

Emerging Digital Media, Games and Simulations: A Challenge for Open and Distance Learning

José Bidarra

Universidade Aberta, DCeT

bidarra@univ-ab.pt

Abstract

In this article we examine the state-of-the-art research related to digital media in education and evaluate the information concerning a new generation of students that are community-minded and technologically savvy, highlighting the innovative technology behind the new interaction and communication processes, and assessing the challenges for Open and Distance Learning (ODL). Where traditional distance education is based on the completion of carefully graded assignments and tests, today games, simulations and virtual environments may become safe platforms for trial and error experimentation. With games the chance of failure is high, but the cost is low and the lessons are learned immediately and with greater emotional impact. However, these conditions may become more difficult to address when the volume of users increases from small to medium, large or extra-large. Dealing effectively with tens or even hundreds of thousands of students in absentia requires following very sound organizational principles and good technical implementation, systematic monitoring of deviations from established norms, regular audition of users' comments and criticisms, careful analysis of final results. In this emerging scenario, involving digital media, games and simulations, ODL systems must have means of establishing rich connections with each member of the universe of users. In this sense we propose using a virtual space with multiple places, in ways that use the Internet, social applications, games and mobile devices to involve students in pedagogical activities.

Keywords: Open and Distance Learning, Digital Media, Games, Simulations

1 Introduction

A common feature of systems that incorporate what we briefly call *distance learning methods* in their mode of operation is the fact that there is no need for the physical presence of students and teachers. Also, there is some time flexibility, meaning that the communication between students, teachers and the teaching or training system may be asynchronous. In a previous article (Trindade, Carmo & Bidarra, 2000), the situation of Open and Distance Learning (ODL) at the turn of the century was evaluated, and it was then clear that “students and trainees needed to have *access to appropriate learning materials* other than by *interpersonal contact*: buying books, cassettes or CD-ROMs, receiving broadcast emissions, using mail or e-mail, accessing the Web.”. Another finding was that “the distance learning methodology requires also that some kind of *support mechanism* be available to students, so that they can

overcome their learning difficulties, get supplementary information, evaluate their own progresses, exchange ideas with teachers, tutors and fellow students.” (p. 2). But this situation has dramatically evolved and new factors have to be considered.

In the last decade, the classroom and distance learning modes have been converging, not only due to the success of ODL experiences, but also due to the progress in information and communication technologies and their permeating all learning environments in most developed countries. Using computers and accessing the Web in schools and universities, taking advantage of quality learning products in digital format, linking institutions with broadband connections, using Web 2.0 networking applications, all create favourable conditions for increasing student autonomy and learning effectiveness (Moore, M. G. and W. G. Anderson, 2003). This obviously means that a shift is necessary in teacher's profiles and roles: the ability to virtually experience events in shared spaces determines that they will become *mediators* between students and the information provided by a variety of sources, rather than being the exclusive owners of knowledge to be transmitted.

On the other hand, students bring with them large networks that reach back into students' communities and schools. Using social software and social network tools such as SMS, IM, *Facebook*, and *Twitter*, they extend the discussions, debates, sessions and study groups, which naturally arise, to encompass a broader population, thus amplifying the effect of conventional ODL offering fixed curricula and prescribed books. For students, the major motivation for enrolling in distance education is not the technology or the network access capability, but the freedom that allows them to manage their studies at a time and pace of their choice. Of course, the participation in a virtual community of learners almost inevitably places constraints upon this independence, no matter what technology is used, as the isolation factor is not totally eliminated by the use of synchronous or asynchronous communications tools.

A new situation emerged in some institutions: students have to work with each other in projects and access a world of subject-matter experts and resources available on the Web. As a rule, freedom of choice, challenge, participation, transparency, integrity, collaboration, fun, speed, and innovation must be a part of their learning experiences. Interactive multimedia, such as games, simulations, and virtual worlds, are key vehicles for such educational online environments. Playing games may be an important part of learning as this generation's game-playing experiences are more widespread than the game-playing experiences of previous generations. This is particularly important with the increasing use of mobile and handheld devices by today's students. A recent Educause Center for Applied Research (ECAR, 2008) survey of undergraduate technology used in the United States reports that 82.2% of undergraduates own a computer, with 80.5% owning a laptop. Web-enabled or smart phones are owned by 66.1% of undergraduate students, though not all use the features due to cost. Over 85% of students surveyed report using network resources for activities such as accessing social networking sites, playing online multiuser computer games, or accessing virtual worlds (Salaway & Caruso, 2008). Video game use has become a more diverse and popular form of entertainment than it was a decade ago. Games are not just for young people, as nearly half (49%) of players are between the ages of 18 and 49. The gender divide in gamers has also greatly narrowed, with males making up 57% of online game players, and women at 43% (ESA, 2008).

Popular video games like *World of Warcraft* emphasize cooperation and leadership rather than individual competition for the highest score (typical of arcade games, for example). These video games reward creative problem solving, multitasking, collaboration,

experimentation, and stimulate the creation of models (Steinkuehler, 2004). The instant feedback and risk-free environment invite exploration and experimentation, stimulating curiosity, discovery learning and perseverance (Kirriemuir, 2002). Learning how to learn becomes an essential skill and the speed and dexterity developed playing video games becomes an added-value. Social skills are also important: to be a guild master in a game like *World of Warcraft*, a player needs to be able to create a vision, recruit and inspire people, and organize the group's strategy. And while the game industry has recognized and embraced such learning fundamentals, weaving them into design to increase value to the player, institutions have yet to fully recognize and integrate these models.

It has been established that ODL institutions hold great potential for the instruction of a broad and diversified range of learners. It has also been established that well-designed interactive media tools such as games, simulations, and virtual environments provide learners with relevant and engaging paths to content mastery. The next step is to bring the two together. Overcoming the technology gap between learners and institutions is just one aspect of the problem. Traditional ODL pedagogy has to be reformulated, accommodating the latest technology but also enabling rich social interaction, enhancing group work and communication within educational settings. Squire and Giovanetto (2008) argue that, when considering the higher education of gaming, a core intellectual feature of a twenty-first-century educational system should include inroads into participating in cultures of simulation.

In this article we discuss first and foremost what distance education might become in this emerging framework, based on an exploratory study that took place at the University of Wisconsin – Madison in 2009. In this up-and-coming scenario, involving digital media, games and simulations, ODL systems must have the means of establishing rich connections with each member of the universe of users. In this sense we propose using a virtual space with multiple places, in ways that use the Internet, social applications, games and mobile devices to involve students in pedagogical activities.

2 Education without distance

Open and Distance Learning (ODL) is now widely based on the e-learning methodology and this technology-based model has emerged as a serious contender to help support the learning needs of individuals in this day and age. According to Klopfer (2008), “e-learning itself can mean many things to many people and at its core simply means electronically supported learning, which can be online, on desktop PCs, or even on mobile devices (though the latter is sometimes referred to as m-learning). In practice e-learning often means delivery of information and content to learners through online hypertext, accompanied by images, audio, and video. But e-learning can mean much more, as evidenced by the recent surge of interest in using video games to teach everything from basic math skills for young learners to advanced communication skills for adults.” (p. 8). Some researchers of mobile learning try to define and conceptualize it in terms of devices and technologies while others prefer an educational framework to situate the mobility of learners and the potential of learning. The role of theory seems to be a contested topic in a community that encompasses philosophical affiliations from empiricists to post-structuralists, each with different prospects about the extent and authority of theory in their work. The mobile learning field could nevertheless use the authority and credibility of some conceptual base (Traxler, 2007).

Perhaps the most important shift in distance education today is the change in the concept of *distance*: since we are permanently interconnected via wireless networking devices *distance* is not an issue anymore! On the other hand, in this world of ubiquitous computing mobile technologies and social networks provide a huge scope for designing innovative learning experiences. Handheld mobile devices (PDAs, *iPhones* and other smart phones) are smart, low cost, portable, and wireless devices that have easy information access without being tied up to a location. But the concept can be extended to accommodate laptop computers as these tend to be cheaper, smaller and lighter these days. All these devices offer vast opportunities for learning, without the constraints of time and space, and making use of vast repositories of software applications and other resources.

De Jong *et al.* (2008), at the Open University of the Netherlands, provide a reference model for mobile social software and use it to analyze the current state-of-the-art in m-learning (mobile learning). The reference model consists of five dimensions: purpose, content, context filter, information flow and pedagogical model. They classified current research in relation to a reference model and the results suggest that most mobile social software for learning just aims at providing a shared content or knowledge repository with storage for all kinds of multimedia information. Additionally, the authors found that location context was used most, and that situated pedagogic models are a foundation of most current software solutions (Fig. 1). However, they acknowledge the limitations of current state-of-the-art technology and mobile social software, and emphasize the need for systems that address a range of different learning purposes, extending the use of metadata, improving the use of notifications, and making more use of context information, to be possible the gathering of more detailed information about a learner's current situation. A case in point is *ContextBlogger*, software that already provides a shared content system in which learners can collaborate to create and edit content and view the contributions of their peers.

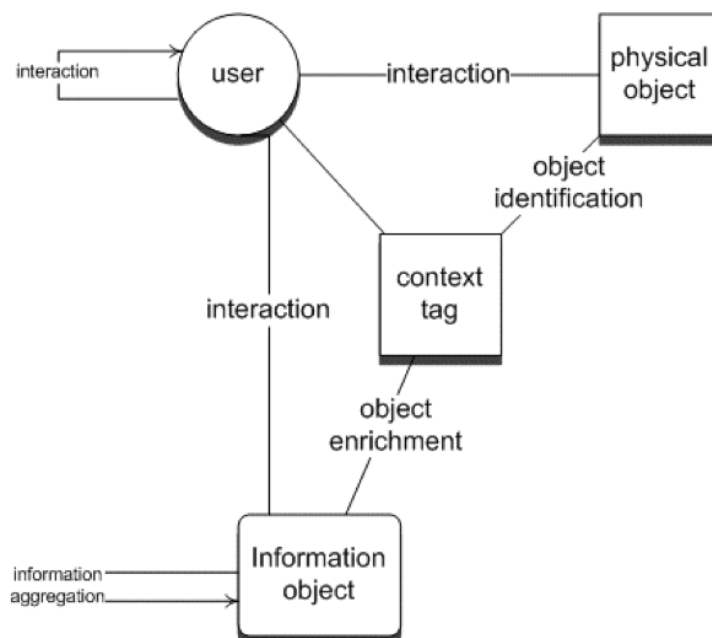


Figure 1. Reference model for ContextBlogger (De Jong et al. 2008)

On the hardware side, the limitations of handhelds, when compared with laptops, with its display size, stylus interface, storage capacity, and low processing power, make it difficult to use any kind of mainstream software (Klopfer & Squire, 2007). But we should also

emphasize that each user employs his handheld device in a different way. For instance, teenagers frequently use SMS and IM to communicate, while professionals are more likely to be using corporate email. Most probably, in the first case an *iPhone* with specific applications is used and in the latter a *BlackBerry* with proprietary applications is the norm.

From direct observation of (University of Wisconsin) students' activities with mobile equipment, and taking into account the most common devices (*iPhones*, PDAs, smartphones and laptops), we may conclude that:

- Mobile learning evolves around the individual's social environment rather than the classroom (sharing podcasts, texts, and tips, for example)
- Learning activities are mainly based on connections to resources and other people (motivated by assignments and other academic work).
- Networked collaboration and group work are an important aspect of mobile interaction and communication (supported by friendly software)
- The aptitude to instantly publish content online empowers learners to become researchers and authors (from micro-blogging to more elaborate work)
- The ability to easily capture, record and publish multimedia turns learners into media producers and critics (with a large audience on *Flicker* or *YouTube*)

These activities may take place in traditional universities but they are typical distance learning activities! So, for the most part, distance learning has become a way of life for students wherever they are. For the institutions this is good news, as for the first time in history we have educational technologies that cost nothing to governments and schools: mobile phones (everyone has one), networking software (freely available, e.g. *Facebook*, *Twitter*, *Skype*), learning applications (freely and increasingly available, e.g. *Apple Store*, *IBM*, *Microsoft*) and open educational resources (freely and increasingly available, e.g. *MIT – OCW*, *Stanford* and many others at *iTunes U*). There are other free tools available for learning organizations, such as collaborative tools (e.g., blogs, wikis, knowledge-building software), immersive environments (e.g., virtual worlds like *Second Life*), media production and distribution tools, and many more.

Globally, the implications of this re-conception of education, as a mobile and flexible exchange of ideas in a specific context, are profound. It goes beyond the traditional view of classroom instruction, and of education as the transmission or construction of knowledge within the constraints set by a curriculum, to replace it with an ongoing process of learning through continued exploration and negotiation. As Don Tapscott (2008) put it: "Educators should take note. The current model of pedagogy is teacher focused, one-way, one size fits all. It isolates the student in the learning process. Many Net Geners learn more by collaborating—both with their teacher and with each other. They'll respond to the new model of education that's beginning to surface—student-focused and multiway, which is customized and collaborative." (p. 108). We would just add that learning in this way is in fact pervasive or ubiquitous education. This means that education is available 24 hours a day, 7 days a week, anywhere, anytime. Pervasive learning is also a social process that connects learners to communities of devices, people, and society so that students can construct relevant and meaningful learning experiences, author specific content (text, images, audio, video), in locations and at times that they find meaningful and relevant.

3 The potential of games and simulations.

Current research in education goes beyond hands on multimedia learning to acknowledge the emergence of new learning experiences that games and simulations may turn out and understand their consequences for how we think, act, play, and learn (Shaffer, Squire, Halverson & Gee, 2005). Most educational researchers today would define learning as a multidimensional construct of learning skills and cognitive learning results, for instance, procedural, normative and strategic knowledge, and attitude (Pivec & Dziabenko, 2004). So, the game-based learning model may be used in formal education very successfully, and can be introduced in many kinds of ODL scenarios. But how do we define *game*? For our educational purposes an operational definition may be that proposed by Klopfer (2008): a game is a “purposeful, goal-oriented, rule-based activity that the players perceive as fun.” In the context of ODL, where fun is not typically a priority design feature of most activities, this description is very accommodating and may cover a lot of ground. Many researchers have sustained for a long time that there are potential elements in commercial games that can be used in educational contexts and may provide learners with a most engaging and valuable experience (Prensky, 2001; Gee, 2003; Squire & Jenkins, 2003; Kirriemur & McFarlane, 2004; Johnson, 2005).

Learning through games is possible by immersing players in relevant experiences, modeling expert problem solving, providing guidelines to solve a problem, and structuring problems so that the player builds on previous knowledge, which are all features of powerful and well designed learning environments (Bransford *et al.*, 2000; Gee, 2003). On a less positive note, according to Huntington (2006), there are obvious barriers to the development of effective educational games in general. For instance:

- High development costs in an uncertain market makes investment in educational gaming innovations too risky for the commercial video game producers and even the educational material industries.
- Change in institutions comes slowly in terms of adopting any new innovations and making the necessary organization and instructions changes that allow use of new learning technologies.
- There is unwillingness on the part of institutions to give up textbooks in order to purchase educational gaming products.
- The specific educational values that are tied to established standards have not been proven through in-depth research.
- Some parents and teachers have very negative attitudes about the use of videogames in the classroom.
- Games are especially good at teaching higher order skills, which are not typically assessed in standard examinations.
- Access to computers is sometimes so low that it can't play a mainstream role in student learning (the case of many developing countries).

Game historian David Parlett (2009) defines the formal game as having a twofold structure based on ends and means. The *ends* structure is a contest to achieve an objective. To achieve that objective is to win. The *means* are an agreed set of equipment and “rules” by which a winning state can be achieved (Salen & Zimmerman, 2004). In another definition adapted from Rouse's (2005) *Game Design: Theory and Practice*, games are the presentation of an entertaining challenge to the player—a challenge that the player can understand and may be able to succeed at by using his or her knowledge, wit, and dexterity. Popular games can range

from shooting games to casual games, from role-playing games to family entertainment games. Strategy (34.6%) and role-playing (19.6%) games make up over half of the best selling games sold for play on computer systems (ESA 2008), and good strategy and role playing games are touted by educational game researchers as two of the genres that support good learning.

In summary, games, simulations, and virtual worlds can serve multiple educational purposes, but a more sustained approach is required, in which specific game genres are identified and suitable frameworks are set to facilitate the provision of educational games in such genres. We tried to address this need in a concise and schematic way by developing a site with resources and references (Fig 2).



Figure 2. Site developed during this study - LEARNINGGAMES at FCT-UNL:
<http://moodle.fct.unl.pt/course/view?id=2176>

Let's point out some basic definitions of broader terms for games referenced in educational game studies.

Edutainment Games

These are usually games that combine education and entertainment with intended educational outcomes targeted at specific groups of learner, very often targeted as youth and children's games. Most edutainment games currently in the market are not supported by empirical learning evidence.

Serious Games

These are games with many of the characteristics of an entertainment gaming environment but with intended educational outcomes targeted at specific groups of learners. The serious adjective is generally applied to refer to products used by industries like defense, education, scientific exploration, health care, emergency management, city planning, engineering, religion, and politics. Put simply, these are games with a purpose.

Location Aware Games

This rather new designation usually refers to virtual experiences played out in real world spaces. In general, contextualized clues can only be discovered via the digital interface when a player with a mobile device arrives at the right location. There is a connection between location and digital game usually based on GPS data accessed by the program.

Global Reach Games

Also a recent phenomenon, exemplified by games such as World of Warcraft or Ultima. The term covers any video game capable of supporting hundreds or thousands of players simultaneously. These games are inevitably played on the Internet and feature at least one persistent world. Second Life is not a game per se but constitutes also a virtual world with a game-like society of users.

Comparative merits and distinctive learning attributes of games categories and genres

Growing now in design specificity, we will take a look at individual game genres and the potential for use in online education. The educational value of these games could be greatly increased by integrating them with emerging e-learning standards (such as IMS or SCORM) and platforms (such as MOODLE or Blackboard). These categories and genres are by no means an exhaustive list of possibilities. In many cases they extend and overlap to create a mixed category.

Traditional and Casual Games

Chess, solitaire, and card games, whether traditional or game specific, are examples of such games. Other casual games are commonly deployed online, and offer movement in 2D or 3D space with obstacles to overcome. Timing is sometimes critical, with heavy reliance on motor skills, memory, and planning. The flash technology can be used to easily produce cards or other digital artifacts for ODL. Themes may vary from games that expand concepts, such as the food chain, set matching, etc. to card games aimed at teaching math, animal, and plant species. Other games in this genre have shown potential for involving math and physics, for example, bridge building games such as *World of Goo*. Potential in this genre exist for games that support systems engineering and computing concepts.

Shooting /Action

These games can include first person shooters (FPS) or other fighting games. In shooter games, players typically aim and fire at moving objects to destroy them. This involves the development of fast hand to eye coordination and may be important in training areas associated with the police or military. In most cases the player operates virtual mechanical devices and has to accomplish some objective (e. g. drive a vehicle, fire a weapon or use a tool). Shooter and fighting games may be played solo, or designed for team collaboration. Military strategy games in these genres may also include cultural learning objectives, using local cues to engage with others in-game to accomplish missions. These games can be used in ODL as a drill-and-practice component of a course, for example, in engineering, sports, or military training. Team development objectives can also be met through multi-player modes.

Adventure Games

The adventures or quests offer a series of challenges usually within a detailed framework. Most adventure games do not rely on speed or “twitch” play for success. Classic examples in this genre include Myst, and other interactive fiction games. The tasks in the game may be relevant to the curriculum and the learning process, often in terms of motivation, as in the

case of Sid Meyer's Civilization, a widely popular and researched game (also falling within the strategy genre).

Role-Playing Games

A role-playing game (RPG) is a game in which the participants assume the roles of fictional characters. Drawing from original RPGs like Dungeons and Dragons, players inhabit a role with status and responsibility within a shared context, and in which the context is defined by a set of rules. The educational function of RPGs may be extensive. Players in educational RPGs may establish the actions of their characters (e.g. lawyers or politicians) based on their characterization, and the actions succeed or fail according to a formal system of rules and guidelines. This may be interesting for many ODL courses requiring students to learn those kinds of skills and the related tacit knowledge. This is also very useful for learners to practice behaviors in an environment that provides clear consequences based on the context and rules of the game world.

Strategy Games

Sometimes referred to as real time strategy (RTS) games, this genre of video games emphasizes skillful thinking and planning to achieve a goal. They involve strategic, tactical, and sometimes logistical challenges. There are many good examples of this type of games, in the areas of history, economy, management, ecology, society, etc. Typically these games involve multiple challenges and are aimed at developing problem-based skills. Some very popular and successful titles are: Civilization and Age of Empires. These are very expensive games to design and produce but some of the themes and inherent characteristics of those commercially available may be interesting for ODL courses.

Simulation Games

In simulation games, the player operates a model or simulation that behaves according to a programmed set of rules. Many simulation games focus on some element of realism, thus forcing players to understand and remember complex principles and relations and progress by trial-and-error. These often very expensive games can teach anything, from flying a plane up in the sky to driving a submarine deep in the ocean. Typical examples are *Flight Simulator* and *Train Simulator*. Another is *SimCity*, a popular mainstream title that has been used for educational purposes. Social simulation games are also a large component in the simulation genre, with Wil Wright's *The Sims* being the most widely recognized title. Another recent (and free) simulation game developed for Business Project Management training is *INNOV8*, developed by *IBM* a few years ago and now reaching version 2 (2009). These kinds of simulation games are often suitable for online cooperative work and thus very apt for integration in ODL.

Modeling Games

Modeling is often a component of the game rather than the game itself, and usually is tied with other types of games (Action, Strategy, Simulation, Programming, etc.). For example, some car racing titles involve creating a track or building the car before you can race it. This genre is also linked with Programming games, as learners may create the models before they are able to program them. Examples include robots, cars, bikes, machines, factories, companies, electronic devices, etc.

Programming Games

A programming game is basically a computer game where the player has no direct influence on the course of the game. Instead, a computer program or scripts written in some domain-specific programming language in order to control the actions of the characters (usually robots, tanks or bacteria, which seek to destroy each other). Most programming games can be considered environments of digital organisms, related to artificial life simulations. Games that enable users to build microworlds have been created at the MIT MediaLab, and extensive research has been published on this (programming of Lego robots and Logo projects). The potential for use in ODL is great and technology is freely available.

Massively Multiplayer Online Games

A massively multiplayer online game (also called MMOG or simply MMO) is a game capable of supporting hundreds or thousands of players simultaneously. The most accomplished and famous MMO is World of Warcraft, with many millions of players all over the world, but in education this is a hard choice to make due to technological demands (software, servers, technical support, etc.). There are a few multiplayer games with educational intentions, for example, with MEGG (<http://www.cybertrain.info/megg.html>) one can build an online multiplayer educational game on any theme, with menus, text, graphics and multichoice quiz banks.

Virtual Worlds

Virtual Worlds are one of the newer developments on the Internet, with Second Life being the most well known. The unique qualities of 3D virtual worlds can provide opportunities for rich sensory immersive experiences, with authentic contexts and activities for experiential learning, simulation and role-play, including the creation of complex environments and scenarios. Hundreds of university systems around the world use the Second Life Grid™ as a lively part of their educational programs. Many of the previous types of games can be set up in a virtual world and take full advantage of a 3D environment and its realistic interaction modes. One recent example is SMART Chairs, an open source gameshow for Second Life (see here: http://www.youtube.com/watch?v=SRVVrAp_64U)

Layered Reality Games

These games are representative of a new set of experiences that consists of roughly three different categories of games: Augmented Reality Games, Hybrid Reality Games, and Alternate Reality Games, mostly involving active engagement, participation in groups, frequent interaction and feedback, and connections to real world contexts. This last aspect makes the difference and identifies the genre more specifically.

Augmented Reality Games

Augmented reality games typically layer a digital, location-based, and context sensitive dimension to a concrete, physical or geographical space. Also known as enhanced reality, this term is often used to refer to virtual experiences being played out in real world spaces.

Hybrid Reality Games

A hybrid reality game is defined usually as a game that occurs simultaneously in both physical and digital spaces. Players adopt more than one role in this type of game. For example, roaming through the physical streets of a city and/or sitting at a computer playing online. The game board runs in parallel to the real world and bridges the space between the physical and digital worlds.

Alternate Reality Games

This kind of game may be more accurately described as an interactive narrative that unfolds in distributed fragments as players solve enormously complex puzzles. The game world is layered or superimposed on the real world. Clues are dispersed by means of real world media channels, like the Internet, movie clips, billboards, newspapers, telephones, e-mails, etc.

In this last category - Layered Reality Games – there is a lot of research going on at the moment (O’Shea, 2008; Klopfer, 2008), for instance, at the University of Wisconsin’ s Advanced Distributed Learning Co-Lab (2009) where most of our research work was done. A case in point is *Lake Wingra* (Fig. 3), an Augmented Reality Game (ARG) that uses PDA devices with GPS to enable students to play an educational game at a real geographic location. Because learning is a process of creating meaning in context, the environment plays an important role in the processes of knowing and learning; the environment constrains activity, affords particular types of activity or performance and this can also be supported by distance learning in what concerns field work activities and practice (e. g. in ecology, archaeology, biology, etc.).

It is also important to highlight the success of MMO games in engaging large groups of remotely located users (e.g. *World of Warcraft* or *Ultima*), leading to the expansion of educational projects in many training organizations, using multiplayer online role-play gaming approaches as a means for engaging and retaining large remotely located learner groups, and for supporting collaborative learning objectives and 'communities of practice' (De Freitas & Griffiths, 2007). An example of one such project is *Rochester Castle*; it demonstrates the potential for supporting collaborative learning processes, such as those associated with problem- and experience-based learning (Lee *et al.*, 2005). Other cases are *StrikeCOM* a multiplayer online strategy game, designed to research and teach group interactions, dynamics and processes (Twitchell *et al.*, 2005) and *Full Spectrum Command (FSC)* a more immersive and visually absorbing style of MMORPG that was developed as an educational tool (Biros *et al.*, 2005).

Another fresh research path that is useful for ODL takes the view of students as authors of game content in line with the emerging phenomenon of students creating their own learning content while using digital media tools. In a study on students building a self-organizing game-based learning environment Squire *et al.* (2005) suggest that this kind of programs may be feasible in educational contexts. It was found that game players developed new vocabularies and displayed complex thinking and negotiation skills while playing *Civilization III*, although they could not demonstrate what kind of long term impact the experience could have on their academic performance.

Last but not least, the pedagogical requirements for the use of educational games has been extensively discussed by Moreno-Ger *et al.* (2008) and by De Freitas & Oliver (2006), namely identifying specific game design requirements that are relevant for ODL: integration with online education using learning objects and platforms, adaptation to different learning styles, different levels of initial knowledge and expectations, and assessment by means of automated processes or by instructor participation. These are core aspects that have to be considered in the design of e-learning materials that integrate games and simulations, and probably go up against many current e-learning environments that use passive educational models based on content that is distributed rather than learnt.



Figure 3. Screen Layout and XML script of AR game developed at ADL Co-Lab

4 Conclusion

Whatever the technological scenario, we believe that all technologies should be considered as mere *tools* in the service of Open and Distance Learning (ODL), rather than an essential factor involved in the learning process. In fact, distance learning really implies much more than just using intensively a given set of applications: it comprises all the human factors and qualified work involved in conceiving appropriate learning materials, devising a sound pedagogical strategy, providing each student with efficient online support, assessing individual progress using a LMS, and certifying their final results.

Our stance is the transformation of ODL curriculum and instruction processes based on new digital media capabilities and its patterns of use by students, namely through interactive and rich content embedded in effective learning experiences. We discussed how some popular categories/genres of games and simulations, such as strategy and role-playing, may integrate successfully with online education. These educational games should be able to coexist in environments that follow the learning objects model and include an elevated pedagogical value as discussed in the literature. At the moment the number of ODL cases to study is very small but future research on game-based learning projects will show how this can be accomplished and with what results.

This overview is just a first step in the creation of a model for the deployment and use of games and simulations in ODL. We have full knowledge that the use of games and simulations may set the teaching and learning decisions against the planning and organizational policies with unpredictable outcomes. We also recognize that, even though we find these developments to be necessary and important for ODL, they probably involve an overwhelming effort for many organizations around the world where the struggle to get low

cost computing and broadband access is a priority. But this is a great time for ODL to take on the challenge of adopting emerging digital media, games and simulations.

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