the ProActive evaluation framework and appropriate evaluation tools are designed as consequence of the elicited methodology.

Traditionally, teachers and trainers used in their practice a dominant learning paradigm: the instructional, thus limiting their creative potential and inhibiting learning. Recent studies instead show that in normal situations learners combine different metaphors to a lesser or greater degree simultaneously: Imitation, Participation, Acquisition, Exercising, and Discovery (Simons, 2003, 2004, 2008). In ProActive we consider that we don't learn in just one way, but in different ways that depend on personal aptitudes, on the situation where learning takes place and on the content to be learnt. The five metaphors learning model (Simons, 2003, 2004, 2008) is a description of different ways of learning in different people, embedded with learning theories. It can be treated as a comprehensive model that comes out by combining some learning models with the theories of change by De Caluwé and Vermaak (1999). The result is a classification of the ways of learning into five groups (one per metaphor), each one representing a preference for learning that is not exclusive. In fact, every person is able to use all metaphors, but each one in a different situation. The core idea is that we don't learn in a sole way, but in different ways that depend on personal aptitudes, on the situation where the learning takes place and on the content to be learnt (Simons & Ruijters, 2004).

Simons (2003) recognizes that we need a language to talk about learning in less educational ways, incorporating implicit, social, collective and dynamic learning and describing different ways of learning besides the traditional perspective on training. The aim of the metaphors is to find an escape from automatic educational thinking when designing workplace learning trajectories.

In fact, although in formal contexts of learning teachers use a sole dominant paradigm, relevant studies show that it is quite different in the ways of learning in everyday contexts. If in formal learning contexts we learn essentially in individual situations from abstract concepts that are separated from the contexts where these concepts will be applied, in everyday life we learn from direct experience using the concept directly in the real situation where they have to be applied in interaction with others.

Simons' work on learning metaphors has been chosen as core psycho-pedagogical model for ProActive since it offers a comprehensive explanation of possible situated learning experiences. The strenghtness of this model in respect of others (Marzano, 2000; Costa & Kallick, 2009) is, in fact, the focus on contextualized educational theories rather then on cognitive instructional paradigms.

Despite this model is a core reference for the ProActive project, it has anyway to be contextualized and adapted to our methodology and purposes. In fact, the metaphor model is quite unrefined and uses the existing literature on learning in not ever clear and compatible ways. Simons' core contribution is that learning can be experienced in different ways, but the metaphors in Simons' work are analyzed basing on organization and professional learning literature, so we have adapted them, as follows, in order to cover also formal educational contexts (schools and universities) and psycho-pedagogical literature.

Our thinking is that everyone can learn in different ways, which depend on the context of learning, the actors involved in the learning process and the artifacts used for learning, etc. Starting from this socio-cultural approach on learning we also claim that artifacts are not neutral: they reflect the psycho-pedagogical model adopted by the artifact designer.

The five metaphors are: acquisition, imitation, experimentation, participation and discovery, and are briefly described below:

1. Acquisition: Regarding the acquisition metaphor, the idea is to transfer information from one who possesses it (the teacher) to another one who acts as a passive receiver (the learner). It doesn't matter who the learner is and how he / she prefers to learn, as learning is always a repetition and a replication of the acquired knowledge, or product of an individual mental activity.
2. Imitation: The imitation metaphor focuses on modeling behaviours by observing others' reactions to events. The leading idea is that vicarious learning experiences can help to shape one's own actions.
3. Experimentation: This metaphor is closely related to "learning by doing" processes. It applies to learning specific activities, complex or dangerous tasks, as it promotes active and contextualized learning processes, mainly related to practical activities and skills (including refining movements). It generally applies to individual practices, but may include some social activities, such as the coordination of teams.
4. Participation: This metaphor focuses on social aspects of learning. Indeed, the content transmitted by the teacher acts as a stimulus for learning, but he / she cannot predict learners' actions (new meanings and learning paths are created).
5. Discovery: Discovery comes from transformative actions through engagement with learning materials and situations, and allows for "incidental" learning experience. Learning by discovery can be individual and / or social; the crucial point is that it creates new contents through an active involvement of the learner.

Taking into account the metaphors in the design phase of the activity can help teachers to increase the pedagogical value of the resulting GBL experience. Besides, thinking about which metaphors they want to use is a way for teachers to escape from the traditional learning model and include innovative and creative teaching practices in their daily strategies.

In order to design meaningful GBL activities, it is important to consider many aspects. Indeed, the game should be perceived as embedded in a learning scenario that takes into account the different parameters of the teaching/learning context. While planning their GBL scenarios, teachers/trainers should take into account the specific characteristics of the learning audience, the specific learning objectives, the evaluation approach, the time-space resources or the technical requirements of the games. Moreover, the step by step organization of the learning activities (i.e. structure of the activities before, during and after the game) should be planned.

Success factors for the construction of a good educational game have been identified. Three different dimensions have been pointed out, namely *gaming aspects*, *learning aspects* and *technical aspects.*

Within gaming aspects**,** it is important to take into account that the game should include final objectives, but might also have intermediate / short-term goals in order to facilitate the player in reaching the final ones. The game should be based on clear and consistent rules. Players should strive for continuous improvement. This can be achieved by increasing level of difficulty. However, the level of challenge should not surpass the level of possibilities, in order not to discourage the player. Players should be able to perceive the impact and consequences that their actions have in the game world, in order to be informed about how they are performing, check their progress continuously, and enable them to eventually adjust their actions. Positive feedbacks are often associated with rewards, which help the player in the achievement of the objectives and acts as a mechanism to increase engagement and immersion. The game should be engaging, exciting and interesting for the wider possible number within the target group of students. This is achieved by using game elements like an interesting plot / story, an appealing environment / virtual world, contextualization, challenging goals, etc. The player should feel willing to play the game more than once. It's important to verify that the game includes jokes, humor, or any other elements required to make it more fun. But be aware these elements will not suit every game! (Inaccuracies in content can be dramatic in educational settings).

For what concerns the learning aspects**,** teachers should consider how well the game fit with their educational objectives. They should also check that the contents, puzzles and language used are adequate for their students, taking into account aspects like age, skills, knowledge level, socio-cultural context, etc. It is highly recommended that teachers provide additional content to students to reinforce learning. It could be provided as additional links, books, reading notes, etc., but also as content that is embedded in the game. These aspects should be considered from the beginning when the learning scenario is being designed. The game should be included in a wider learning scenario which might include other learning activities, such as further discussion / reflection sessions in the classroom, group activities, reports, presentations, homework, etc. The level of challenge of the learning experience should be high enough to keep students engaged but without surpassing their abilities so they do not become frustrated. The game should provide a context in which the level of autonomy of the learner is adequate. Moreover when the GBL scenario is put into practice, it's important to verify if students are really more motivated.

Finally, and considering the technical aspects, the game should be user-friendly and easy to use, so as to allow the player to concentrate on the objectives and not on dealing with a bad interface. The graphics should be appropriate for the target group. For example, cartoon styles are appropriate for kids, while photo-realistic environments are better for teenagers or university students. It is desirable that the game could be reused in different contexts without the need of complex and costly modifications. Besides teachers could be interested in adapting the games produced by other teachers.

Thus, the main goal reached during the ProActive project process, still in progress, has been to involve teachers coming from three different educational setting (school, university and professional organization) and from four different Contries (Spain, Italy, UK and Romania) in the creation of educational scenarios employing digital tools provided by the partnership (Picture 1). One of the game editor is EUTOPIA.

Picture 1. Teachers developing their GBL scenarios

For example one teacher proposed to employ the platform to develop a game whose aim is to train doctors and medical students to introduce, choose and presctipt handicap supports for those people who may need them within their school setting. The game presents moreover an indirect goal: to build a specific knowledge around the handicap supports in order to make the target group more expert about both impairments and technological aids to facilitate learning processes.

Another idea to employ the tool is training young/junior teachers in group dynamics. In particular, teachers should be helped to gain expertise in how to become members of a group in order to facilitate their future students' relationships. The idea is that being part of a community can be considered something to learn.

What comes out from the project activities is that generally, teachers' current practices are based on a quite common employment of ICT tools as a support for learning process. The main goal of every teacher is to interest the students and the idea of joining Proactive project is surely linked to this goal. Teachers also feel important to adapt the educational style to students' actual computer skills and to society change, trying to fill the generational gap on this issue. A strong link between GBL and creativity has been highlighted during the whole activities. Creativity seems enhanced by an innovative way of considering learning processes based on educative serious game. These new tools can improve students' curiosity about the world and facilitate knowledge sharing. Group creativity can be achieved, where everyone joins the everybody's learning process. An interesting difference between *teaching creatively* and *teaching creativity* emerged, where the first refers to a general flexibility within teacher's own approach to learning process, and the second refers to the possibility to teach students how to work in collaborative way, to be open to change towards flexibility and adaptability. In addition, we are talking about teaching through games, giving a good emphasis on the playfulness of the learning dynamics.

In relation to the editor proposed by Proactive, all teachers showed a high level of interest in employing it in their own teaching approach. One of the most important reason is that educational games provide a safe environment where exploring and experimenting knowledge. On the other hand, these tools can enhance both individual and collaborative learning, bringing innovative elements to teachers' teaching styles. These platforms could also help students in their self studying development, thus assuring them a teaching guidance together with the chance to freely produce and build their knowledge. In addition, teachers believed it could be interesting the idea to develop their own editors to support the daily practice. Nevertheless they seemed worried about reaching this specific goal because of their lack of computer skills, expressing the need to be updated and costantly trained.

Eutopia was perceived as a tool to teach and improve relational attitudes (being an on-line role-playing game), thus being employed more in psicosocial subjects like counselling, mediation and negotiation, soft skills training, human resources training (the only exception being a proposal to employ Eutopia also to explore formal knowledge).

4.2 T3 - Teaching to Teach with Technology project

In a recent review-article Selfton-Green (2006) has discussed different definitions of formal and informal learning linked to the context of learning. Both trainers and students have rules, strategies and learning patterns that differ according to age. Therefore, it is crucial to

identify strategies of using technology that will be appropriate and consistent with the target of the intervention, in order to produce effective teaching strategies and be able to stimulate a real path of "active processing" of information. In this respect, it is known that the use of serious games is particularly appropriate for young people, but the use of new technologies is difficult in formal learning contexts, with mature individuals accustomed to different types of training.

Against this background, the "Teaching to Teach with Technology (T3)" project designed and validated an innovative teacher/trainer program, demonstrating realistic ways of exploiting advanced techniques within the real constraints facing teachers in their work.

In particular, the "Teaching to Teach with Technology (T3)" project promotes the use of advanced learning technology by:

- university teaching staff in Spain;
- secondary school teachers in UK;
- trainers involved in VET in Italy.

The Project started in December 2009 and was organized into work packages. The milestone of the project were: Needs Analysis; Selection of technologies; Methodology and Learning program; Testing, Trials of the Training Programme, production of guide-lines for games use.

Key features of the program included:

- theoretical classes discussing the features and advantage of the new technologies;
- practical workshops, in which learners (university teaching staff, teachers and trainers) simulate learning sessions and familiarize with technologies;
- project work, in which learners prepare learning projects for use in their own classes, implement the project, and evaluate the results;
- joint assessment of the results by participants in the program.

The final output of the project is a set of freely available tools, designed to encourage the uptake of new learning technologies to employ in universities, schools and professional training.

The principle underlying the definition of learning we have proposed is the classic learning by doing. It's important to underline that before games can take on a meaningful role in formal or informal education, the education sector and the wider public need to better understand the potential and diversity of such 'tools'. In fact, Blunt (2007) advocates that pedagogical methods are typically influenced by the available technologies of the period. Due to the pervasiveness and evolution of technology, students often learn differently from how their educators learnt.

Both psychological and educational literature stressed that the real context, which takes place in the educational relationship, plays a key role in the choice of methods and processes that involve the teaching-learning process. The different learning contexts, in fact, need and use different means of transferring knowledge and they need to be calibrated on partners, setting, and real or virtual places.

For these reasons, T3 project defined different steps of exploring games for educators (for more detailes see www.t3.unina.it). Through the exploration of few steps, the user may

initially familiarize with the use of games in education and, then, he can learn to use them in order to increase complexity ranging from a closed mode to an open mode using.

The closed and open system definition aims at representing a training strategy based on instructions, closed systems, or on a more constructivist strategy (open systems). From a technological point of view, the new learning technologies (Miglino, Rega, Nigrelli, 2010) can be distinguished in: closed systems (tools and platforms developed by professionals which deal with a particular subject area and can be used for educational / training purpose), and open systems (tools and platforms that enable teachers to realize learning environments).

The training program proposes three steps (Sica, Nigrelli, Rega, & Miglino, 2011): 1. try sample curriculum; 2. Create your curriculum; 3. Try it in classroom (Fig. 1).
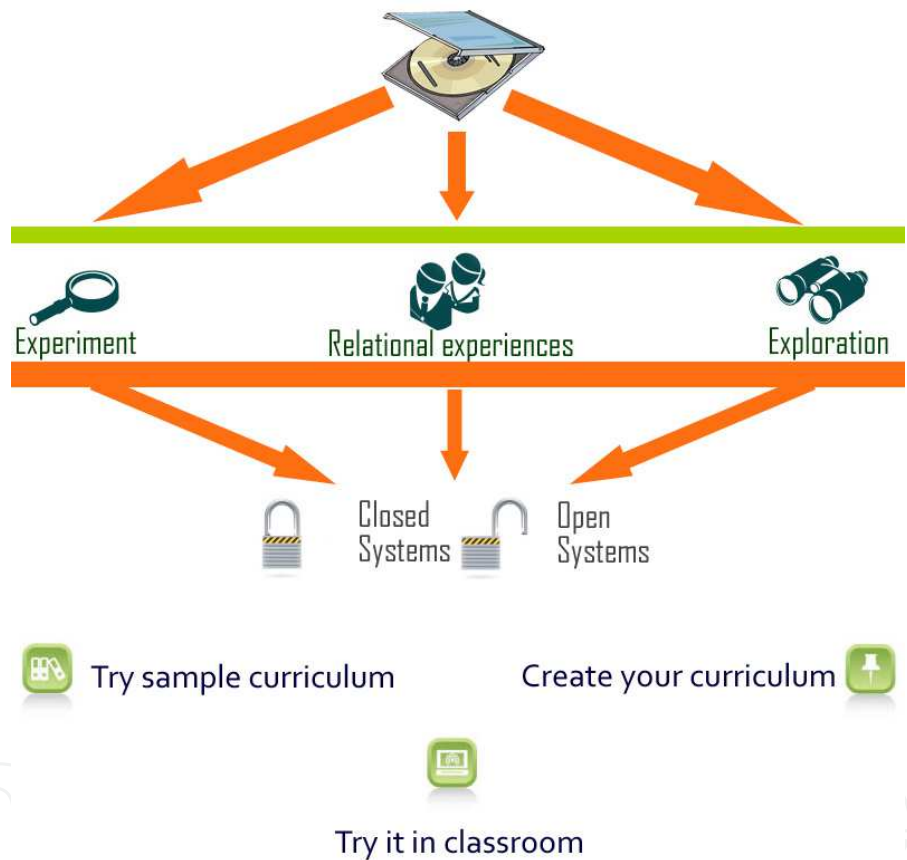

Fig. 1. The training steps of T3 project.

A review of the DGBL (digital game-based learning) literature shows that, in general, educators have adopted three approaches for integrating games into the learning process: students build games from scratch; educators and/or developers build educational games from scratch to teach students; integration of commercial off-the-shelf (COTS) games into the classroom. According to Van Eck (2006), we assume that this approach to DGBL is the most promising in the short term because of its practicality and efficacy and in the long term because of its potential to generate the evidence and support we need to entice game companies to begin developing serious games. This approach involves taking existing games, not necessarily developed as learning games, and using them in the classroom.

The strategies and functions of technology selected were: a. experimenting; b. experiencing soft skills; c. exploring.

a. The "demonstration-experiment" as a teaching strategy is one of the most popular and traditional strategy used by teachers. Perform laboratory experiments is, in fact, the core teaching of many disciplines.
b. "Learning by experience" is a fundamental model and it is referenced in literature pertaining to "the learning organization". This form of learning has the following characteristics: it is an explicit learning focused on the working environment; it is both individual and collective; it is focused not on knowledge, but on skills, attitudes and expertise; the learner has an active role and consciously learns though collaboration with others and under the guidance of experts in safe environments.
c. "exploring" is an innate human propensity to experience the environments in which they are to act. Many educational practices used to explore this tendency to transfer their skills and knowledge. The adventure games are transpositions in technological environment of this type of educational practice.

In light of these considerations, we considered appropriate to calibrate the choice of technologies to be tested taking into account a combination of factors: learning environments, characteristics of the trainers to be trained and subject matter. The learning process is highly dependent on the direct participation within a specific activity. This implies that very little learning is achieved in the traditional sense of the term.

The different learning contexts, as stressed above, need different means of transferring knowledge and they need to be calibrated on: partners, setting, and real or virtual places. Both trainers and students have also rules, strategies and learning patterns that differ according to age (as cognitive and psycho-social development; eg "digital natives" vs. "digital immigrants"). Therefore, it is crucial to identify strategies of using technology that will be appropriate and consistent with the target of the intervention, in order to produce effective teaching strategies and able to stimulate a real path of "active processing" of information.

Figure 2 summarizes the process that led to selection of technologies.

AIM → **The selection criteria** → **Classification system**

- The aim of the exploration of technology was mainly to identify technology appropriate for different users of the trial of T3: university teaching staff; secondary school teachers; and trainers in industry.

- The selection technology process was based on a) a *general assumption* related to new trends of educational psychology; and b) on a *specific classification system* created specifically for this step of research (Miglino, Rega, Nigrelli, 2010).

- It's based on:1. the *type of teaching/learning strategy* (experimenting; experiencing soft skills; exploring) and 2. the *type of technology* (open system, closed system).
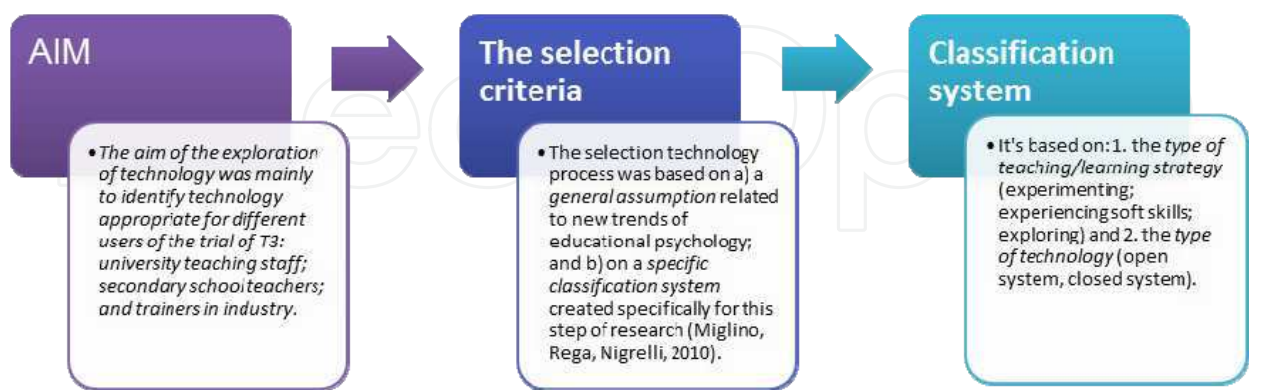
Fig. 2 Step for selection of technologies

Table 2 summarizes the work of classification and identification of learning technologies carried out within the T3 project (Miglino, Rega, & Nigrelli, 2010) and it reports some examples of systems and prototypes that can be used as example of the following categories.

TYPE OF TECHNOLOGY		TYPE OF TEACHING/LEARNING STRATEGY		
		Experimenting	*Experiecing soft skills*	*Exploring*
TYPE OF TECHNOLOGY	*Closed System*	• Avida • BestBot • SimCity • Nerone	• Dread-Ed	• Civilasation • Age of Empires • The Sims
	Open System	• NetLogo • Lego MindStorms	• **Eutopia** • E-circus • Forio	• Anima • E-adventure • QR Code

Table 2. Classification scheme of learning technologies (examples in each category) (Miglino, Rega, & Nigrelli, 2010)

For easier reading of the table 2, Miglino, Rega, and Nigrelli (2010) deepen the description of the technology by splitting the table into three quadrants.

Quadrant 1. Experimenting (Table 3)

Experiments are the core of many disciplines. The design of an experimental session goes in parallel with the assimilation of a body of theory that explains the general generative mechanisms of a given phenomenon. The correct understanding of the theory should lead to a forecast of empirically observable behaviors.

		Type of teaching/learning strategy
		Experiment
Type of technology	Closed System	Avida
		BestBot
		SimCity
		Nerone
	Open System	NetLogo
		Lego MindStorms

Table 3. Experimenting

This methodology can be applied in different teaching and learning contexts. These software packages fall into the category of closed systems as a focus in the reproduction of a very specific "piece of reality". In addition, to use virtual labs, teachers and students can create their own artificial models of several phenomena. There are programming suites that allow the development of computer simulations (Miglino, Gigliotta, Ponticorvo, & Nolfi, 2007) and physical machines (e.g. robots), even to those people who don't have a sounding background in technical computing.

By using such, so-called, open systems, teachers and students can easily reproduce natural, psychological and social events.

Quadrant 2. Experiecing soft skills (Table 4.)

In addition to the theoretical and technical education, training agencies are also in charge of transferring to students a set of behavioral skills that are a necessary background to deal

with professional communities and society. Examples of such skills (commonly referred to as soft skills) are the ability to manage emergencies, the ability to negotiate, to take decisions collectively, the attitude to understand others' view points. In general, the teaching of soft skills is primarily linked to experience, where a teacher organizes, supervises and encourages small groups of learners to take part in role playing and simulation. Es. *Palma* (Gigliotta, Miglino, & Parisi, 2007).

		Teaching / learning strategy
Technology	Closed System	Experiecing soft skills
		Dread-Ed
		Palma
		Talk To Me
	Open System	Eutopia
		E-circus
		Forio

Table 4. Experiecing soft skills

Most of these techniques for learning soft skills can be transferred in digital platforms and online technologies. There are many different educational games (serious games) in which the player-learner has a particular role and must pursue a goal assigned by the teacher / trainer. Also for this category, trainers can find games that are dedicated to the transfer of a particular segment of knowledge / skills (closed systems) and platforms that enable teachers and learners to develop and edit their own educational scenarios with specific goals (open systems).

Quadrant 3. Exploring (Table 5.)

Basically, learning and exploring can be considered two sides of same coin. Teach and train mean mainly supply schemes (and motivation) to better "travel" in the world where people are living.

Many educational and training practices exploit the exploratory instinct of people to transfer knowledge and skills. Perhaps the best known example of this paradigma is represented by the many versions of the educational treasure hunt.

		Teaching / learning strategy
Technology	Closed System	Explore
		Civilazation
		Age of Empires
		The Sims
	Open System	Anima
		E-adventure
		QR Code

Table 5. Exploring

According to T3 results, one of the most promising platform in this sense is EUTOPIA.

5. The Platform

EUTOPIA is an online 3D role-playing environment similar to other virtual environments like Second Life™. With this platform educators can create virtual scenarios where students play a role and simulate a specific situation. EUTOPIA can be used to improve negotiating skills and intercultural awareness of professional trainers and staff in contact with the public.

The game development process in EUTOPIA is quite straightforward. Teachers just need to select one of the predefined 3D scenarios (e.g. a city or a meeting room), select the roles that will take part (i.e. define the personality and choose a predefined avatar for each character) and assign them to each participant/student. Then the teacher must set up a virtual session (i.e. simulation) in a server using the created scenario. Participants and teacher join the session and then they interact with each other, following the teacher's plan.

EUTOPIA represents the current development of a previous experience in Information and Communication Technology, SISINE, developed by Natural and Artificial Cognition Laboratory.

SISINE (Miglino *et al.,* 2007) was used to provide innovative training practices and to improve negotiating skills and intercultural awareness of professional trainers, front-office staff and other staff in contact with the public. The training offered focused on the kinds of negotiation workers engage during their everyday professional activities (rather than on classical managerial negotiation). The training methodology was based on a blended strategy combining classroom learning with e-Learning based self-study. Both the classroom learning and the self-study sessions made intensive use of a novel simulation environment. The environment incorporated technologies from Multiplayer Online Role Playing Games (MORPG) (Okamoto *et al.,* 2007). The use of simulation ensured that users can "learn by doing" at home as well in the classroom (Miglino, 2007).

EUTOPIA, in fact, is an on-line platform that allows the production of a particular type of serious game: an educational Multiplayer On-Line Role Playing Games (e-MORPG).

From a formative/teaching side, EUTOPIA has the role to transfer the methodological tradition of the Psychodrama (Moreno, 1946) from the real world to a virtual 3D world.

The platform provides the normal functionality expected by Multiplayer Online Role-Playing Games (Madani & Chohra, 2008), as well as additional functions that allow a trainer to set up games, intervene during game, record specific phases of a game, annotate recordings and discuss them with the players.

Teachers can write scripts for on-line multiplayer games. In designing a multiplayer game they can choose the roles, goals, bodies and personalities of individual players. Once the game is in progress, they can watch what is going on from any viewpoint, intervene at any moment, send messages to players, or activate special "events". When it is over, they can become critics, leading a group discussion and analysing the strategies adopted by the players. This step of debriefing becomes fundamental for the learning process.

As well as preparing scripts for on-line games and assigning characters to users, there are two other ways in which teachers/tutors can intervene in learners' interactions with EUTOPIA. One is to take the role of one of the characters in the simulation. The other is to act as an invisible stage director. In this second role, teachers can: a) invisibly observe the

interactions among players; b) access the players' "private characteristics"; c) listen to private messages ("whispers") between players; d) "broadcast" messages visible to all players; e) exchange private messages with a specific user; and f) activate events, changing the course of the simulation.

Learners that play the act reach the virtual stage-set where they can interact each other controlling a virtual alter ego, the avatar (see Fig.3).

Fig. 3. Some avatars

Once logged in, they join a 3D graphical environment in which they are represented by avatars, and can use them to explore the environment. Players communicate via short texts and different forms of paraverbal and non-verbal communication. For instance, they can control how loud they want to speak (shown by the size of characters used in the bubble cartoons) and in what tone of voice (shown by the shape of the bubble). Players can control avatars' gestures and body movements. They can also 'whisper' messages to each other: these are audible only to the other partner in the conversation, and to the tutor. Finally, they can communicate with the tutor to ask for advice or clarification or to raise any other question that concerns them.

In particular, EUTOPIA kit is made up of three software with different functions:

1. Editor - Creation of group sessions and of the elements needed for the training. Editor is used by tutors.
2. Client – Interaction with other users inside the group sessions. Client is divided into:
   • Master for tutors
   • Player for user
3. Viewer – Visualize the previous recorded group interaction sessions, recorder editing and add personal comments. Viewer can be used by users

The environment is represented in 3D graphics allowing participants to move around in the space and to approach other avatars (see Fig. 4).

The first step is to create a storyboard/script which defines the starting point for a story. All scripts are based on a standard structure which determines the way it is stored in the database. Each script has a name (a brief definition which defines the activity), a description of the activity, a story (a detailed, perhaps even quantitative description of the scenario, of the events related to the training session issues, and of possible outcomes), a maximum available time, group goals and success criteria (information about one or more goals common to all participants in the interaction).

Fig. 4. 3D environment

Each script has a "general goal". The success of the training course depends on how far this goal is achieved. Additionally the script describes partial goals for each online session. Of course partial goals are related to the general goal.

The software gives the chance to choose and define the personality of the different characters that will be involved in the session. For each character we can define:

- Features (sex, age, social status).
- Characteristic elements (physical aspect).
- Role in the story.
- Personal story.
- Personality aspects (associated with specific non-verbal communication capabilities).
- Individual goals.

Starting from a script chosen by the tutor, each participant plays the role of one of the characters, associated with an avatar.

Each participant knows the story in which his/her character is involved, knows the goals shared by all participants, knows the goals of his/her character and his/her own individual story (which is not known by the other participants).

During the simulation, the tutor can introduce new elements which may influence the interaction: unforeseen difficulties and new resources. All these events are foreseen in the script, which provides a description of the event and the way it should be presented. The tutor activates events, at what he/she deems to be the most appropriate moment in the simulation. An event could be either a text (letter, fax or document) which appears on the screen, or be represented by an "avatar" character who enters the scene and delivers a message (text and other non-verbal elements).

At the end of the interaction, the tutor watches the simulation recording, notes his/her impressions and conclusions and analyzes the results (if necessary in quantitative terms). It

is very important he/she should assess whether group and individual goals have been achieved and to what extent.

The tutor sums up the most important aspects of the session and the way in which the participants have conducted the session. He/she makes it clear whether and to what extent the participants have achieved their individual and group goals. Feedback can be provided immediately after the simulation or in a later meeting. The discussion of the results of the session is conducted in the simulation environment, in free chat mode. During the training experience, players are asked to fill questionnaires on their learning process, in order to give the chance to collect data and analyze the final outcomes.

6. Discussion of results

Results of Proactive and T3 programs are consistent with the literature and they stress the importance of game-based learning, clarifying that it's a balance between conceptual (teaching about) and procedural (teaching how to do) knowledge (Miglino, & Walker, 2010; Sica, Nigrelli, Rega, & Miglino, 2011). In brief, advanced games technologies (computer games, augmented reality, robotics) could address many of the limitations of traditional instructional methods; games have the ability to motivate learning, increase knowledge and skill acquisition and support traditional teaching methods.

In conclusion, the experimental steps of both the projects described leads us to believe that the use of new technologies can also be applied in education. According to scientific literature (Senge, 1990) we could find advantages related to strictly cognitive aspects: the spatial and temporal proximity of stimuli faciliting learning, the relevance or consistency of the material proposed, the different ways of transmitting information, the customization of dynamic teaching / learning. However, we believe that the use of games in education should be preceded by a period of training and familiarization of educators, in order to bridge generational distance in learning modality. Last few generations of adolescents are much more used to frequent on-line platforms, to engage in video-games, compared to teachers met in various training agencies. We think it's useful that teachers are approaching the language of learners, to provide a better educational dialogue.

In this sense, the projects' results are highly encouraging, and T3- program is especially useful in providing a first pragmatic approach to the the use of games in education. Furthermore, Eutopia platform was perceived as a tool to teach and improve relational attitudes, thus being employed more in psicosocial subjects like counselling, mediation and negotiation, soft skills training, human resources training.

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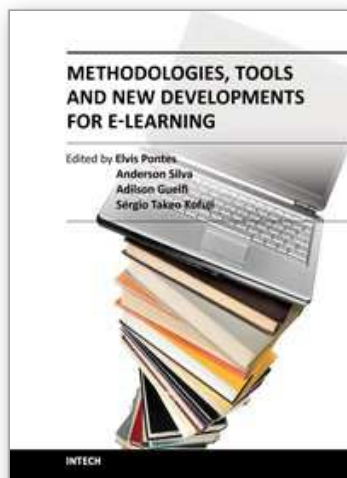
Methodologies, Tools and New Developments for E-Learning

Edited by Dr. Elvis Pontes

With the resources provided by communication technologies, E-learning has been employed in multiple universities, as well as in wide range of training centers and schools. This book presents a structured collection of chapters, dealing with the subject and stressing the importance of E-learning. It shows the evolution of E-learning, with discussion about tools, methodologies, improvements and new possibilities for long-distance learning. The book is divided into three sections and their respective chapters refer to three macro areas. The first section of the book covers methodologies and tools applied for E-learning, considering collaborative methodologies and specific environments. The second section is about E-learning assessment, highlighting studies about E-learning features and evaluations for different methodologies. The last section deals with the new developments in E-learning, emphasizing subjects like knowledge building in virtual environments, new proposals for architectures in tutoring systems, and case studies.

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