CHAPTER TWO

EDUCATION

Education and Culture DG
Lifelong Learning Programme

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1. Education And Theory of E-Learning

Introduction

It is true that of all the major components of daily life, formal learning is the one that has, to date, been least affected by the technological developments of the past 50 years. Advances in technology have revolutionized communication, transportation, and even household chores, but in fundamental respects, the process of learning today is much the same as it has been throughout recorded history.
During the last years, however, there has been a powerful growth in the learning sector in parallel with the rapid development of Internet. Distance Learning has played the main role in that growth. Distance Learning has the potential for rapid growth and acceptance. It should come as no surprise that learning in America, both in schools and the workplace, is already big business. According to The Digest of Education Statistics 1999[1], education expenditures alone account for over 7% of the GPD, making it second in size only to the healthcare industry.
Many people have touted the ability of eLearning to provide information to "anyone, anytime, anywhere", and although we believe that this is the phrase that best describes it now, this description is also appropriate for traditional distance learning methods or even the Internet in general. We believe that the true power of eLearning will be in its ability to bring the right information to the right people at the right time.
This is the yet-to-be fulfillment promise of eLearning. Web-based integrated learning systems will revolutionize eLearning by enabling personalized, interactive, just-in-time, current and user-centric learning tools. These systems will allow all facets of a course of study, including pre-assessment, learning modules completed, practice items, collaboration, and testing to be tracked. Adjustments can then be made to the learning program to make it more effective, and learners will be able to monitor progress. More analytically, eLearning will embrace the following characteristics:

- **Personalized**: Entire programs of study will be customized for the learner. By analyzing the learner's objectives and existing skill level, courses will be assembled on the fly that address exactly what the learner needs to know without wasting time working on areas in which the learner is already proficient or uninterested. This level of personalization will be achieved by using small chunks of information, or learning objects, to assemble a course from the ground up using pre-existing templates. The reusability of these learning objects will make this level of customization feasible in terms of both time and expense.
- **Interactive**: Much of today's technology-based learning is simply an extension of traditional textbook-based learning, where the user reads content from a screen instead of from a page. Today's interaction generally consists of the learner being able to click on an unknown word for the definition on a linked page or the ability to play a short video clip. Coming manifestations of eLearning will truly engage the learner in a give-and-take type of learning that involves simulations of real-world events and sophisticated collaborations with other learners and the instructor.

[1] Johnson S., Aragon S., Shaik N., Palma-Rivas N., "The Influence of Learning Style Preferences on Student Success in Online vs. Face-to-Face Environments", WebNet 2000: World Conference on the WWW and Internet, Association for the Advancement of Computing in Education, San Antonio, Texas, November 1, 2000.

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- **Geographic ant time independence**: Learners will be able to join in the class from anywhere in the world. This will have as a result that there will be no building restrictions for the learning process and we will have not problems of overcrowding inside the classes. Geographic independence means also that the stored data in a web-based lesson can be changed whenever we want, without any delays in the distribution of the material. When information is in the web all users have access in them. In that way it is not necessary for both the instructors and the learners to be present in the same class at the same time. So there are no excuses for anyone (instructor or learner) to be absent. The freedom of choosing the time increases the sense of controlling the learning experience and thus increases the motivation for learning.
- **Operating System Independence:** different learning applications such as Computer Managed Learning (CML) or Computer Based Training (CBT), are designed for a specific operating system (Linux, Windows, Macintosh). This specification means that a producer of a such programs probably will lose a significant part of the marketplace or that he must try hard in order to sypport multiple systems. The independent of platform function of Internet reduces such problems.

As the eLearning industry begins to mature, we are seeing product offerings that are far beyond the simple click-and-read courses that have characterized the industry to date. Future manifestations of eLearning will allow the learner more control over his own learning experience, thus making it more efficient and reducing time and costs. The chart below, illustrates the changes that learning technologies are undergoing and the effect of those changes on the effective delivery cost.

For the creation of Distance learning course usually are used web-based learning environments. These are integrated software packages that offer all the appropriate characteristics and functions for building complete eLearning applications. Recently, there has been in the market a variety of learning environments like those of the list below: Lotus Learning Space[2], SumTotal Learning Management[3], Blackboard[4], TopClass[5], Embanet&Compass[6], Intralearn[7], Ecollege[8], Ellucian[9] , Moodle[10].

[2] http://www.lotus.com
[3] http://www.sumtotalsystems.com
[4] http://www.blackboard.com
[5] http://www.wbtsystems.com
[6] http://embanetcompass.com
[7] http://www.intralearn.com
[8] http://www.ecollege.com
[9] http://www.sungardhe.com
[10] http://moodle.org/

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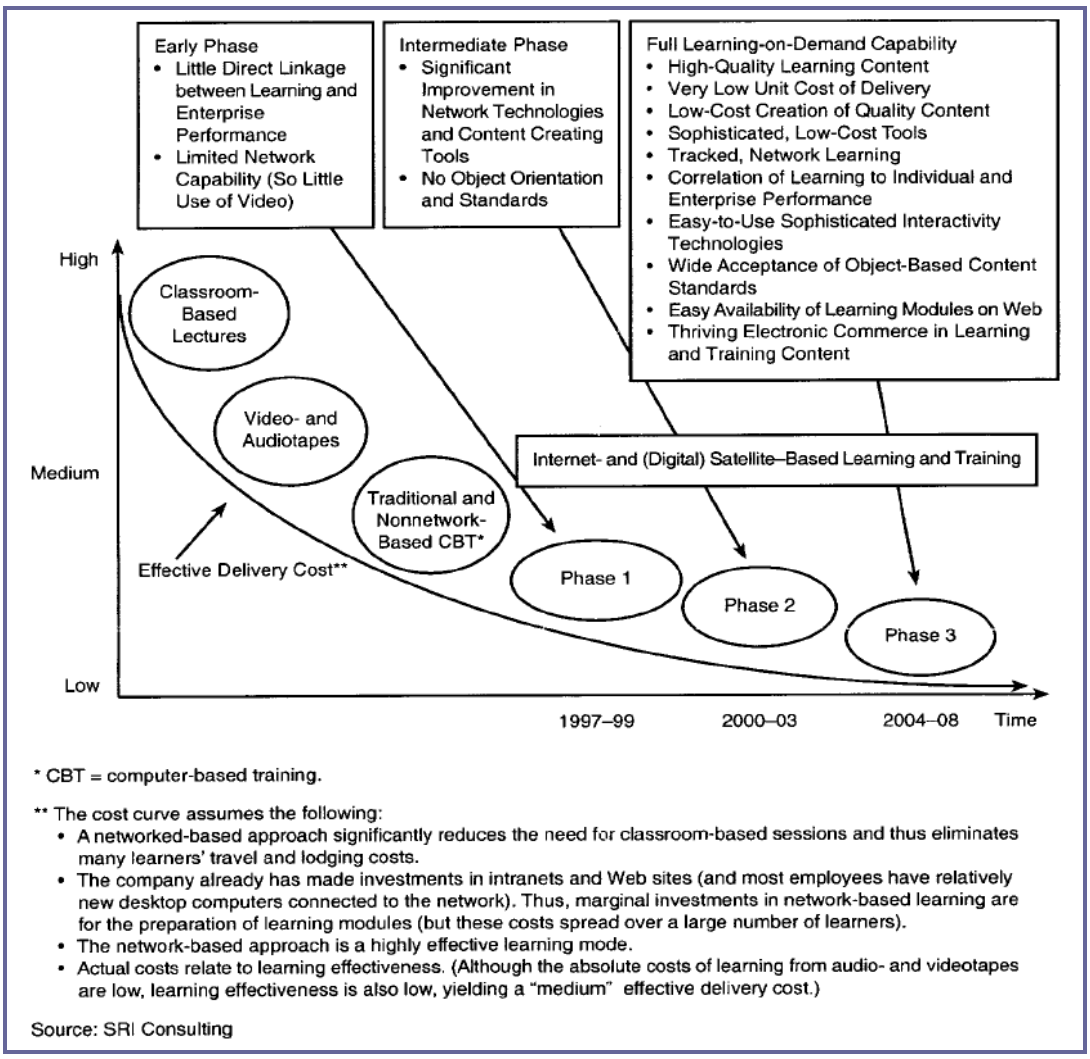

Chart 1 Evolution of Technology-Based Learning

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Comparison studies of Learning Management Systems

Most educational centers are adopting some kind of eLearning tool as an integral part of their learning systems; to enhance their traditional learning system or to create alternative models based on virtual learning. An important resource for these eLearning solutions is the eLearning platform. Therefore, those eLearning centers have to choose the best package of LCMS suitable to their needs, because there are dozens of packages with diverse feature; some of them are commercial Software, while others are free Open Source (OSS).

There are some concepts similar to eLearning platform: LCMS (Learning content management system), LMS/ CMS (Learning/ Course Management System), Portal Learning and platform of eLearning. We will use the abbreviation LMS to represent those concepts. The LMS is the eLearning platform which is considered as the important part of eLearning solutions from a university's viewpoint.[11]

LMS is the software that automates the administration of training events. All LM systems manage the login of registered users, manage course catalogs, track learner activities and results, and provide reports to management. An LMS may include additional functions such as: authoring of content, management of classroom training and learner collaboration tools.

Nowadays, many university administrations have established departments or centers to manage issues of eLearning which include:

- Propose the necessary changes in the system of the university.
- Decide the approach of eLearning implantation; to implement eLearning as apart of the existing system to enhance the traditional learning system or to establish a parallel system based on virtual learning.
- Decides to select the most suitable LMS platform.
- Implementing the selected LMS and training the tutors, teachers and related employees.
- Maintain, develop and backup the system.

Deciding to select the most suitable LMS platform is a difficult process, because there are dozens of packages with diverse features, however the result of survey analysis comparing recommended and known LMS offers us a good point to choose, because both Blackboard and Moodle are addressed as the top LMS[12] as we can see in the following excerp of the study:

[11] Itmazi, J. A. et. al, 2005. A Comparison and evaluation of open source learning managment systems. To appear at IADIS International Conference - Applied Computing 2005. Algarve, Portugal. 22-25 Feb. 2005. http://www.iadis.net/dl/Search_list_open.asp?code=1189

[12] Itmazi, J. A "Survey: Comparison and evaluation studies of learning content management systems" ETSI, University of Granada, Spain

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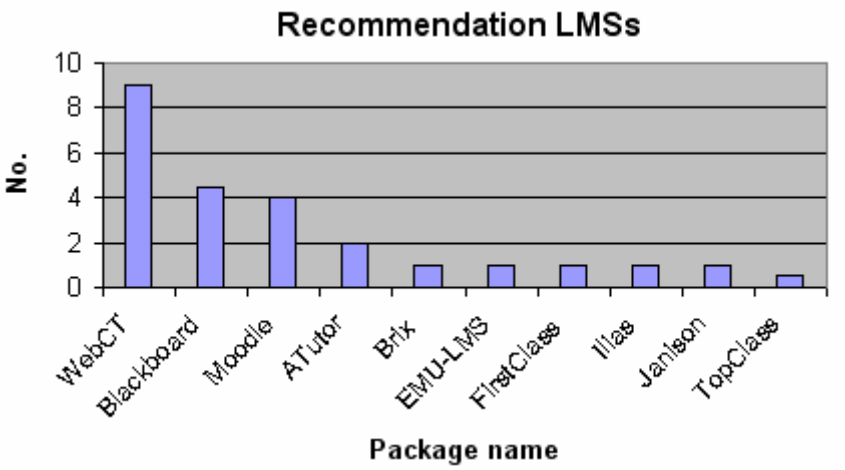

WebCT[13] *is the most recommended package with 9 out of 20 points, while blackboard occupied the second and Moodle the third. Upon OSS, Moodle is the most recommended OSS with 4 out of 7 points. The competition frequency for each LMS shows his popularity, famous and interesting packages at that time and taking of course from the views of the authors of those studies. WEBCT is the most popular package with 46 out of 362 points. Blackboard and Moodle are the followers. Moodle is the most popular OSS.*

[13] In February 2006, WebCT was acquired by rival Blackboard Inc and As part of the acquisition terms with Blackboard, the WebCT name was phased out in favor of the Blackboard brand. http://en.wikipedia.org/wiki/WebCT

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How video gaming languages can integrate distance learning

Advantages and disadvantages of computer games used as learning tools

Computer games engage. They are seductive, deploying rich visual and spatial aesthetics that draw players into fantasy worlds that seem very real on their own terms, exciting awe and pleasure. They motivate via fun ('part of the natural learning process in human development'[14], via challenge and via instant, visual feedback within a complete, interactive virtual playing environment, whereby ambience information creates an immersive experience, sustaining interest in the game. They are fast and responsive, and can be played against real people anywhere in the world, or against a computer. They handle huge amounts of content and can be instantly updated and customized by individual players. It has been suggested[15] that computer games can incorporate as many as 36 important learning principles.

For example, they put learners in the role of decision-maker, pushing them through ever harder challenges, engaging the player in experimenting with different ways of learning and thinking[16].

Crucially for learning, computer games can provide instant feedback.

In other words, computer games are valuable tools in enhancing learning. They are seen as a means of encouraging learners who may lack interest or confidence[17] and of enhancing their self-esteem. In training and educational settings it is suggested that they can reduce training time and instructor load, for example affording opportunities for drill and practice (which is a form of instruction where learners rehearse sets of material following the same pattern), thereby enhancing knowledge acquisition and retention[18];[19]. However, recall may be promoted less by games than by lessons if games are difficult because they have multiple goals and distracting components[20].

Though regulated by rules, computer games allow manipulation of objects, supporting development towards levels of proficiency[21]. They are said to be particularly effective when 'designed to address a specific problem or to teach a certain skill', for example in encouraging learning in curriculum areas such as maths, physics and language arts, where specific objectives can be stated, and when deployed selectively within a context relevant to learning activity and goal[22].

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[14] Bisson C, Luckner J (1996). Fun in learning: the pedagogical role of fun in adventure education. Journal of Experimental Education, 19(2), 108–112.

[15] Prensky M (2001). Digital game-based learning. New York: McGraw-Hill.

[16] Gee JP (2003). What video games have to teach us about learning and literacy. New York: Palgrave Macmillan.

[17] Klawe MM (1994). The educational potential of electronic games and the E-GEMS Project. In T Ottman and I Tomek (eds) Proceedings of the ED-MEDIA 94 World Conference on Educational Multimedia and Hypermedia. Panel discussion 'Can electronic games make a positive contribution to the learning of mathematics and science in the intermediate classroom?' AACE (Association for the Advancement of Computing in Education), Vancouver, Canada, 25–30 June 1994.

[18] Brownfield S, Vik G (1983). Teaching basic skills with computer games. Training and Developmental Journal, 37(2), 52–56.

[19] Ricci KE (1994). The use of computer-based videogames in knowledge acquisition and retention. Journal of Interactive Instruction Development, 7(1), 17–22.

[20] Oyen A, Bebko JM (1996). The effects of computer games and lesson contexts on children's mnemonic strategies. Journal of Experimental Child Psychology, 62, 173–189.

[21] Fabricatore C (2000). Learning and videogames: an unexploited synergy.

[22] Kirriemuir J (2002). The relevance of video games and gaming consoles to the higher and further education learning experience. April 2002. Techwatch Report TSW 02.01. At www.jisc.ac.uk/index.cfm?name=techwatch_report_0201, accessed 14 April

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It is important, however, that they are used to facilitate tasks appropriate to learners' level of maturity in the skill[23]. Moreover, for skills to be enhanced by game playing, players must possess such skills to some degree already[24].

Even simple types of game can be designed to address specific learning outcomes such as recall of factual content or as the basis for active involvement and discussion[25].

- Exploratory, interactive games are good vehicles for embedding curriculum content such as maths and science concepts that may be hard to visualize or manipulate with concrete materials. Riddles and interactive computer games have been used successfully with college students to enhance creative and other forms of critical thought[26].
- Complex games, in particular, have the potential to support cognitive processing and the development of strategic skills. Brain oscillations associated with navigational and spatial learning occur more frequently in more complex games. This increases users' learning and recollection capabilities and encourages greater academic, social and computer literacy skills[27].
- Simulation games enable engagement in learning activities otherwise too costly to resource or too dangerous, difficult or impractical to implement in the classroom[28] as well as those that are hard to accomplish by other means. Imaginative, well-produced simulation games can be seen as interactive stories. Participation in these stories can change learners' relationships to information by encouraging visualisation, experimentation and creativity in finding new ways to tackle the game[29]. Furthermore, simulation games are flexible and complex enough to cater for different learning styles, for example via the graphics. They broaden learners' exposure to different people and perspectives, encourage collaboration, and support meaningful post-game discussion. They put the learner in the role of decision-maker and push players through ever harder challenges.

There are opportunities with new and emerging technologies for providing effective coaching in an adventure games environment. For example, the player can experience a role or roles in a near real-life setting and at the same time learn about the setting itself, developing intuitive skills at coping in that environment[30]. When connected to an intranet, learners can interact simultaneously with other users as well as with the environment itself[31]. Increasing use of mobile devices and of handheld

[23] Din FS, Calao J (2001). The effects of playing educational video games on kindergarten achievement. Child Study Journal, 31(1), 95–102.
[24] Subrahmanyam K, Greenfield P, Kraut R, Gross E (2001). The impact of computer use on children's and adolescents' development. Journal of Applied Developmental Psychology, 22(1), 7–30.
[25] Dempsey JV, Lucassen BA, Haynes LL, Casey MS (1996). Instructional applications of computer games. Paper presented to the American Educational Research Association, 8–12 April 1996, New York. ERIC Document Reproduction Service No. ED 394 500.
[26] Doolittle JH (1995). Using riddles and interactive computer games to teach problem-solving skills. Teaching of Psychology, 22(1), 33–36.
[27] Natale MJ (2002). The effect of a male-oriented computer gaming culture on careers in the computer industry. Computers and Society, 32(2), 24–31.
[28] Berson MJ (1996). Effectiveness of computer technology in social studies: a review of the literature. Journal of Research on Computing in Education, 28(4), 486–499.
[29] Betz JA (1995). Computer games: increase learning in an interactive multidisciplinary environment. Journal of Educational Technology Systems, 24(2), 195–205.
[30] Khan MM (2002). Implementing an intelligent tutoring system for adventure learning. The Electronic Library, 20(2), 134–142.
[31] Lee KM (2000). MUD and self efficacy. Educational Media International 2000 (September), 37(3), 177–183.

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games consoles such as the Game Boy Advance offers opportunities for developing educational software to support blended learning, for example classroom-based learning linked to learning online and/or outdoor activities such as museum visits and field trips.

There are, however, some educational considerations. For example, for skills to be enhanced by game playing, players must possess them to some degree already. Teacher bias towards a particular learning method and teacher input into debriefing can affect the effectiveness of games in encouraging learning[32]. A number of risk factors can impact negatively on encouraging learning via computer games. For example, learning objectives may not be congruent with game objectives, games can distract from learning as players concentrate on completing, scoring and winning, and games require suspension of belief – it may be difficult to retain learning acquired in that state[33]. What seems like a game to someone will feel like work to another; hence, it is argued the intention should be enlightenment, not entertainment. There is also an opportunity cost of learning via computers: time spent in front of a screen could instead be spent, for example, in social or sport activity[34].

How have computer games been used for learning?

Computer games have been used to serve a variety of functions in training and educational environments, for example: Tutoring, amusing, helping to explore new skills, promoting self-esteem, practicing skills, or seeking to change attitudes. Even simple types of game have been used to address specific learning outcomes such as recall of factual content or providing the basis for discussion, while complex games, in particular, have been seen to support cognitive processing and the development of strategic skills, increasing learning and recollection capabilities, and promoting computer literacy skills. Computer games have been particularly effective in raising achievement levels of both children and adults in areas such as maths and language, where specific objectives can easily be stated, and have been used to support National Curriculum learning. Information-processing educational game components that have been designed to imitate popular computer games have been found to help poor readers to make significant learning gains, with the greatest improvement shown by the poorest readers and resource-deprived learners. They have also had positive effects on motivation and classroom dynamics[35].

The use of quiz games has also led to positive results in long-term student retention (ie ensuring they complete a course) by attracting higher student interest than traditional classroom approaches. For example, in training environments such as the Naval Training Systems Center in Orlando, Florida, computer-based versions of board games such as Serious Pursuit were adapted to cater for service personnel whose jobs required a pre-existing knowledge base for certain tasks. This prompted development of GameShell, a software program to house question and answer databases. When these games were used there was better retention. This was attributed to more focused attention, because the students enjoyed the approach. Simulation games have been used in schools to enhance children's spatial abilities and general cognitive development, with both boys and girls performing

[32] Randel JM, Morris BA, Wetzel CD, Whitehill BV (1992). The effectiveness of games for educational purposes: a review of recent research. Simulation and Gaming, 23(3), 261–276.
[33] Clark D (2003). Computer games in education and training. Presentation at LSDA seminar Learning by playing: can computer games and simulations support teaching and learning for post-16 learners in formal, workplace and informal learning contexts? 20 November 2003, London.
[34] Stoll C (1999). High tech heretic – reflections of a computer contrarian. New York: First Anchor Books.
[35] Rosas R, Nussbaum M, Cumsile P, Marianov V, Correa M, Flores P, Grau V, Lagos F, Lσpez X, Lσpez V, Rodriguez P, Salinas M (2003). Beyond Nintendo: design and assessment of educational video games for first and second grade students. Computers and Education, 40, 71–94.

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equally well[36], while[37] reports that versions of strategy games like Sim City have been used in schools to encourage learning in subjects such as geography. Simulation games have also been used in business environments, for example in teaching administration skills. Off-the-shelf games simulations such as Doom II have been used in conjunction with free tools downloaded from the internet to provide cost-effective military training, for example where real-world environments or locations may be unavailable to troops. Simulation games have been found to be most effective in encouraging discovery learning where the system provides two kinds of instructional support: learner-requested background information and elaborate system-initiated advice. However, the role of teacher mediation remains important, in explaining or augmenting the game. For example, task cards were used with games, requiring learners to describe their strategies and to provide tips to others, thereby stimulating reflection and writing skills. Working with sections, rather than the whole game, may be more useful to particular learning objectives. This means the teacher must know the content behind the titles and understand controls, menus and skill levels of the game, and this requirement thus increases teacher workload. Complex games have been useful in encouraging attitude change, in supporting the development of critical thinking, in problem solving and in developing decision-making skills. They have been explored as a means to foster learners' understanding of theoretical models and interaction effects and to support the development of team, social, communication and resource sharing skills[38],[39],[40].

Conclusions

The reasons for playing games appear to be gender-related – males can focus on winning a game, whereas females can focus on completion. Either way, struggle is a key factor in motivating learners. Struggle is also important in supporting cognitive learning, but there should be a satisfactory end to each game, to reflect an element of progress. Context is also key: it must be meaningful and relevant to target audiences. There is a strong case for games to incorporate creative tools, giving the learner control. This can extend to allowing them to enhance the game or create new games. It is true that few learners may want or feel able to take up such options and that even if they do so the results may be unsatisfactory. Nevertheless, it is vital to encourage aspiration in learning, with at risk students in particular. It would be beneficial for the game to afford opportunities for players to personalise the medium, thereby allowing them to key into their lifelong learning experience. This is important because games should not just relate to curriculum, but also to youth culture and learning styles.

The implications for the planning and design of educational computer games include the issue of the cognitive style changes associated with a generation growing up in the age of digital computer games. If complex games support the development of 'expert behaviours' such as pattern recognition, strategic decision-making, superior memory skills and self-monitoring, students having honed such

[36] De Lisi R, Wolford JL (2002). Improving children's mental rotation accuracy with computer game playing. Journal of Genetic Psychology, 163(3), 272–282.
[37] Jayakanthan R (2002). Application of computer games in the field of education. The Electronic Library, 20(2), 98–102.
[38] Leutner D (1993). Guided discovery learning with computer-based simulation games: effects of adaptive and non-adaptive instructional support. Learning and Instruction, 3(2), 113–132.
[39] Ritchie D, Dodge B (1992). Integrating technology usage across the curriculum. Paper presented to the Annual Conference on Technology and Teacher Education, 12–15 March 1992, Houston, TX.
[40] Helliar CV, Michaelson R, Power DM, Sinclair CD (2000). Using a portfolio management game (Finesse) to teach finance. Accounting Education, 9(1), 37–51.

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skills may become disenchanted with learning games if there is little opportunity to deploy those skills. Educational games should therefore engage and stretch players in learning at different levels, from the straightforward to the sophisticated. This review has indicated that producing educational games that are true games is a worthwhile activity. Indeed, it is a necessary development if we are to reach out to current and future generations in ways that cater for their needs and expectations.

Educators and industry experts must work together to research the computer culture, to ensure that innovations are capable of engaging and sustaining interest. Designers should not only explore ways of combining new technologies such as mobile networking, context-aware computing and sensor-based computing but should also ensure the new generation of edugames builds on the principles of successful commercial games such as risk–reward structures. However, there are budgetary implications in following this route. The modest profits thus far gained from educational games pale into insignificance against the huge profits to be made from commercial games. As the required investment is correspondingly large, the endeavour requires collaboration between educationalists and industry and the commitment of policy-makers and funding bodies.

Supplementary information and examples can be found in Annex 1

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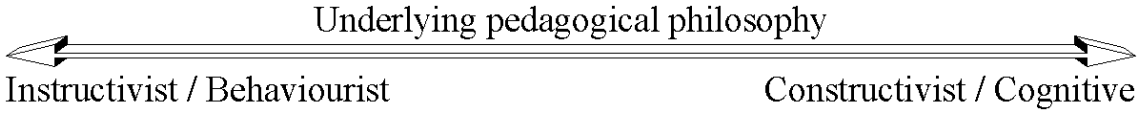
2. Practical Methodologies Of E-Learning

Designing quality e-learning environments

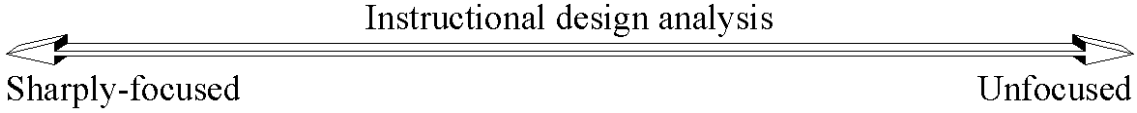
With the ever-increasing integration of online learning into university courses, there is strong need for practical guidelines and recommendations to facilitate the development and delivery of pedagogically effective e-earning environments. An investigation by Siragusa (2005) examined factors which make for effective instructional design principles and learning strategies for higher education students studying within these learning environments. Surveys were administered to students and lecturers in Western Australian universities which revealed numerous areas of students' e-learning experiences which they had perceived as being successful and those needing improvements.

This unity presents a model containing 24 sets of recommendations that were developed from the study's survey findings. The 24 recommendations accommodate the varying pedagogical needs of learners as well as modes of course delivery. For each recommendation, a pedagogical dimension is presented to illustrate the pedagogical needs and instructional requirements These 24 dimensions, which are grouped within nine main sections, highlight the decisions which need to be made during the instructional analysis, design, delivery and evaluation phases of e-learning environments in higher education in order to optimise their pedagogical quality.[41]

Pedagogical philosophy and instructional strategy for e-learning: This requires an analysis of the learner, the learning context and the learners' specific learning needs. Students may be required to learn a set of principles within a discipline area and integrate previously learned knowledge with new knowledge by employing techniques such as advanced organisers, worked-out examples, and elaborative questions. A lecturer with postgraduate students completing a Masters degree may prefer to adopt a constructivist approach to teaching, where students are encouraged to construct their own meaning of the content through their prior experiences.



Instructional design analysis: The development of online learning environments needs to draw upon the vast body of knowledge relating to instructional design models. The lecturer will develop an instructional strategy which will employ online learning technologies to assist with achieving this instructional goal, or he/she may adopt a constructivist learning environment where students combine new learning with existing knowledge and the learning experiences are authentic depictions of existing practices.



Content: The detail and extent of the content provided to students may vary depending upon the students' pedagogical needs.

[41] Lou Siragusa, Kathryn C Dixon, Robert Dixon "Designing quality e-learning environments in higher education". Faculty of Education, Language Studies and Social Work. Curtin University of Technology. Ascilite 2007 Singapore. http://www.ascilite.org.au/conferences/singapore07/procs/siragusa.pdf

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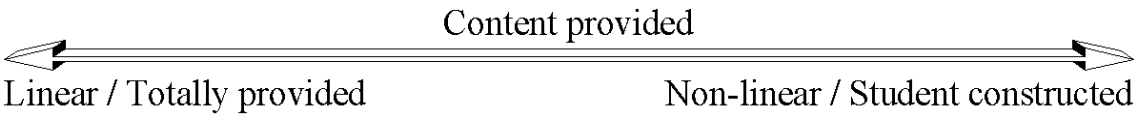
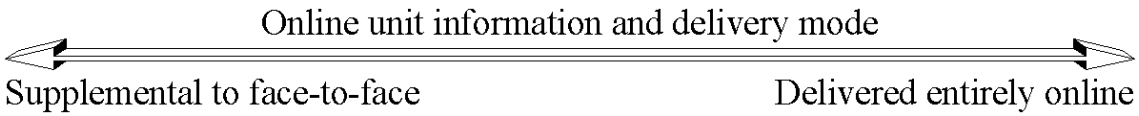
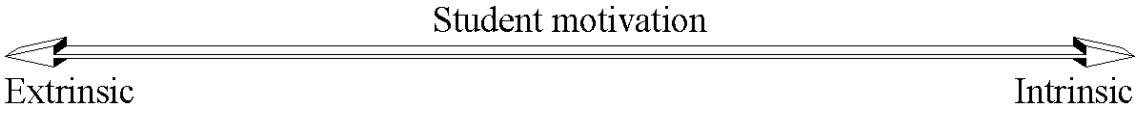


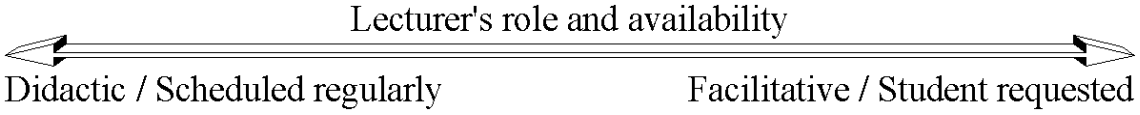
Online information and delivery mode: The amount of information to provide on a class website may be determined by the delivery mode. If a unit is to be delivered entirely online, then the website must include all the information needed for students' successful completion of the unit including appropriately detailed content, learning activities, assignment requirements, and supporting materials. If the class website is to be supplemental to face-to-face classes, then the lecturer will need to determine which information will be provided on the website and which information shall be distributed during classes.



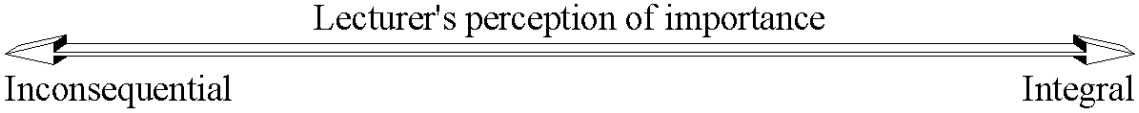
Student motivation in e-learning: Students enrolled in higher education courses come from a variety of backgrounds and have different reasons for studying. While it is generally accepted that online learning designers should use intrinsic motivation strategies, extrinsic motivation may also be used. Students studying in distance mode need to feel that they are part of a group of learners and are able to obtain assistance with the unit's requirements and technical difficulties



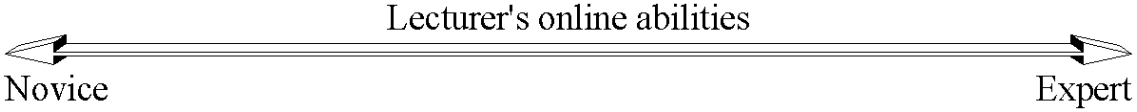
Lecturer's role and availability: The lecturer's role is an important factor in the design of online learning environments. The lecturer needs to be available at regularly scheduled times to assist students with the learning activities and for clarifying concepts. Lecturers should routinely check the online communication facilities for new postings and provide prompt and adequate replies to student questions.



Lecturer's perception of importance: How lecturers perceive the importance of online learning will influence how online learning is utilised and integrated into their teaching practices. Lecturers with a low perception of the importance of online learning may not fully consider how to apply online strategies to enhance their students' learning. Lecturers with high perceptions of the importance of online learning may explore integrating learning strategies utilising online technologies such as automated interactive activities.



Lecturer's online abilities: Lecturers' knowledge and abilities of online learning technologies may influence how they utilise the class website to enhance their students' learning.



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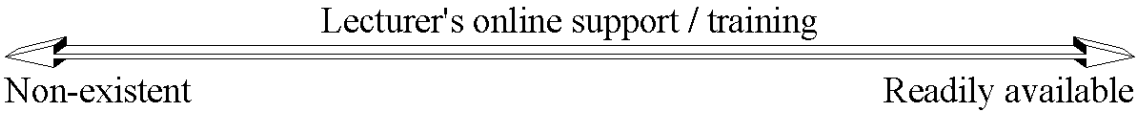
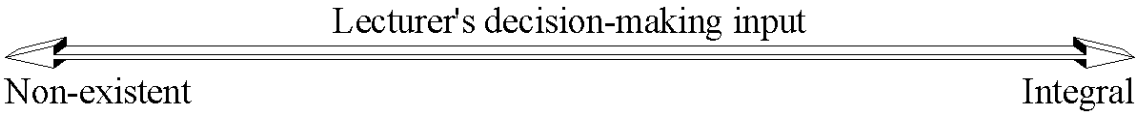
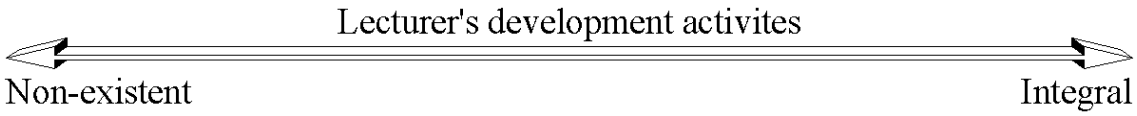
Lecturer's online support and training: Lecturers involved in developing further knowledge of online learning through professional development may integrate what they learn into their own online learning environments.



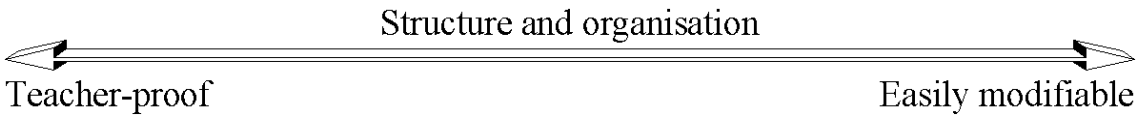
Lecturer's decision making input: Lecturers showing interest in the development and decision making aspects of online learning are often involved in innovative solutions for online learning within their teaching area. A lecturer with a specific need for online learning to assist with the teaching of specific concepts may explore the use of automated interactive activities.



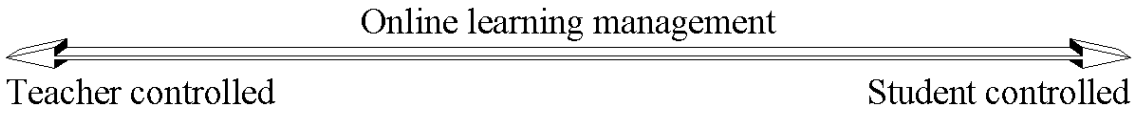
Lecturer's development activities: The existing body of knowledge relating to instructional design should be made aware to all lecturers involved in the development of online learning. Lecturers involved in online learning design are more likely to employ some form of instructional design process in order to analyse and accommodate the specific learning needs of their students.



Structure and organisation: The structure of the class website, including navigation, nformation provided, and use of the online LMS features may vary depending on the targeted students and pedagogical need for online learning.

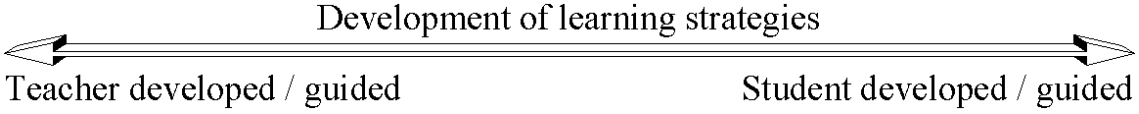


Online learning management: The features contained within proprietary online LMS applications may be utilised by students in various ways for enhancing their online learning experience.



Web-based design principles: While developing an online learning environment, sound web design principles suited to the targeted audience need to be employed including self-intuitive navigation, page layouts, text usage, background colours and textures, compatibility with various computer configurations, and allowances for human disabilities.

Development of learning strategies: Instructional design decisions can influence and encourage different learning strategies that can be used by students. The development of content for online learning may include specific learning strategies for building new knowledge upon previously learned knowledge.



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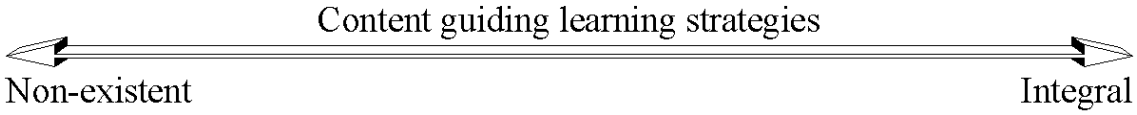
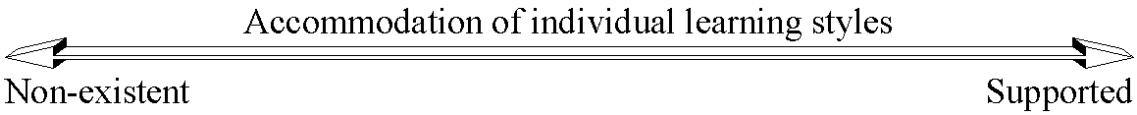
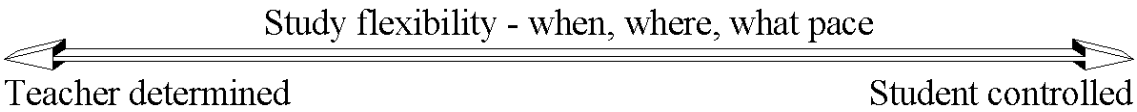
Content guiding learning strategies: The content placed on the class website may assist with guiding particular learning strategies to foster deep understanding of the subject matter



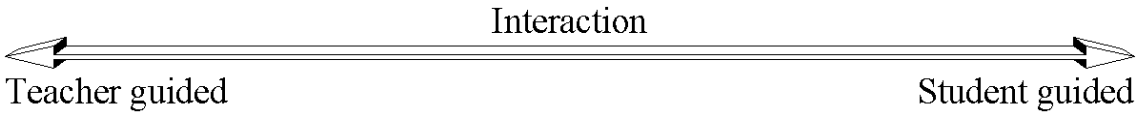
Accommodation of individual learning styles: Lecturers involved in the development of online learning needs to consider how the design of online materials may accommodate students' learning styles and facilitate deep approaches to learning through active engagement with the online materials.



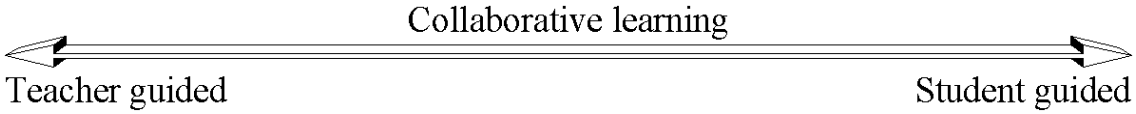
Study flexibility – when, where, at what pace: Students in higher education are demanding greater flexibility in the delivery of their courses. The design of an online learning environment may facilitate whether students are able to study when, where, in what sequence and at what pace they choose.



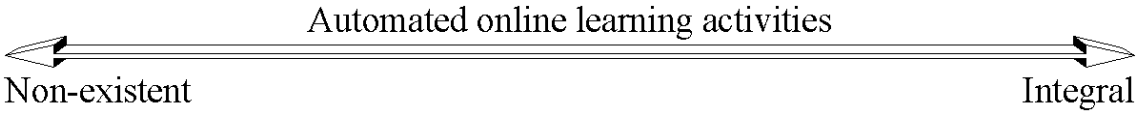
Interaction: Social constructivism suggests that learning is derived through a collaborative negotiation of meaning through multiple perspectives. A student interacting with other students and their lecturer, in conjunction with engagement with the content, will build his or her understanding of the unit's principles.



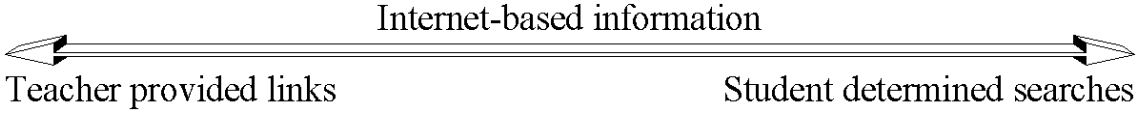
Collaborative learning: Student collaboration activities may be designed with varying levels of predefined structure.



Automated online interactive activities: Automated online learning activities may be provided for student learning to support repeated practice and feedback (behaviourist) type learning providing optimal conditions for the learner to receive and process information (cognitivist).



Internet-based information: Purposes for encouraging students to search for specific Internet-based information to foster deeper understanding of the subject matter may vary.



Feedback: Students are increasingly expecting more reliable and valid assessment with prompt feedback on their performance. The amount and type of feedback students require will vary depending upon student need and level of engagement with the learning materials.

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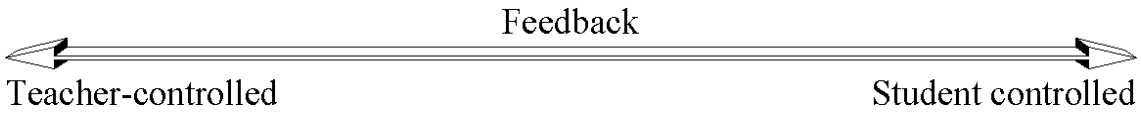
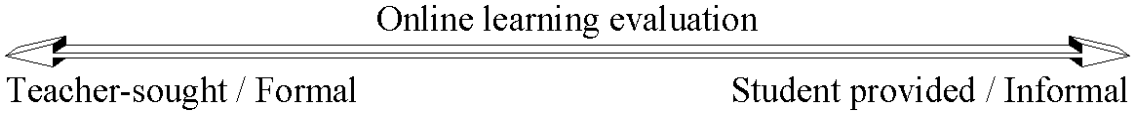


Online learning evaluation: Information collected about the learning environment through a formative evaluation process can be used to revise this environment for efficiency and effectiveness. The continuing development of online learning environments can benefit from students' evaluation comments regarding their experiences.



Instructional design for online learning model

The 24 recommendations above need to be considered at the design phase of teaching aterials to consider what role online learning will have with the delivery of the unit. This will vary depending upon a number of factors including the skills and knowledge of students, the selection of pedagogical approaches the learning context and mode of delivery, instructional strategies, the role of the educator, and the method of evaluation.

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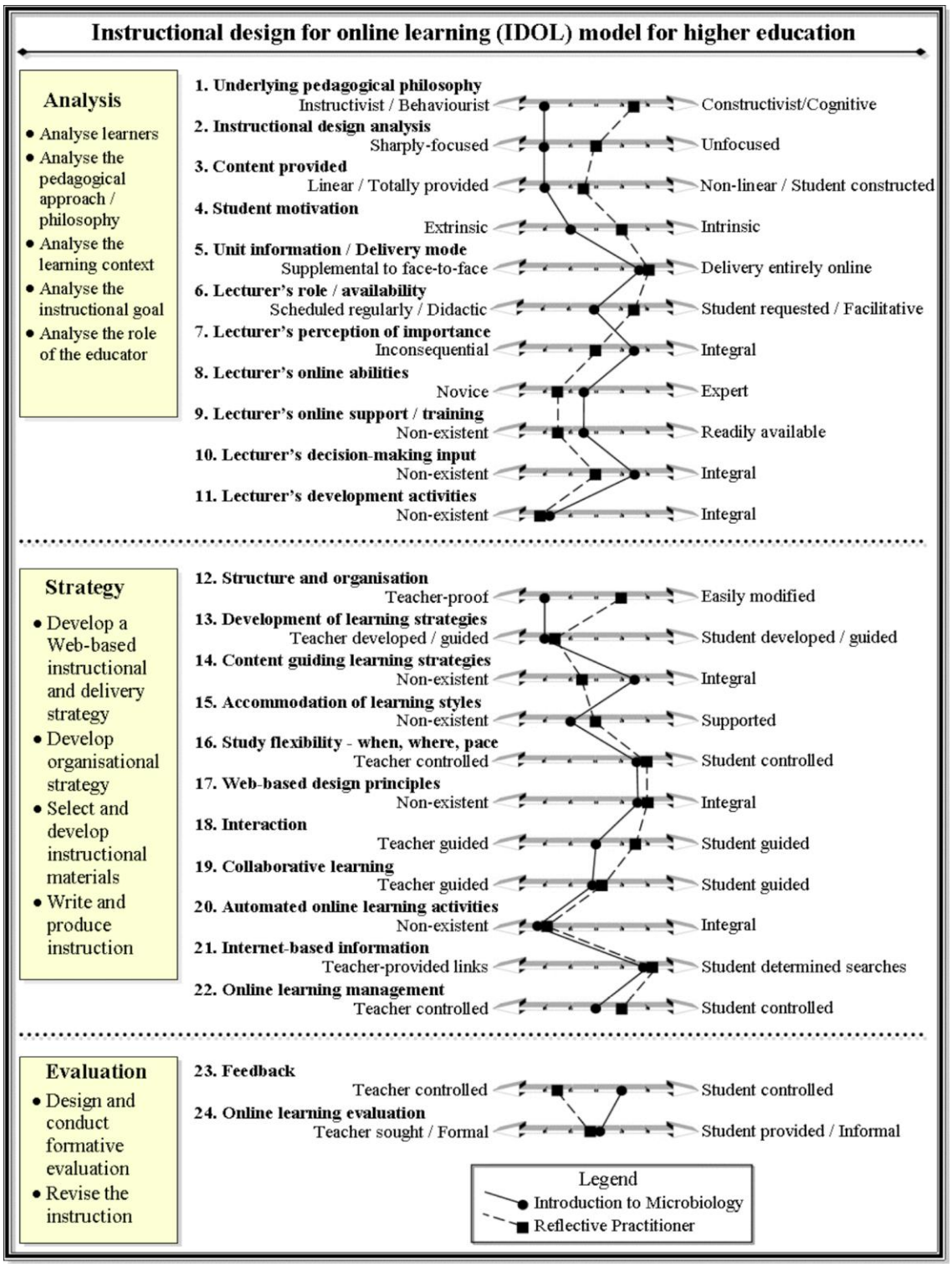

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Learning and teaching by online education

The information and knowledge age and the so-called network society are forcing the teaching staff to rethink about the educational experience in both senses, the structural and the conceptual scope. That is, learning on the Net and for the Net requires rethinking what and how to teach and learn and which today's needs and demands arising this society are, and, especially, in which way it specially responds to learners for taking a more active, critical and reflective participation in society.
Training, overcoming barriers of space and time, has to take advantage and use of information and communication technology properly, and it can only be achieved with the redesign of the methodology required for training programs.
These methodological proposals should be based on flexibility, interactivity and collaborative learning network, since the key feature of learning is carried out in collaboration.

Online students: active, collaborative and lifelong learners
Students must become the main characters of their training, having more autonomy and control over their own learning process. Currently, what is more relevant, is not that the individuals keep in memory all the information that receive from multiple fields, but the process that allow them to build the knowledge in interaction with the sociocultural context. That is, rather than receiving and storing information, the educational challenge is learning to find, selecting and analyzing this information in different reference sources. Thus, learning does not focus on the development of memory capacity, but in the process of analysis and reflection. This requires the ability to carry out a proper use of multiple resources and different media (printing, audiovisual, computer).
The networked learning students play a much more active and participatory role than in traditional classroom teaching, who often used to assume a passive role. Online Learning Students build their representations, build up concepts and solve problems. In this vein, the online learning students must take into account elements that define their role and living of their learning experience.

- Students are active and manage their own learning process. The online learning students do not have to develop a mechanical learning in acquiring knowledge with an open mind, but must be active individuals and stakeholders of their own learning process. Consequently, students should be proactive and autonomous, showing initiative in their learning and their performance during the course.
- They build their own knowledge from the study material and also from the peers and teacher relationship: learning from peers and teacher, and with them too. Therefore, although it is a virtual environment, they interact with peers and with teachers, ask for help, collaborate, maintain a good atmosphere in the classroom, etc..
- They organize their time wisely, so that they reconcile the academic dedication to their family and their work duties, in this line, flexibility is the key. It should be noted that online learning is no more difficult or easier than learning in a virtual environment, but it takes work and requires discipline.
- They carry out the training process through technological environment.

This involves having a high degree of autonomy and not only rely on either the content of the teacher or the available tools. To the extent that the information and personal interactions are available online via Internet, students can decide how to organize work or where they will develop it from, since the information is only no longer in training centers or in hands of teachers.

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The online teachers: facilitators of learning processes

Internet allows interaction at two levels; knowledge and people. This fact facilitates that it can easily develop a learning process focused more on research, treatment, processing and presentation of information. In an educational model designed to research, students who use the possibilities of telematics systems can take more responsibility for learning without forgetting the fact that they require frequently attention (daily) by the teacher.

In this sense, teachers can no longer be the only source of information to become advisers and guides, being responsible to provide educational structures and to guide students to access and transform their knowledge interactions. Teachers model features, guide the discussion of the students initiatives and do the assessment process. Therefore, rather than transmitters of knowledge, teachers must be characterized by tutoring and guiding students learning process, they must be intermediaries of knowledge. Teachers will plan an educational process open and flexible with current, varied, clear and motivating sources, using an interactive and collaborative work. They should also be able to analyze and refine their teaching practice using the different actors of the educational community (student participation, links with local companies) and working with other professionals on common projects. These activities and functions must have the support of lifelong learning and the reflection in educational practices, fundamental requirements for developing teaching-learning processes adapted to new contexts, social and technological environments.

In most cases the actual teachers are trained in a traditional way. To change this role, it requires on one hand, a continuing education that allows them to update and on the other hand, and in parallel, working collaboratively using information and communication technologies, because as they use them with their colleagues to work, they will be able to rethink their role as teachers.

The use of network technologies changes the role of the teacher, in the same way that the teacher-student relationships with educational resources and learning processes changes. The virtual environment requires a different set of teaching, i.e. a radical shift of traditional roles while diversifying the forms of participation in the learning process. There are five main characteristics or skills to be developed by teaching online:

1. understanding the processes online
2. technical skills
3. online communication skills
4. expert content
5. personal characteristics

Modern society, thanks to internet, promotes networking, and enables teachers to work collaboratively to help themselves upgrade, facilitates the creation of materials together and exchange of life experiences, in short, as it happens in the case of students, it allows the creation of cooperative knowledge. These new features show a significant change in the role, and become "the guide that accompanies" that is, a mentor or facilitator of the learning process. Specifically, the analysis of literature in the field that indicates the basic functions of the teacher in network:

- Facilitator of communication and collaboration.
- Intermediary, tutor and moderator.
- Designer of innovative teaching proposals, organizer of activities and facilitator of content, materials, resources, etc..

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- Manager and promoter of network information.
- Supplier of tools.
- Facilitator of help and support in relation to the content, methodology and technological and educational environment. In this line, highlighting the following tasks:
  - Advising, guiding and counseling.
  - Formulating questions and solving problems.
  - Facilitating integration in the technical-human training environment.
  - Assisting in overcoming the possible feeling of isolation.
  - Detecting academic students needs and guiding them in the academic track.
- Promoter of learning processes in the Network while encouraging participation, virtual communication processes and fostering motivation creating a pleasant learning environment.
- System Administrator.
- Coordinator of teams.
- Supervisor and evaluator.

In response to these functions, teachers leave the network former role as custodians and transmitters of knowledge, being professionals who master the skills required by today's society, while they know how to combine them all with the educational potential from Internet in order to facilitate students acquisition of these skills . Therefore, online teachers do not provide lectures, but the main function is to provide students with resources and strategies that help them develop their learning process, while addressing their concerns and needs.

Supplementary information and examples can be found in Annex 2

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3. How And Why To Use Videogames In Didactics

The educational benefits of videogames[42]

Most reported effects of videogames appear to centre upon the alleged negative consequences. These have included research into video game addiction[43] [44], increased aggressiveness [45], and the various medical and psychosocial effects. However, there are many references to the positive benefits of videogames in the literature.[46] [47]

Videogames have the capacity to engage children in learning experiences. Just by watching children it becomes very clear that they prefer this type of approach to learning. However, it appears that very few games on the commercial market have educational value. Some evidence suggests that important skills may be built or reinforced by videogames.For instance :

- Videogames can be used as research and/or measurement tools. Furthermore, as research tools they have great diversity
- Videogames attract participation by individuals across many demographic boundaries
- Videogames can assist children in setting goals, ensuring goal rehearsal, providing feedback, reinforcement, and maintaining records of behavioural change
- Videogames can be useful because they allow the researcher to measure performance on a very wide variety of tasks, and can be easily changed, standardized and understood
- Videogames can be used when examining individual characteristics such as self-esteem, self-concept, goal-setting and individual differences
- Videogames are fun and stimulating for participants. Consequently, it is easier to achieve and maintain a person's undivided attention for long periods of time. Because of the fun and excitement, they may also provide an innovative way of learning
- Videogames can provide elements of interactivity that may stimulate learning
- Videogames also allow participants to experience novelty, curiosity and challenge. This may stimulate learning
- Videogames equip children with state-of-the art technology.
- Videogames may help in the development of transferable IT skills
- Videogames can act as simulations. These allow participants to engage in extraordinary activities and to destroy or even die without real consequences

Videogames have been used in comprehensive programmes to help develop social skills in children and adolescents who are severely retarded or who have severe developmental problems. Some of the therapeutic benifits outlined are language skills, mathematics and reading skills, and social skills.

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[42] Griffiths, Mark "The educational benefits of videogames" Education and Health Vol. 20 No.3, 2002. http://sheu.org.uk/sites/sheu.org.uk/files/imagepicker/1/eh203mg.pdf

[43] Griffiths, M.D. & Hunt, N. (1995). Computer game playing in adolescence : Prevalence and demographic indicators. *Journal of Community and Applied Social Psychology,* 5, 189-194.

[44] Griffiths, M.D. (1998). Video games and aggression : A review of the literature. *Aggression and Violent Behavior,* 4, 203-212.

[45] Griffiths, M.D. & Hunt, N. (1998). Dependence on computer game playing by adolescents. *Psychological Reports*, 82, 475-480.

[46] Lawrence, G.H. (1986). Using computers for the treatment of psychological problems. *Computers in Human Behavior,* 2, 43-62.

[47] Griffiths, M.D. (1997). Video games and clinical practice : Issues, uses and treatments. *British Journal of Clinical Psychology,* 36, 639-641.

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Videogames have also been used to improve children's health care. Several games have been developed specifically for children with chronic medical conditions. One of the best-studied is an educational game called 'Packy and Marlon'.This game was designed to improve self-care skills and medical compliance in children and adolescents with diabetes. Players assume the role of characters who demonstrate good diabetes care practices while working to save a summer camp for children with diabetes from rats and mice who have stolen the supplies.

There are also several case reports describing the use of videogames for rehabilitation. In one application, an electronic game was used to improve arm control in a 13 year old boy with Erb's palsy. The authors concluded that the game format capitalized on the child's motivation to succeed in the game and focused attention away from potential discomfort.

Electronic games have also been used to enhance adolescents' perceived self-efficacy in HIV/AIDS prevention programs. Using a time travel adventure game format, information and opportunities for practice discussing prevention practices were provided to high-risk adolescents. Game-playing resulted in significant gains in factual information about safe sex practices, and in the participants' perceptions of their ability to successfully negotiate and implement such practices with a potential partner.

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Elements to evaluate when choosing a educational videogame[48]

It is vital that we continue to develop the positive potential of videogames while remaining aware of possible unintended negative effects when game content is not prosocial. At the present time, the most popular games are usually violent. Given current findings, it is reasonable to be concerned about the impact of violent games on some children and adolescents. Game developers need support and encouragement to put in the additional effort necessary to develop interesting games which do not rely heavily on violent actions.

Finally, most parents would probably support the use of videogames if they were sure they helped their children learn about school subjects. There are several elements which the teacher, parent, or facilitator should evaluate when choosing a health promoting/educational or helping videogame:

- **Educational or therapeutic objective.** The objective of the game should be clear. Professional helpers and developers should have a known goal in mind for the players of the game. The outcomes they are seeking should be clear to the teacher and to the player
- **Type of game.** There are many types of activity content : games, puzzles, mazes, play, fantasy/adventure, simulations, and simulation games. Some games require physical skill and strategy, while others are games of chance. Some videogames are board or adventure game, while others involve simulation involving real events or fantasy. No evidence supports a greater therapeutic or educational effect in either situation
- **Required level and nature of involvement.** The evaluator should assess whether the videogame player is passive or active. In some games, the computer plays the game while the participant watches the results. In computer-moderated games, the computer provides the environment for the game to occur and presents decisions or questions to the player at key points during the game. The computer then reveals the consequences of the decisions made by the player
- **Information and rules.** Some games allow the player to have a range of knowledge and information about past experiences with the game. Others provide minimal amounts of information to the player. Part of the strategy may involve the player's response to this lack of information. Rules and player participation in setting rules may vary among games
- **The role of luck.** Some games are driven by chance. It is assumed that the greater the influence of chance in the working of the game, the less educational and therapeutic in nature. However, some players prefer games of chance over games of strategy
- **Difficulty.** Some games allow the player to choose the difficulty level. Others adjust difficulty level based on the progression of the player. This approach allows the game to become progressively more interesting as it becomes more challenging
- **Competition.** Many games build in competition. Some players are attracted by competition. Teachers may wish to examine if the competition is presented in such a way that all can win and that one does not win at the expense of all others
- **Duration.** Some games have very short duration, while others may go on at length. Making of user rewards, personal challenges, or changes in color or graphical surroundings to maintain interest some games can hold player interest for long periods of time

[48] Griffiths, Mark "The educational benefits of videogames" Education and Health Vol. 20 No.3, 2002. http://sheu.org.uk/sites/sheu.org.uk/files/imagepicker/1/eh203mg.pdf

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- **Participant age and characteristics.** Computerized games have been developed for a range of ages. It assumes that the participant can understand the rules of the game and has the skill level to accomplish the motor aspects of playing the game. Some games allow for modification of text to meet the needs of poorly sighted players
- **Number of players.** Some videogames are solitary in nature. Others pit players against each other or the computer. Solitary games may meet the needs of those who find group work difficult
- **Facilitator's role.** In some videogames, the teacher or facilitator merely observes. In others, the facilitator may be an important part of the game format
- **Setting.** Fully prepare staff to integrate these games into the curriculum. Without proper acceptance, the games may be used primarily as a game or toy rather than as a therapeutic or educational tool

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Educational game design for online education[49]

The use of educational games in learning environments is an increasingly relevant trend. The motivational and immersive traits of game-based learning have been deeply studied in the literature, but the systematic design and implementation of educational games remain an elusive topic. In this study some relevant requirements for the design of educational games in online education are analyzed, and a general game design method that includes adaptation and assessment features is proposed. Finally, a particular implementation of that design is described in light of its applicability to other implementations and environments.
The main pedagogical requirements of educational games identified are:

- **Integration with online education:** It is common to find situations where games are included in a traditional classroom environment, and an instructor monitors the activity of the students inside the game. In these scenarios, the instructor fills the gap between the game and the rest of the course by promoting reflection and discussion. In online education, the educational value of these educational videogames could be greatly increased byintegrating them with the emerging e-learning standards and platforms in on-line education.
- **Adaptation:** Adaptation can play a very important role in the quality of the educational experience, allowing the learning environments to cater to students with different learning styles, different levels of initial knowledge and different expectations and objectives. Videogames are inherently interactive and reactive to the actions of the user and they are complex pieces of software being executed in the student's computer, which facilitates the inclusion of adaptation mechanisms in the games.
- **Assessment:** A very important part of any learning process is the assessment of the progress of the learning experience. Games are a very rich interactive medium, and this interactive behaviour can be exploited for assessment purposes. When a LMS delivers a PDF file to the student for study, there is little that the LMS or the instructor can know about how the student used that PDF file. In contrast, as already mentioned, games are active pieces of software running on the student's computer. We can leverage this and define an assessment model in which the game monitors the student's activity, logs all the relevant events and generates useful information which can be used to grade the student's activity. This process can be either automated (the game sets the grade) or require the participation of an instructor to assess what the student's activity tells of the learning experience

There are a set of design guidelines that allows the integration of adaptive and assessable games in online education environments, taking into account the requirements identified in the previous section.

- **Choosing an appropriate genre:** The first design decision is to choose a suitable genre for the games to develop. By doing so, it is possible to devise a suitable language for describing the games, and thus to support the language with an appropriate engine. As an example of choosing a genre we can highlight classic point and click adventure games. In these games

[49] Pablo Moreno-Ger, Daniel Burgos, Iván Martínez-Ortiz, José Luis Sierra, Baltasar Fernández-Manjón "Educational game design for online education" Department of Software Engineering and Artificial Intelligence, Universidad Complutense de Madrid, Spain. Published in Computers in Human Behaviour, avaiable at http://www.e-ucm.es/drafts/e-UCM_draft_80.pdf

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the player is the main character in a story and drives it forward by speaking to other characters, finding objects, combining them in creative ways and solving riddles and puzzles. The game progresses through a storyline in which performing some actions unlocks some other potential interactions. The presence of elements such as a slow pace, reflection, study of the environment, and problem-solving make point and click adventure games relevant from a pedagogical perspective.

- **Adding assessment and adaptation to the design:** Choosing a suitable genre is only one aspect in the design process. From the description of the games as state transition systems we can design assessment and adaptation mechanisms based on checking and modifying specific states of these systems. In particular, the assessment of the activity of the student inside the game can be performed as an analysis of the states that the game went through during the game session. The game engine should keep track of the transitions, log relevant events and generate reports describing them.
- **Integration with an online environment:** Integration of games with standards-compliant learning management systems implies packaging them as learning objects and the inclusion of standard metadata to facilitate their discovery, integration and deployment. More important, it is necessary to face the notion of communication between the games and the LMS.

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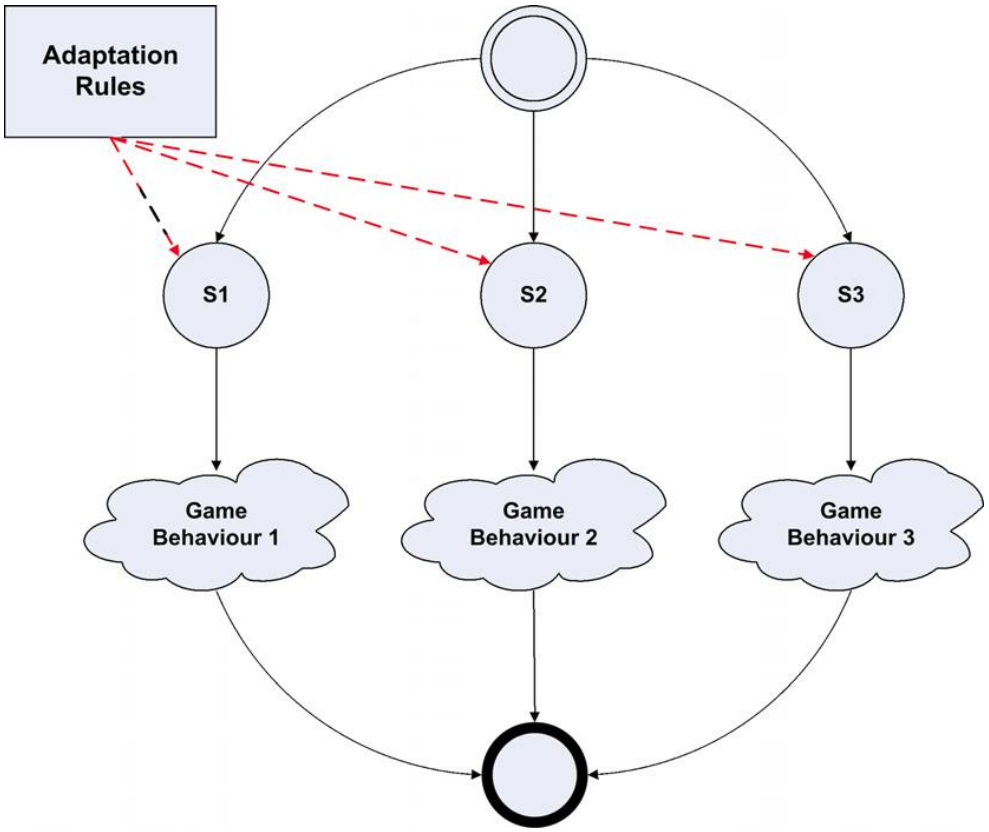

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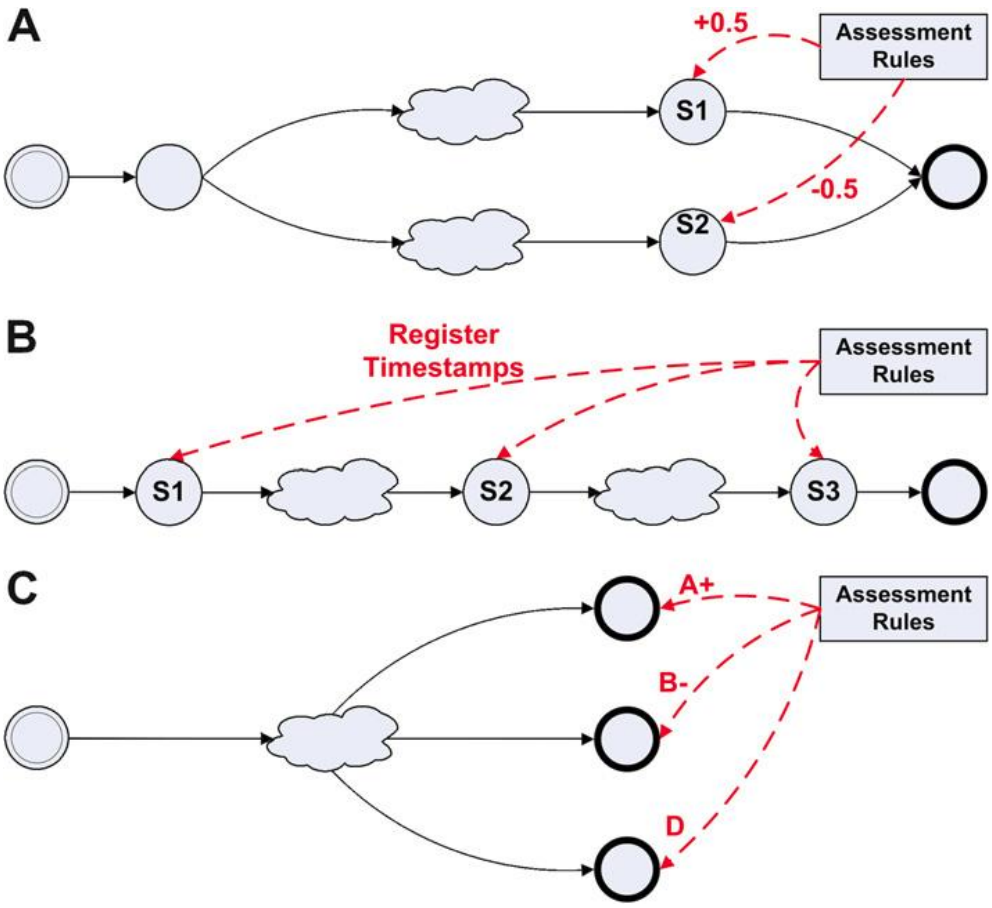

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The problem of violence in videogames

Psychology Of Aggression

Gaming has two sides, positive as well as negative effects. Games are not just for fun - they have an effect on the player. In all compound of computer games Educational games constitute only a little part. “Many of the most popular and successful games are not violent or overly sexualized and many address topics of educational value”[50] , you should however make sure, that the game you choose or the game you design lacks such elements. Many commercial and free accessible videogames contain serious violence.

The term of violence (in computer games) is not so easy to define. Is self defense or defense of the family, country, etc., the violence? If “good” is fighting against “evil”, is it the violence? Trying to answer the question, why children are aggressive, psychologist say that sometimes children do not have the social skills or self-control to manage their behavior. When children can't find the words to deal with aggressive feelings or are not encouraged to express themselves, they become frustrated. At other times, children cannot cope with growing levels of anger in themselves or in others. In both cases, children need to learn acceptable ways to assert themselves and to learn coping skills.

The aggressive kids will rarely have self-confidence and gains it through aggressive behavior. Aggressive kids are attention seekers and they enjoy the attention they gain from being aggressive. Power brings attention and the aggressor has learned this. Due to the child's weaker self-image and the fact that he or she doesn't fit in, they try aggressive behavior and soon become leaders, even though they usually know that they are behaving inappropriately.

Research indicates that playing violent games increases aggression in players in both everyday settings and laboratory studies. Scientists have noted playing violent games leads to increased aggressive behavior, thoughts, increased physiological arousal and decreased levels of helping behavior. It is an established fact that consistent exposure to violent games leads to delinquency, fighting in school and outside, as well as criminal behavior.

Since games are interactive they involve participation of the player and this tends to influence thinking as well as intuitive reactions. This being so, violent games are more harmful than violence in movies or television.

Psychologists estimated relationship between violent video game playing and brain function. Brain scans of kids who played a violent video game showed an increase in emotional arousal – and a corresponding decrease of activity in brain areas involved in self-control, inhibition and attention.

Psychologists have noted that aggression escalates in players who already have an in born tendency to aggressive behavior and that repeated exposure to violence is like a conditioning and over time, the person becomes trained or conditioned to be violent.

Computer games usually stresses the positive outcome of violence. Playing violent games teach the gamer that success can be had from being violent. Gaming rewards violence, so gamers tend to start believing that violence can be rewarding. In games increases the impact in the minds of gamers, especially kids. Violence in gaming tends to teach gamers that violence is the way to solve differences or conflict. Repeated gaming increases a gamer’s aggression and tendency to fight, argue, and use physical force to win an argument or settle differences in real life. American Academy of Pediatrics

[50] Vilnius Pedagogical University (LT), How and why to use videogames in didactics, in this training Manual, Chapter 3, Part 2B: Education, pp. 14.

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states, there are several measurable negative effects of children's exposure to violent entertainment. These effects take several forms.
Children who see a lot of violence are more likely to view violence as an effective way of settling conflicts.
Children exposed to violence are more likely to assume that acts of violence are acceptable behavior. Viewing violence can lead to emotional desensitization towards violence in real life. It can decrease the likelihood that one will take action on behalf of a victim when violence occurs. Entertainment violence feeds a perception that the world is a violent and mean place. Viewing violence increases fear of becoming a victim of violence, with a resultant increase in self-protective behaviors and a mistrust of others. Viewing violence may lead to real life violence. Children exposed to violent programming at a young age have a higher tendency for violent and aggressive behavior later in life than children who are not so exposed.
But educational games are not the same as today's commercial video games. Instruction, rather than entertainment, is the purpose of educational games. Educational game design must target the desired learning outcomes, and design a game to achieve the specific learning goals. Educational games must be build on the foundation of learning science. This requires expertise beyond the specialists that design commercial entertainment games. If fact, educational games represent a new type of product – where knowledge of pedagogy is integrated with the features of games that are so motivating, engaging, and rewarding to users.

How to channel competitiveness

The games' interactivity allows for a continuous stream of challenging and competitive situations that have to be resolved by the players. Competition is therefore regarded a key element of the explanation of players' entertainment experience. Competitive elements are considered the most important determinant of the enjoyment arising from playing video games. Although the simple exploration of the available possibilities to act may also be entertaining, the suspenseful coping with challenges such as tasks, dangers, and threats that may lead to highly enjoyable success appears to be the more important source of entertainment during the playing process. However, engagement in competitive situations holds the risk to lose, which would cause negative emotions and reduce the enjoyment. Playing computer games is therefore expected to be fun only if a sufficient portion of the competitive game situations is mastered by the player. For this reason, many games allow for adjustments of difficulty levels in order to regulate the probability of success and failure in competitive situations according to the player's skill.

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Learning games examples[51]

While the field of learning games is still nascent, there are some good examples already emerging that demonstrate unique aspects and show the potential of this approach.

Zoo Scene Investigators[52]: Zoo Scene Investigators (ZSI) is a game played on location at the Columbus Zoo. This location-based game is built on MIT's outdoor augmented reality platform. Augmented Reality (AR) games engage participants in activities that combine real-world experiences with additional information supplied to them by handheld computers. As students physically move about the physical space (e.g., a school campus, an outdoor plaza, a zoo, etc.), their location-aware handheld computers (e.g., Windows Mobile devices equipped with GPS) allow them to collect additional information by interviewing virtual characters, viewing rich media or accessing real or simulated data. Participants in AR games are often tasked with role-playing and collaboratively investigating a problem or issue in a game-like fashion. Players in this game (primarily middle school students) are equipped with location aware handheld computers through which they investigate a fictitious crime at the zoo. Through this investigation they learn about particular animals and the impact of the illegal wildlife trade. Players in the game must physically walk around the zoo in teams to collect the virtual information provided on their handhelds to apprehend the criminal and complete the game. This game demonstrates the means by which one can integrate games into informal learning environments such as museums, zoos and aquaria. It is also an example of games that integrate relevant, real world experiences with the virtual worlds of games.

Palmagotchi[53]: The mobile game Palmagotchi (developed at the MIT Scheller Teacher Education Program) combines the ideas of virtual pets (such as the popular Tamagotchi toy) and the evolutionary story of Darwin's finches in the Galapagos Islands. Players maintain families of birds and islands of flowers. They monitor and feed birds in order to keep them alive. They also mate their birds with other players' birds in order to get offspring with desirable traits that maximize their chances of surviving various hazards in the game. The game is designed to be school-friendly so it is paced to require interactions every three to four hours so as not to disrupt classes, yet create some sense that the players must be vigilant to keep their organisms alive and well. Each interaction is designed to present the player with data that she can use to inform her decisions, though the only way that the player learns how this data maps on to success is through experience. In order to forage, a player looks across her current set of birds and decides which one needs to eat. After selecting that bird, she selects an island to visit. Once on that island, the player is presented with a list of flowers that she is able to "see" (only those flowers whose color is close to the bird's color preference). This game demonstrates novel ways of integrating games into schools without requiring games to be played at reserved times in computer labs. Instead games can be played casually anytime and anywhere.

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[51] Eric Klopfer, Scot Osterweil, and Katie Salen "Move learning games forward". Massachusetts Institute of Technology. Available at http://education.mit.edu/papers/MovingLearningGamesForward_EdArcade.pdf The education arcade. http://www.educationarcade.org/

[52] http://www.youtube.com/watch?v=jSlLgnS-Jrg

[53] http://education.mit.edu/projects/palmagotchi

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Racing Academy[54]**:** Racing Academy allows students to access accurate, real-time models of how cars work in the context of a racing game. Developed by FutureLab in the United Kingdom in combination with independent developer Lateral Visions, the UK Higher and Further Education Joint Information Services Council and the Department of Psychology at the University of Bath. Students build, maintain and race their vehicles, and in order to succeed they must monitor and analyze their cars' performances via data from various telemetry outputs. By participating in virtual communities of practice, students get to make complex decisions collaboratively, manipulating over 1000 parameters on their vehicles.

Ayiti: the Cost of Life[55]**:** A creation of high school students in New York's Global Kids program and the developers at Gamelab, Ayiti: the Cost of Life is a strategy game that asks the question, "What is it like to live in poverty, struggling every day to stay healthy, keep out of debt, and get educated?" Set in rural Haiti, players must manage the lives of a family of five, struggling with minimal resources to achieve a stable, safe and healthy environment. The game is, as one might imagine, very difficult, but unlike some of the editorial games in the Persuasive Games movement, there are win states and a belief that no problem is unsolvable.

Gamestar Mechanic[56]**:** Gamestar Mechanic, a collaboration between the University of Wisconsin-Madison and Gamelab, engages students in multi-modal thinking, engaging them in the concerns of technology, social concerns, artistic concerns and communication concerns. Set in a steampunk-world and designed with an anime flare, Gamestar Mechanic teaches students about game design by asking students to develop hypotheses for their designs, implement and test those designs while simultaneously describing and defending their designs to their teammates, becoming "socio-technical engineers." The Gamestar Mechanic team argues that by participating in and understanding the interactions of multiple complex systems, they are developing skills that are crucial for an increasing collaborative, networked, and high tech society.

Making History: The Calm and the Storm[57]**:** Developed by Muzzy Lane Software, Making History teaches history, international relations, and political science to high school and college students. This multiplayer, turn-based strategy game feels similar to Civilization, except that it focuses on only 20 years surrounding World War II. Students take on the roles of the leaders of nations with historically interesting roles to play. Each student has a unique set of goals, leading to temporary alliances on certain issues. The game features four policy areas, including domestic, diplomatic, economic, and military policy. The original, self-published game was designed for use in classrooms, and each scenario can be played in 40 minutes or so. An updated version of the game was published by Strategy First for an entertainment market and sold through traditional retail channels.

Mind Rover: The Europa Project[58]**:** MindRover was developed by CogniToy to help players learn to program. Specifically, players code artificial intelligence for robotic vehicles to help them navigate

[54] http://www.jisc.ac.uk/whatwedo/programmes/elearninginnovation/racing.aspx
[55] http://costoflife.ning.com/
[56] http://gamestarmechanic.com/
[57] http://muzzylane.com/project/making_history
[58] http://www.mindrover.com/mindrover.html

obstacle courses and overcome other challenges. The programming interface involves dragging logical pieces of the robots mechanics and setting a few parameters for each one. There are no lines of code. An updated version of the game allows players to export sets of instructions to actual robots, enabling real world competitions. The game encourages an exploratory approach to learning programming, helping players get programs running quickly so they can experiment and iterate.

Lure of the Labyrinth[59]**:** Lure of the Labyrinth's target audience is middle school students, and its primary goal is the enhancement of prealgebra math learning, with a secondary goal of improving literacy. It is a long-form puzzle adventure game played over many sessions, with a persistent narrative that evolves over time. In order to complete the game players must navigate complex mathematical spaces, and solve puzzles that embody the big ideas of mathematics. Playing on teams, students also have incentives to share their ideas about puzzle solving through an in-game message board, thereby bringing into the game space the kind of literacy activities usually reserved for game FAQs and interest groups. Teachers are encouraged to let students play the game in advance of encountering the same material in school, so that when the topic is introduced in the classroom students can demonstrate their hard-earned expertise, rather than meet each new subject as neophytes.

Supplementary information and examples can be found in Annex 3

[59] http://labyrinth.thinkport.org/www/

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