www.futurelab.org.uk

futurelab
innovation in education

Computer games and learning

A FUTURELAB HANDBOOK

This document is designed to be read with Adobe Acrobat

Contents

Mary Ulicsak and Ben Williamson

June 2010

Foreword

The stance that games have the potential to be relevant and meaningful and engage both teachers and learners — even if they do not, or cannot, revolutionise education — is not new. The difficulty lies in taking games and actually achieving this meaningful learning. Unfortunately, the unique nature of each learning situation means there are no hard and fast rules around how to use games to support learning.

It is assumed by some that the models games employ lead to learning, as young people effectively learn how to play without necessarily being explicitly taught, doing vast amounts of reading or interacting with others; while others see games as boring, tedious, time-consuming, and repetitive. Both of these viewpoints can be true: as stated the impact of a game is dependent on the game itself, but also the player, circumstance of use, mediation of the teacher and other players. In fact, many academic researchers of young people's uses of digital media argue, counter to the hype, that computer games have been insufficiently well researched as a medium for learning.

In this handbook we aim to summarise not only the key theories around why they are considered to have potential, but how they have been used in the past, how they are used for learning in a family context, what attributes lead to learning, and considerations for using them with young people.

Audience

This handbook is primarily designed for teachers and those interested in using games with an educational intent. We aim to provide some useful anchoring points for educators to make sense of the area and to develop practical approaches to the use of computer games as a medium for learning.

However, the content will also be of interest to policy makers, parents, and games developers who may wish to use games for formal and informal learning.

Scope

The aims of the handbook are to:

– look at the theoretical basis for games and learning in a jargon-free manner

– describe the arguments for and against using them

– give a context to game use by looking at the pedagogy behind games

– list current issues around using games in classrooms

– derive lessons around learning from how games are used by families

– provide a checklist for using games in the classroom.

The handbook concludes with further reading and suggests some sites where games can be found.

This document should be seen as a useful guide and introduction to areas of interest and emerging development, rather than a definitive handbook around games and learning. It does not have the space for a discussion around how gender, race and socio-economic conditions affect young people's equality of access to games. Neither does it address the issues around games and violence.[1] Finally, it does not explicitly discuss emerging technologies used by games, for example, headsets that respond to brainwaves[2], haptic devices[3], and intuitive interfaces where there are no tangible controls (eg the Kinect). For games used in adult learning see the Futurelab 2010 Serious Games Report.[4]

01.
For a discussion around violence in games see Ulicsak, M, Cranmer, S and Wright, M (2009) Gaming in Families, **http://archive.futurelab.org.uk/resources/publications-reports-articles/literature-reviews/Literature-Review1377**

02.
For a discussion of devices that use neurofeedback see the 2009 discussion paper 'Neurofeedback: is there a potential for use in education?', **http://www2.futurelab.org.uk/resources/publications-reports-articles/discussion-papers/Discussion-Paper1257**

03.
Haptic devices provide users with the opportunity to interact with virtual experiences on the screen and to receive physical feedback. This means that users can feel what it would be like to touch the thing they are seeing on screen. There is increasing interest in the use of **haptic** and **tangible** devices for education. With haptic devices already used in vocational teaching environments such as developing skills in medicine. See http://archive.futurelab.org.uk/glossary for definitions.

04.
Ulicsak, M (2010) Games in Education: Serious Games, **http://media.futurelab.org.uk/resources/documents/lit_reviews/Serious-Games_Review.pdf**

Introduction

As Pivec points out: 'Although video games have been around for nearly 40 years, and GBL [games based learning] has been researched for over 20 years, the uptake of this technology in the classroom has been slow.'[5] As yet there are no definitive studies on the effectiveness of games, nor how they can be used for formal assessment purposes, or for learning in the home.

Despite this lack of evidence, in a 2009 study by Futurelab 60% of over 1600 teachers surveyed said they wished to use games in their lessons.[6] They believed they would be engaging, motivating and lead to learning — especially with boys. This idea does not seem to have moved on since the first Futurelab games handbook in 2005. Then we stated: "educators are increasingly becoming interested in the potential role of computer and video games to support young people's learning". Yet after five years only 34% of teachers surveyed said they had used a game in the classroom, and even then there is a tendency to use simple games rather than the complex games identified by researchers as those demonstrating more motivating and engaging environments.

This is not to say the field has not moved on, and games are always found on the fringes of classroom teaching. An often quoted example of best practice is the Consolarium in Scotland — where games form the basis of multiple activities.[7] The Quest to Learn secondary school is another frequently cited example. This opened in the autumn of 2009 in New York and is using and investigating the format of games as its pedagogical model.[8] IMAGINE (Increasing Mainstreaming of Games In Learning Policies) was a two year project funded by the European Commission aimed to persuade policy makers, including those in schools, to mainstream GBL. It also collated case studies, best practice, and provided guidance for teachers.[9]

05.
Pivec, M and Pivec, P (2008) Games in Schools: Literature review (Brussels: EUN/ISFE), **http://games.eun.org**, p.2

06.
Williamson, B (2009) Computer games, schools, and young people: A report for educators on using games for learning, **http://archive.futurelab.org.uk/resources/documents/project_reports/becta/Games_and_Learning_educators_report.pdf**

07.
For a description of the Consolarium see **www.ltscotland.org.uk/usingglowandict/gamesbasedlearning/consolarium.asp**, or for a review on console games used by the Consolarium see the Futurelab report 'The impact of console games in the classroom: Evidence from schools in Scotland"', **www.futurelab.org.uk/case-studies/console-games**

08.
http://q2l.org

09.
www.imaginegames.eu

In addition to practical use, academic research around games and GBL continues to increase. The Serious Games Institute was set up in 2007 in Coventry[10], while the Games for Learning Institute (G4LI) was set up at New York University in 2008 to study what makes computer games engaging and educationally effective[11]. Another research organisation is the Epistemic Games Group (that arose from the Wisconsin-Madison University) with its interest in games that model professional practice.[12] In the UK the Digital Games Research Association[13] (DiGRA) focuses on all digital games, not only those used in education. And there are journals that focus on games, eg the online Game Studies journal[14], Simulation and Gaming[15] and launched in 2011, the International Journal of Game-Based Learning (IJGBL)[16]. There are also multiple conferences: the European Conferences on Games Based Learning started in 2007, while the Serious Games conference has been going since 2003.

Defining games

Regardless of all this interest, since Futurelab's first handbook the definition of games has not become any clearer. For ease in this handbook, unless otherwise stated, we use the term 'game' to refer to:

Digital games - as used by DiGRA to denote all games that have a digital technology base

Electronic gaming - a phrase used by Ofcom to cover handheld games consoles, games consoles connected to a television, computer games online, computer games on a PC or CD ROM games

Video games - a term used by industry bodies such as Interactive Software Federation of Europe (ISFE) for television-linked consoles and portable video game systems

Computer games - those played directly on a PC

Online games - including massively multi player online role playing games (MMORPGS) and casual (ie intuitive, accessible, chunked — that is easy to start and stop — and easy to play) games

Mobile games - those played on a handheld device (including mobile phones, mobile consoles and tablet computers)

10. www.seriousgamesinstitute.co.uk

11. This group is headed by Prof Ken Perlin; it consists of thirteen primary investigators from seven US universities as well as research staff. The group has financial, software and advisory support from Microsoft External Research and Motorola. http://g4li.org/about

12. Epistemic games are authentic tasks in which students are apprenticed to a profession, and use that profession's tool kit of knowledge, skills and values in order to produce the products that those professionals produce. The Epistemic Games Group is made up of researchers, educators, and game designers, including James Gee and William Shaffer. http://epistemicgames.org/eg/category/games/front/

13. www.digra.org/digrainfo

14. www.gamestudies.org/0901/about

15. http://sag.sagepub.com

16. www.igi-global.com/Bookstore/TitleDetails.aspx?TitleId=41019. For a more detailed description of contents see www.digra.org/news_old/archive/2010/03/03/cfp-international-journal-of-game-based-learning-ijgbl

These games can be subdivided into three categories: educational games, leisure games and educational leisure games. **Educational games** are those designed with explicit educational goals that are intended to support processes of teaching and learning.[17] This definition of educational games includes edutainment, serious games, game-based simulations and epistemic games. All of these have unique definitions — and in the case of serious games not even an agreed definition. It should be noted that some educational digital games have a mix of 'real' and digital aspects. For example, the ICT-supported educational role-playing game Homicide[18] or the piloted game for Space Missions[19]. In contrast we will refer to **leisure games** when describing games that do not have learning as an explicit goal (although theoretically any leisure game could be used to learn something). This would include most COTS (commercial off-the-shelf) games. The final category we will use is **educational leisure games**. These are games such as The Sims, the Roller Coaster Tycoon series, Civilisation, or Age of Empires which have all been used successfully within a classroom environment to aid teaching although designed for leisure use. This group is expanding as companies realise the potential. For example, teacher packs are being proposed to go with the latest release of LittleBigPlanet[20] and games such as Professor Layton and Nintendogs are starting points for lessons.

Where necessary we will state whether we are discussing an educational game, leisure game, or a leisure game used for education.

Games can be subdivided into three categories: educational games, leisure games and educational leisure games.

17.
This description is based on the PhD thesis of Thorkild Hanghøj **(www.academic-conferences.org/ecgbl/ecgbl2010/ecgbl10-biographies.htm#hanghoj)**, **http://ncom.nordicom.gu.se/ncom/research/playful_knowledge(134543)/**

18.
Homicide is a game developed by the Denmark Learning Lab. The participants play forensic detectives, and working in groups try to solve one or more murder cases. The game utilises narrative desire in order to engage the participants in solving a number of science tasks within the areas of mathematics, biology, chemistry, physics, etc. It lasts a week and students are scaffolded through a variety of online and 'real' activities with the teacher taking the role of Head of Police.

19.
For a description see **http://www2.futurelab.org.uk/projects/space-mission-ice-moon**

20.
The Head of Sony Entertainment suggested that teacher packs would be created for the second release of LittleBigPlanet, **www.gamesradar.com/ps3/littlebigplanet/news/sony-uk-pushes-for-schools-to-adopt-games/a-20110111154413390 81/g-20070307359273440 42**

Introducing games and learning

Educational games, leisure games and educational leisure games have been the subject of sustained attention amongst educators now for twenty years. Although there are a number of earlier and influential publications dedicated to exploring the use of games for learning, the debate has accelerated and widened in the 21st century.

Despite this wide debate there is no single orthodoxy for the study and development of games and learning, which can make it difficult for educators to make sense of the field or identify sources, references and resources which can help them.[21]

As Linderoth and colleagues have pointed out in a 'mapping' exercise of the research literature in the emerging academic field of game studies, computer games have been studied from a number of different perspectives in different academic disciplines with different theoretical assumptions and with different references:

'There is seldom any communication between the actors from different traditions, and after some reading one gets the feeling that everyone is exploring their own 'area' without bothering about where to place themselves on the 'overview map'.'[22]

Obviously, one of the first tasks that is necessary in the field of games and learning is to provide an overview map of the terrain and locate in it sensible navigation points. This is the first task we aim to achieve in this handbook.

21.
For example, games have been studied from a film studies perspective in King, G and Krzywinska, T (2002) ScreenPlay: cinema/videogames/interfaces (London: Wallflower); from a literary theory perspective in Kucklich, J (2006) Literary Theory and Digital Games, in Rutter, J and Bryce, J (eds) Understanding Digital Games (London: Sage); and from cultural studies in Dovey, J and Kennedy, H (2006) Game Cultures: Computer games as new media (Maidenhead: Open University Press); and from ludology/play perspectives in Carr, D (2006) 'Play and pleasure', in Carr, D, Buckingham, D, Burn, A and Schott, G, Computer Games: Text, narrative and play (Cambridge: Polity), pp.45-58.

22.
Linderoth, J, Lantz-Andersson, A, and Lindstrom, B (2002) Electronic exaggerations and virtual worries: mapping research of computer games relevant to the understanding of children's game play. Contemporary Issues in Early Childhood, 3(2), pp.226-250

Context

In a recent introduction to a volume on connecting youth, games and learning Katie Salen notes that:

'Although there has been a considerable amount written on games and young people's use of them, there has been little work done to establish an overall 'ecology' of gaming, game design, and play, in the sense of how all the various elements — from code to rhetoric to social practices and aesthetics — cohabit and populate the game world.'[23]

She adds that the 'debate around the value of games and gaming' has been 'to date, overly polemic and surprisingly shallow.'[24] Similarly, David Buckingham points out that 'in the absence of solid empirical evidence about the actual use of games in the classroom, sweeping claims about their value' — 'often drawn from an uncritical reading of the work of games advocates' — 'continue to be recycled.'[25]

This recycling tendency is represented by the constant reproduction of reviews on the subject of games and learning in lieu of any real research evidence, reviews which are sometimes interpreted as if they constitute fresh intelligence.[26] It has also been claimed that researchers in the field of games and learning suffer from intellectual amnesia, neglecting to note that there is a long history of prior research and publications in the field.[27]

23.
Salen, K (2008) 'Toward and Ecology of Gaming', in Salen, K (ed) The Ecology of Games: Connecting youth, games, and learning (L: MIT press), **http://mitpress.mit.edu/books/full_pdfs/The_Ecology_of_Games.pdf** p.2

24.
Ibid, p.2

25.
Buckingham, D (2007) Beyond Technology: Children's learning in the age of digital culture (Cambridge: Polity), p.116

26.
See Kirriemuir, J (2007) Groundhog Day for Games in Learning, Digra Hardcore Column, 3 March. **www.digra.org/hardcore/hc13**

27.
See Egenfeldt-Nielsen, S (2006) Overview of research on the educational use of games. Digital Kompetanse, 3(1), pp.184-213

Indeed, this is not the first document Futurelab has produced on the subject of games. In addition to the 2005 handbook and the preceding comprehensive literature review from 2003 there has been a substantive report on the Teaching with Games project and a set of teaching resources in 2006; and between 2008 and 2010 Futurelab completed three games projects with funding from Becta.[28]

In this section of the handbook we attempt to summarise the main outcomes and arguments arising from these activities and publications — providing an overview map that can help educators navigate the field — whilst recognising that arguments about games and learning continue to be disputed and contested.[29] By doing so, we hope to provide educators with a useful point of entry to the relevant debates and research references.

28.
These projects are Gaming in Families project **(http://www2.futurelab.org.uk/projects/gaming-in-families)**, Games-Based Experiences for Learning **(www.futurelab.org.uk/resources/games-based-experiences-learning)** and Serious Games in Education **(http://archive.futurelab.org.uk/projects/games-in-education?q=projects/games-in-education)**

29.
For relevant literature reviews, see Kirriemuir, J and McFarlane, A (2004) Literature Review in Games and Learning (Bristol: Futurelab); Mitchell, A and Savill-Smith, C (2004) The Use of Computer and Video Games for Learning: A literature review (London: LSDA); Egenfeldt-Nielsen, S (2006) Overview of research on the educational use of games. Digital Kompetanse, 3(1) pp.184-213; Pivec, M and Pivec, P (2008) Games in Schools: Literature review (Brussels: EUN/ISFE), **http://games.eun.org**

Games as a medium for learning

What are the main arguments in favour of games as a medium for learning? There is widespread agreement that games are a significant cultural force in children's lives. It is regularly claimed that they are more motivating, challenging and engaging than the formal offer of schools, and also that they provide more authentic learning experiences. For these reasons, some commentators suggest that educators and educational policymakers should take note of what games offer to players and reengineer their approaches to teaching to make the learning experience as immersive as playing computer games. For some this means that games have specific potential to be used within schools. In this brief section we review some of these main arguments, and in the next we look at the counter arguments.

Computer gaming as social practice

The writing of James Paul Gee has been highly influential in developing the credibility of computer games as a medium for learning. A linguist and literacy expert, Gee sees games as requiring players to master new literacy practices, something they do socially rather than only through some individual mental act. What Gee means by 'literacy' is that reading and writing (and this includes the interpretation and manipulation of images and sounds such as in computer game play) are not only mental achievements but social and cultural practices with economic, historical, and political implications, and that what goes on in people's heads is situated within a material, social, and cultural world.

But games are also, Gee claims, designed to be learned. They 'represent a process ... that leads to better and better designs for good learning and, indeed, good learning of hard and challenging things'. This is because games are ideally suited to practising things in authentic contexts:

'Humans need to practice what they are learning a good deal before they master it. ... The fact that human learning is a practice effect can create a good deal of difficulty for learning in school. Children cannot learn in a deep way if they have no opportunities to practice what they are learning. They cannot learn deeply only be being told things outside the context of embodied actions. ... Good video games involve the player in a compelling world of action and interaction. ... Thanks to this fact, the player practices a myriad of skills, over and over again, relevant to playing the game.'[30]

The skills that Gee sees as especially important are those that allow children to become more flexible and adaptable — or as he terms it, to become 'portfolio people' able to 'shape-shift' according to immediate context. The 'portfolio', for Gee, is a collection of transferable skills and achievements that people need to be able to manage. And it is the skills of self-managing one's portfolio that Gee regards as commuting from computer game play into successful working in the 'new capitalism.'[31]

30.
Gee, JP (2003) What Video Games Have to Teach Us About Learning and Literacy (Houndmills: Palgrave MacMillan), p.68

31.
Gee, JP (2004) Situated Language and Learning: A critique of traditional schooling (London: Routledge)

A key aspect of this analysis is its focus on player identities. Situated practice with games means taking on the identity offered by a game itself, for example, the identity of a soldier, of an orc, of an adventurous archaeologist and so on.[32] For Gee, identity is a social construct, something developed in the individual through participation in social organisations. Thus, the conditions for deep learning 'go beyond the individual to include the individual's participation in social groups that supply meaning and purpose to goals, interpretations, practice, explanations, debriefing, and feedback', and games do this by:

'recruiting distributed intelligence, collaboration, and cross-functional teams for problem-solving; offering players 'empathy for a system'; marrying emotion to cognition; being challenging while still keeping frustration below the level of the affective filter; giving players a sense of production and ownership; and situating the meanings of words and symbols in terms of actions, images, experiences, and dialogue, not just 'definitions' and texts read outside of contexts of use.'[33]

For Constance Steinkuehler, digital games environments are places where human cognition is always both situated and distributed, that is, they always involve purposeful human action within a specific context, whilst relying on participation within large and distributed communities of players.[34] Likewise, according to Shaffer, playing games allows learners to develop 'collections of skills, knowledge, identities, values, and epistemology that professionals use to think in innovative ways', and consequently 'games can be more authentic than school: more realistic and more meaningful ways of thinking about problems that matter in the world.'[35]

Digital games environments are places where human cognition is always both situated and distributed.

32.
This was later to form the basis of epistemic games where the role of the player mapped to the 'real' world.

33.
Gee, JP (2008) 'Learning and Games', in Salen, K (ed) The Ecology of Games: Connecting youth, games, and learning (London: The MIT Press), p.37

34.
Steinkuehler, CA (2008) Massively multiplayer online games as an educational technology: an outline for research. Educational Technology, 48(1), pp.10-21

35.
Shaffer, DW (2006) How Computer Games Help Children Learn (Houndmills: Palgrave MacMillan)

Re-wiring gamers' brains

The view that digital games are more sophisticated and authentic than school has become widespread. Nick Barham, for example, has claimed that:

'Kids are certainly not too stupid for school. Perhaps school is too stupid for them. Too stupid, too slow, too uncolourful, too mono for a bunch of kids for whom speed, excitement, words, pictures, sound and film are all parts of acquiring and passing on information, all ways of telling stories. ... The form, content and method of knowledge delivery within schools is out of sync with the way that people learn elsewhere, with what they value, with what counts in the world.'[36]

This logic suggests that the standardised focus in schools on absorbing content and skills is not only demotivating and irrelevant to what children are doing outside of school with new media, but is also outdated at a time when information is immediately available and electronic communication is ubiquitous.

Perhaps the most well-known populariser of this view is Marc Prensky, a US-based consultant, writer and designer of educational games and training simulations.[37] Prensky argues that 'game-playing is as beneficial to children's development as reading' and that 'kids learn more positive, useful things for their future from their video games than they learn in school.'[38] Because children have grown up in a world where computers, computer games, the internet and mobile phones have always existed they have developed qualitatively different ways of interacting in the world: in short, children are 'digital natives' and adults are 'digital immigrants'.[39]

Prensky draws from research in 'neuroplasticity' to argue that playing games helps to reorganise brain functioning, although he admits that no one has ever actually directly observed the brain of a 'digital native' to derive empirical findings which support his claims. Dealing with complexity, experiencing failure in a low-risk environment, collaborating with others (often over the web), making ethical decisions, exploring different identities, and managing multimedia information simultaneously are some of the allegedly heightened cognitive competences of Prensky's digital natives. As Prensky optimistically puts it, games 'offer up the most realistic vision of how everyone, young or old, will be learning and working in the decades to come'.[40]

36.
Barham, N (2004) Disconnected: Why your kids are turning their backs on everything you thought you knew (London: Ebury Press), p.234

37.
Prensky maintains a professional website and a weblog at **www.marcprensky.com,** as well as a site acting as a resource bank on games and learning for teachers and parents: **www.gamesparentsteachers.com**

38.
Prensky, M (2006) Don't Bother Me Mom, I'm Learning (Paragon Press)

39.
Prensky, M (2001) Digital natives, digital immigrants. On the Horizon 9, pp.1-6; Prensky, M (2010) Teaching Digital Natives: Partnering for real learning (London: Corwin)

40.
Prensky, M (2006) Don't Bother Me Mom, I'm Learning (Paragon Press)

Steven Johnson's Everything Bad is Good for You: How popular culture is making us smarter suggests that formats such as television dramas have become increasingly intricate, multilayered, and thus cognitively challenging to follow; that media such as the internet, by virtue of being participatory, creating new channels of communication, and by forcing users to adapt to new interfaces, are 'good for the brain'; and that:

'... games force you to decide, to choose, to prioritize. All the intellectual benefits of gaming derive from this fundamental virtue, because learning how to think is ultimately about learning to make the right decisions: weighing evidence, analyzing situations, consulting your long-term goals, and then deciding. No other pop cultural form directly engages the brain's decision-making apparatus in the same way.'[41]

What Johnson sets out to do in this type of analysis is simultaneously demonstrate that games advance players' cognition and that pop cultural forms such as games are complex media products which are as worthy of consideration as great novels and films. Playing computer games requires mental labour that is seemingly unsupported by schools, so that, even though 'classrooms may be overcrowded' and 'teachers underpaid,' outside of school children's 'brains are being challenged at every turn by new forms of media and technology that cultivate sophisticated problem-solving skills'.

The evolution of 'Homo zappiens'

Similar arguments about the positive benefits of computer games are made in Wim Veen and Ben Vrakking's Homo Zappiens: Growing up in a digital age, where it is argued that children — the 'Homo zappiens' of the title — now possess evolutionarily distinct advantages over adults. They are 'active processors of information, skilled problem solvers using gaming strategies and effective communicators' who ostensibly 'consider schools as disconnected institutions, more or less irrelevant to them as far as their daily lives are concerned. ... In fact, Homo zappiens are digital, and school is analogue.'[42]

These examples set out to demonstrate that children's popular culture is composed of powerful media forms of which the computer game is the most advanced medium. By virtue of its interactivity, the computer game engages the brain in all sorts of complex tasks that schools do not. Thus, while schools recourse to standards, computer games act to extend children's mental functioning. These commentators suggest computer games are, in fact, an ideal medium for learning in the 21st century.

41. Johnson, S (2006) Everything Bad is Good for You: How popular culture is making us smarter (London: Penguin)

42. Veen, W and Vrakking, B (2006) Homo Zappiens: Growing up in the digital age (London: Network Continuum Education)

This view fits well with the emergence of calls for the education system to adapt to new economic times, during which the trade of knowledge is becoming more significant than manufacturing. This shift is often referred to as 'post-Fordism' or 'post-industrialism', and implies that the methods of mass-manufacturing and mechanical reproducibility characterised by factory-floor production are being superseded in economic importance by the creation of new knowledge, in an era characterised by the use of digital technologies.

As a consequence, it is increasingly asserted, schools need to change in order to equip children with the skills they will need to thrive. What the economy needs is creativity and innovation, and future personnel with the qualities to ensure that progress is sustainable. Even during the recession, governments have been putting strong emphasis on the need for technical and scientific skills and disciplines.[43]

As a result of these debates, Veen and Vrakking suggest in Homo Zappiens that:

'schools will no longer be institutions training children for certainty; instead they will facilitate learning for a generation that can live and work in knowledge-intensive organizations and institutions where they will have to rely on skills of flexibility and adaptability to cope with ever changing conditions and situations.'[44]

Computer games are ideal platforms for 21st century learning, this argument suggests, because they inculcate the acquisition and development of the skills of adaptability and flexibility.

43.
See, for example, Leadbeater, C (2004) Personalisation Through Participation: A new script for public services (London: Demos).

44.
Veen, W and Vrakking, B (2006) Homo Zappiens: Growing up in the digital age (London: Network Continuum Education), p.13

The 'play ethic' in the economy

The argument about the evolution of 'homo zappiens' is in line with the suggestion that successful organisations are primarily concerned with 'human capital', the labour and knowledge of their staff, and that in uncertain times the most valuable human capital one can possess is to be adaptable to changing circumstances and conditions. It is not enough to possess one core set of skills and knowledge but necessary to be flexible and able to respond to new needs. Playing games is increasingly seen as a form of flexible practice for high-tech labour. As Allucquere Rosanne Stone points out, 'post-industrialist capitalist economies are developing into cultures of 'play' in which a pervasive 'play ethic' is superseding the work ethic.'[45]

Playing games is increasingly seen as a form of flexible practice for high-tech labour.

This is also the central thrust of John C Beck and Mitchell Wade's Got Game: How the gamer generation is reshaping business forever, where computer games are regarded as a determinant of both cognitive development and economic renewal. The argument is that because of the ways in which children's brains have adapted to playing games, then the ways they will run businesses and drive the economy in the 21st century are at odds with more established commercial routines and strategies.[46]

For Steinkuehler, too, these environments are 'push technologies' which introduce and socialise children into high-tech professional practices:

'By demonstrating the potential of such online worlds/cultures rather than reifying the current impoverished use of such technologies in schools, we might one day change the very culture of schooling into something more relevant, promising, and transformative for all.'[47]

In practical terms, it is now suggested that children are developing from computer games the skills of multitasking, 'zapping' between different information flows, non-linear behaviours, learning through enquiry, and collaboration. JC Herz claims that games are 'perfect training' for contemporary life:

'where daily existence demands the ability to parse sixteen kinds of information being fired at you simultaneously ... kids weaned on videogames are not attention-deficit, morally stunted, illiterate little zombies. ... They're simply acclimated to a world that increasingly resembles some kind of arcade experience.'[48]

45.
Stone, AR (1995) The War of Desire and Technology at the Close of the Mechanical Age (Cambridge, MA: MIT Press), p.9. Stone is cautious about the implications of this shift towards a 'play ethic', but others are far more optimistic. For example, see Kane, P (2004) The Play Ethic: A manifesto for a different way of living (London: Macmillan).

46.
Beck, JC and Wade, M (2003) Got Game: How the gamer generation is reshaping business forever (Cambridge, MA: Harvard Business Press).

47.
Steinkuehler, CA (2008) 'Cognition and literacy in massively multiplayer online games', in Coiro, J, Knobel, M, Lankshear, C and Leu, D (eds) Handbook of Research on New Literacies (Mahwah NJ: Erlbaum), pp.611-634 (p.627).

48.
Herz, JC (1997) Joystick Nation: How videogames ate our quarters, won our hearts, and rewired our minds (Boston: Little, Brown)

Therefore educational, leisure, and educational leisure games, have become an important focus for thinking about learning, because they are ideally suited to, and prepare children for, a new economic era that is based on the use of computers and other information and communication technologies. Games are the 'push' technology which will support children to use other computer technologies.

As Kline and colleagues put it, computer games seem to be 'ideal commodity forms' for the contemporary period, just as suburban housing developments, cars and electronic appliances were ideal forms in the post-war decades; that is, they embody 'the most powerful economic, technological, social, and cultural forces at work' in the present day. In the case of games, they represent qualities of perpetual innovation, style and fashion, fluid electronic consumer experiences, digitally enabled enterprise, and the reorganisation of work and business. Kline and colleagues identify how computer games are 'a sort of low-level domestic socialization for high-tech work practices.'[49]

As a consequence of how digital games have been aligned with ideals about the economy and labour, as well as with popular culture, we now need to address some powerful critical arguments against the use of digital games as an ideal medium for learning in the 21st century.

49.
Kline, S, Witheford-Dyer, N and de Peuter, G (2003) Digital Play: The interaction of technology, culture and marketing (London: McGill-Queen's University Press)

Critical arguments

Arguments in favour of games as a medium for learning in the 21st century have been countered from a number of perspectives. The most well-known counter-argument against computer games is that they can contribute to aggressive arousal and antisocial behaviour. The mainstream media has also been attracted to the idea that computer games are addictive and that they are associated with increasingly sedentary youth lifestyles and obesity. However, other critics have begun to develop more subtle critiques of computer games. In particular, there has been a questioning of the 'techno-utopian' ideal of computer games as a more sophisticated and authentic medium for learning than school and a growing concern about computer games and consumerist culture. In this short section we provide an overview of some of these critiques.

Against digital nativism

The view that children are digital natives who are naturally at home or indigenous to digital and games culture has encountered inevitable criticism. Reservations about this discourse include its generalisations and assumptions, its lack of evidence beyond the anecdotal, and its unwillingness to acknowledge that children have very different levels of access to new media of all kinds.[50]

As David Buckingham has argued, 'the optimistic view of young people as a 'digital generation' — as somehow automatically liberated and empowered through their experience of these new technologies — is little more than a form of wishful thinking.'[51]

Minor sites of resistance

The view of digital games as an appropriate medium for learning within formal educational settings such as schools is also contested. Empirical research has begun to show how young people interpret digital games in a variety of ways and that this may affect their appropriation into formal educational settings.

For example, empirical data derived from interviews with young digital game players by Kathy Sanford and Leanna Madill suggests that on one hand digital game players can gain confidence in using new technologies and the belief that they can use and create programs effectively; become more accomplished at decision-making and quick reactions; develop a new level of manual dexterity; and become more competent in reading and processing multiple pieces of information (text or graphic) simultaneously. In other words, digital games operate as effective learning devices to develop the operational knowledge and social capital required in the workplace.

The view of digital games as an appropriate medium for learning within formal educational settings such as schools is also contested.

50.
Bennett S, Maton K and Kervin L (2008) The 'digital natives' debate: a critical review of the evidence. British Journal of Educational Technology, 39, pp.775-786; Jones C, Ramanau R, Cross SJ and Healing G (2010) Net generation or digital natives: is there a distinct new generation entering university? Computers & Education 54, pp.722-732

51.
Buckingham, D (2008) Beyond Technology: Children's learning in the age of digital culture (Cambridge: Polity)

On the other hand, they found that digital games offered players sites for minor acts of anti-authority resistance, encouraging 'resistance to school values, parental authority, and societal expectations'. The perception of resistance in their study was a major attraction for youth: 'Videogames are fun, and this is partly because they are perceived as dangerous, entering forbidden territory.'

They conclude:

'In our observations of videogame play, we believe that the speed of decision making and action taking in videogames mitigates any reflective element of the game beyond how to win — during game play there is often little opportunity to consider alternative, more complex issues and decisions. There is opportunity to learn and experience historical events in multiple modes, but space and encouragement to reflect upon which of these perspectives holds more evidence of ethical and moral truth is also important.'[52]

Thus, for Sanford and Madill, the view that digital games can support players to adopt a range of different cultural perspectives is misguided. Instead, in their study digital games tended to confirm the cultural and gender stereotypes of young players. Similarly, rather than re-engaging young people in school learning, they found that digital games operated as attractive sites of minor resistance to the authority, restricted schedules, values and expectations of school.

52.
Sanford, K and Madill, L (2006) Resistance through video game play: it's a boy thing. Canadian Journal of Education, 29(1), pp.287-306 (p.303)

In addition, a study by Gaudelli and Siegel found that a digital medium such as games, 'with its interactivity, aesthetics, and speed, can be quite appealing':

'Yet, its appeal is in part due to its novelty and the visual wash-over that occurs when viewing it. As such, it can appear to demand less from the audience in terms of attention, circumspection, and critique, whereas the act of reading is necessarily slower, and perhaps more conscious, than that of viewing.'

As a consequence, in their study of digital games with a 'serious' social message:

'most students felt that videogames about human tragedy trivialized the events themselves, alluding to the impossibility of developing situational empathy for those facing possible death. Students were concerned that the typical young person lacks the wherewithal to explore the situation in greater depth, which would foreclose any real purpose in playing the videogame.'[53]

These findings seem to run against the common sense assumption that computer games are an ideal medium for engaging young people in complex issues or that computer games are an appropriate medium at all for exploring complicated and serious social messages.

53.
Gaudelli, W and Siegel, B (2010) Seeking knowledge through global media. Curriculum Inquiry, 40(5), pp.582-599 (quotes p.596, p.594)

Consumer values

Some critics have shown how digital games are a significant global commodity and consumer product. This has implications for education. Kline and co-authors argue that digital games are an 'ideal commodity form' of the present-day informational capitalist era. These authors point out, for example, that the designation 'Nintendo generation' to refer to computer games players was part of a high-intensity marketing and branding campaign by Nintendo itself, the aim being 'to implant in consumers an ongoing awareness of and identification with the branding corporation'. They suggest, therefore, that games companies such as Nintendo act as 'colonizers' of 'the children who play the games':

'What does it mean to say that Nintendo colonizes its child players? It means that the child's attention, time, desires, ambitions, and fantasies become attached to the Nintendo world, from which he or she derives not only the immediate pleasure (and frustration) of gameplay but also an array of metaphors, narratives and codes for the interpretation of life, and often a whole range of social activities — contests, conversations, clubs, etc. Minds, bodies, and social interactions are thus increasingly 'occupied' by Nintendo activities and purchases.'[54]

This concern with a colonization or occupation of children's lives and cultural experiences by major multinational corporations is surely relevant to debates about the use of computer games for learning.

In Jane Kenway and Elizabeth Bullen's analysis of how entertainment and advertising impact on education, it is argued that major media organisations have become a pervasive influence in children's lives to the extent that they compete with schools as sources of knowledge and understanding. Because television, the internet, computer games and so on have become so accessible, entertaining and persuasive, it is claimed that schools increasingly struggle to meet the high production-value expectations of children. This is expressed in the demand for teachers and schools to embrace new technologies, to make lessons more fun and to improve the 'slickness' of their presentations.

54.
Kline, S, Dyer-Witheford, N and de Peuter, G (2003) Digital Play: The interaction of technology, culture and marketing, (McGill-Queen's University Press), p.126

As Kenway and Bullen put it:

'In many ways, corporate pedagogues have become postmodern society's most successful teachers. Their pedagogies are voluptuous and are consumed hungrily by the young. The corporate curriculum has become the yardstick against which all other curricula are judged and found wanting. ... In segmenting children from adults, entertainment from education, and pleasure from school and teachers, the corporate curriculum may have created school students who expect and get no pleasure from the formal aspects of schooling; a cohort of students who do not expect adults to say anything worthwhile except in purely instrumental terms; who are unlikely to take seriously what schools tell them; and who are unlikely to construct their identities through schools.'[55]

While Kenway and Bullen are optimistic that there may be benefits to children's engagement with the entertainment world, they retain some caution about the effects this may have on what and how children learn. Corporate pedagogues, they maintain, tend to instil in children affective pleasures — excitement and emotion — rather than the reflexive pleasures of more conventionally learning for its own sake. This is reminiscent of arguments about the 'work ethic' being superseded by a 'play ethic.'[56] Consequently, the role of commercialization and consumerism in youthful games cultures is now the subject of critical scrutiny.[57]

Dyer-Witheford and de Peuter, for example, claim that digital games are the exemplary and paradigmatic technology of contemporary globalized consumerist capitalism. As a 'techno-cultural-commercial nexus of formidable depth and scope,' the digital games medium is 'increasingly revealing itself as a school for labor, an instrument of rulership, and a laboratory for the fantasies advanced techno-capital'. For them, digital games act as effective tutoring devices, 'tutoring entire generations in digital technologies and networked communication,' and incubating the kinds of skills, subjectivities and identities required by work and consumerism.[58]

55.
Kenway, J and Bullen, E (2001) Consuming Children: Education-entertainment-advertising (Maidenhead: Open University Press).

56.
See Kane, P (2004) The Play Ethic: A manifesto for a different way of living (London: Macmillan).

57.
Buckingham, D (2007) Selling childhood? Children and consumer culture. Journal of Children and Media, 1(1), pp.15-24; Cook, DT (2004) Beyond either/or. Journal of Consumer Culture, 2, pp.147-153

58.
Dyer-Witheford, N and de Peuter, G (2009) Games of Empire: Global capitalism and videogames (London: University of Minnesota Press)

Pedagogy of games

In the previous chapters we discussed the theoretical basis around how games can support learning. From it we see that games have the potential – but that they are not a panacea. In this chapter we take a more concrete look at how games have been developed and used.

The history of games

Early educational games were designed on a behaviourist model where the reward is extrinsic, that is, it does not necessarily correspond to game play. An often cited example of this would be the game MathBlaster! — where completing sums correctly enabled the player to "win" time firing at balloons — an activity totally unrelated to the solving of problems. For practicing multiplication or grammar rules this drill-and-skill approach has been shown to be effective in post-tests. However, there is the danger that the player learns the facts without the underlying theory. This idea of reward after unrelated activities still occurs.

These games can be referred to as exogenic, that is, there is no relationship between the game content and the learning. Instead the game context is imposed on the learning content. In fact, those at the MIT Education Arcade argue they are often little more than interactive quizzes bearing no resemblance to games.[59]

Later games used a cognitivist model, where there is a shift to discovery based learning. This is the start of endogenic games, where the learning and gameplay are integrated — that is, the play provides a context for the active construction of knowledge as the player determines the rules through inquiry. Unlike behaviourist games which can be deterministic the information is presented in various formats, the player is scaffolded, and they have the opportunity to create their own schema for the events. Intrinsic motivation is more often associated with these games, with problem-solving as one of the key meta-skills employed.[60] An example of a game based on this model would be Homicide or Space Missions.

59.
Klopfer, E, Osterweil, S and Salen K (2009) 'Moving Learning Games Forward: obstacles, opportunities and openness', MIT Education Arcade at the Massachusetts Institute of Technology, **http://education.mit.edu/papers/MovingLearningGamesForward_EdArcade.pdf**, p.2

60.
Egenfeldt-Nielsen, S, Smith, JH and Tosca SP (2008). Understanding Video Games: The essential introduction (Routledge)

This group would also include epistemic games, as described by Gee and Shaffer[61]:

'Epistemic games of all kinds make it possible for students of all ages to learn by working as innovators. In playing epistemic games, students learn basic skills, to be sure. They learn the 'facts' and 'content' that we currently reward. But in epistemic games students learn facts and content in the context of innovative ways of thinking and working. They learn in a way that sticks, because they learn in the process of doing things that matter.'

Games that are microworlds, that is, where the player can manipulate an object's properties, connections, and application rather than following a predominantly linear model use a constructivist pedagogy. The player constructs an understanding of the given topic in a sandbox environment. Examples of this style of digital games would be Logo, or more recently Spore. Despite the scaffolding within the game players do not necessarily understand the underlying models. This was illustrated by Roller Coaster Tycoon in the Teaching with Games project. The teacher created exercises from which the students had to deduce the relationship between friction, launch speed and height. By explicitly dictating the number of carriages the teacher overcame the incorrect physics relationship between acceleration, mass and velocity. This avoided the trial and error approach to rollercoaster design that had been apparent.[62]

This led to the prevalent current research focus, the idea that games need to be considered in context. This sociocultural viewpoint, which emerged in the 1980s, views games as culturally embedded, with meaning arising through context (eg museums, classrooms, playgrounds), social interaction (with friends, family, teachers) and psychological and physical needs. Thus games are viewed as tools that mediate discussion, reflection, and analysis. Consequently the emerging game pedagogies support situated, exploratory, and experiential learning rather than more rigid and linear experiences.[63]

Games need to be considered in context.

61.
Gee, JP and Shaffer, DW (2005) Before every child is left behind: How epistemic games can solve the coming crisis in education (WCER Working Paper). Madison: University of Wisconsin-Madison, Wisconsin Center for Education Research, **www.academiccolab.org/resources/documents/learning_crisis.pdf,** p.24

62.
These were lessons with 17 year-old students working pairs or triplets in physics lessons.

63.
For a more detailed description of these game pedagogies see Simon Egenfeldt-Nielsen's work, for example, Overview of research on the educational use of video games, 2006 **(www.itu.dk/~sen/papers/game-overview.pdf)** or 'Chapter 9: Serious games — when entertainment is not enough' of Egenfeldt-Nielsen, S, Smith, JH and Tosca SP (2008) Understanding Video Games: The essential introduction (Routledge)

Game elements

Related to the underlying pedagogy are the game elements whose presence leads to learning. This is an area addressed by many researchers — all with a slightly different focus. However, what is clear what is good or bad depends (as stated) on the learners, their context, and how it is facilitated. The following elements have all been identified as vital to learning from the Digital Games Based learning project[64]:

Key elements	
Challenge	A test of the learner's skills, set at a level to stretch his/her abilities.
Fantasy/Narrative	Imaginary environment, characters or story which can stand as a metaphor for the real world.
Feedback	Response to the learner's actions or progress within the game.
Goals	Clear aims that are meaningful and achievable but stretch the learner's abilities.
Sensori stimuli	Engaging visual and sound effects. Social aspects/community playing with or against other people and social interaction inside and outside the game. Additional learning elements that can be found in digital games.
Additional elements	
Active learning	Learning 'by doing', ie actively engaging in the game-related task.
Adaptivity/ Individualisation	The difficulty of the game or task adjusts itself to suit the learner's ability level.

64.
For a full discussion around game elements and definitions, see the Futurelab report Games-Based Experiences for Learning **(www.futurelab.org.uk/resources/games-based-experiences-learning)**

Assessment	Learners can review how well they are doing in the game and compare it with others.
Authenticity/ Realism/ Fidelity	Visual, sound and tactile effects and character behaviour that contribute to making the game more lifelike and convincing.
Competition	Can be with others or with oneself, with the aim of outperforming others or self-improvement.
Control	The learner is able to manage and direct his/her own actions in the game.
Creativity	Using imagination to solve problems or produce (and share) artefacts in the game.
Mystery/Curiosity	Element of novelty, surprise and informational complexity within the game.
Puzzle-solving	Mental puzzles, riddles or problems need to be solved to progress in the game.
Rapid decision-making	Having to make a series of choices fast and continuously to move forward in the game.
Relevance/ Interest to the learner	Being able to relate to the game in a meaningful way.
Reward	Prize or incentive given in return for what the learner has achieved, matching their increasing skills level.
Role	The learner takes on a specific part in the game and thus acquires skills and knowledge relevant in the real world.

Rules	Conditions and restrictions that direct the actions the learner can take within the game.
Safety	Consequences of risk-taking in the game have no impact on the real world.
Scaffolding and sense of improvement	Gradually increasing level of difficulty and seeing oneself make progress in the game.
Transfer	Learning from the game can be applied in other games or in a real world context.

Table 1: Elements within games to support learning

However, this is not to say that all digital games have all these elements. Just as Wittgenstein argued that there is no one element that occurs in every game, so not every game has winners and losers, nor do they always involve luck or skill, neither do all digital games require rapid decision making or sensori stimuli for example. Instead Wittgenstein described games as belonging to a family, they share: 'the various resemblances between members of a family: build, features, colour of eyes, gait, temperament, etc. etc. overlap and criss-cross in the same way. — And I shall say: 'games' form a family'.[65] Thus so do digital games create a family.

The elements within this family that are most important to learning depend on what is being learnt. But they also vary in importance to the participants. When these elements were reviewed by teachers and students it was found teachers focused more heavily on how the games related to their own teaching strategies and which of the principles offer more opportunities to extend or support this process. Both role and rewards were placed near the bottom of their list. Students focused more heavily on the game-play elements of the games themselves — rules, roles and rewards. This may well be because of their existing preconceptions and experiences with games, much of which was related to digital gaming.[66]

65.
Wittgenstein, L (1958) Philosophical Investigations (GEM Anscombe, Trans.). (USA: Blackwell Publishing) p.67

66.
For more information see **www.futurelab.org.uk/resources/games-based-experiences-learning**

Interacting with games

The way game elements have been implemented have changed as technology evolved. Initially games were computer based and interactions depended on pressing characters on a keyboard. Although many games still use the keyboard for interaction, console games require a mastery of combinations of buttons on a console, while others merely require pointing a device at a screen (as in the Wii), or even interact directly (the Kinect, Eye Toy). The Nintendo DS makes use of the touch sensitive screen and microphone as input devices, for example, in Nintendogs players care for a virtual dog that 'lives' on the DS. This requires a combination of stroking the dog (on the touch sensitive screen), giving it verbal commands (using the built-in microphone), and even taking it for walks where it can interact with other Nintendogs (over the wireless network).

Games are also taking advantage of the ubiquitous nature of mobile phones, with games utilising the simple interface or touch sensitive screens to create casual games that can be complete in a few minutes. For example, Angry Birds, which illustrates many physics principles, had 42 million downloads by Dec 2010.

This shift has led to a differing game demographic, for example, mothers playing more leisure games with children due to short games and intuitive interfaces such as the Wii. The casual game market and more powerful mobile phones have led to more players who play for short periods due to game accessibility.[67]

Games are also taking advantage of the ubiquitous nature of mobile phones.

Training games and educational games

Although not the focus of this handbook, it should be noted that older learners are more likely to use games as learning tools. The serious games market, including simulations, is growing. These games:

'train people for tasks in particular jobs. This might be training army personnel to better identify enemy combatants, or training insurance salesmen how to close a deal. These tasks may be physical or cognitive, or a combination of both. But they are characterized by their specificity and applicability for particular work-related purposes.'[68]

67.
ISFE (2010) Video Gamers in Europe 2010. Prepared for the ISFE by GameVision Europe, **www.isfe-eu.org/index.php?PHPSESSID=s2k50pje795c7h5rbtdhaui8t7&oidit=T001:662b16536388a7260921599321365911**

68.
Klopfer, E, Osterweil, S and Salen K (2009) 'Moving Learning Games Forward: obstacles, opportunities and openness', MIT Education Arcade at the Massachusetts Institute of Technology, **http://education.mit.edu/papers/MovingLearningGamesForward_EdArcade.pdf,** p.20

These games are being designed for situations where:

– there are large number of users that have similar training and learning needs

– businesses that need to optimize and save time on training

– the learner needs real, transferable and accurate learning

– the learner will use the tools they use in the games (which is possible given many jobs use technology)

– there is a need to train users for procedures which would be expensive or impossible to recreate physically

– feedback is required quickly on performance and understanding.

This explains the investment by military, health and business, and the absence of investment by schools which have a different set of criteria.

Educational games used in class usually:

– match the curriculum

– or can be played for short periods (like The SIMs)

– or are casual games which practice explicit skills.

This curriculum-matching format is illustrated by Dimension M, a game to teach mathematics modelled on a first person shooter where answering maths questions scores points, and which easily tracks student progress.[69] Games designed on a traditional leisure game model which takes many hours to complete, for example the Global Conflicts series or Muzzy Lane History games, are harder to integrate.

69. See www.dimensionu.com/dimu/home/dimucontent.aspx?MainNav=subareas&Section=dimM&ref=content%20dimm%20home%20educator

Games in schools

In this section we look at why and how games are currently used in schools to support teaching (rather than as a reward for good behaviour or as an activity when wet). We focus on the expectations of games and the reasons around why they are not used.

What has emerged so far is that games have the potential to assist learning, although this is dependent on the context. But as yet digital games are not commonly used in UK schools, despite 38% of primary teachers and 30% of secondary teachers in a recent survey saying they had used games. Moreover 63% of primary teachers and 58% of secondary teachers said they would like to use games in the future.[70]

The rationale for this was that 46% of teachers said they believed games to be motivating and engage students. This fact was corroborated by the EU project where 27% of teachers when asked an open question around the benefits of games stated games were motivating and attracted pupils' attention.[71] However, this expectation is not always fulfilled. When Global Conflict was played a UK teacher had to admonish his class for turning it into a "click-a-thon" rather than reading the text.[72]

As a consequence of game play, 85% of teachers in the UK believed that computer games can help support children's cognitive development, 74% their ICT development, and 66% their higher-order thinking skills (such as logical thinking, planning and strategising). In contrast 44% of teachers felt that playing computer games can lead to young people developing antisocial behaviours.

So why are digital games not used more? When asked, the five most frequently-identified barriers identified by teachers in the same survey were:

– the expense of games (74%)

– licensing issues (69%)

– teachers' lack of knowledge about the game platform/software (56%)

– inappropriate nature of game content (51%)

– pupils being unable to make the link between playing the game and the wider learning objectives (50%).

70.
Figures from a self-completion survey of over 1,600 practicing classroom teachers in English state primary and secondary schools (with questions designed by Futurelab and conducted by the National Foundation for Educational Research [NFER] through its February 2009 Teacher Omnibus) — see Williamson, B (2009) Computer Games, Schools, and Young People: A report for educators on using games for learning, **http://archive.futurelab.org.uk/resources/documents/project_reports/becta/Games_and_Learning_educators_report.pdf**

71.
For details around this survey of 120 teachers who gave the benefits of using games see Wastiau, P, Kearney, C. and Van den Berghe, W (2009) How Are Digital Games Used in Schools? Final report. pp.73-75 and p.85 **http://games.eun.org/upload/gis-full_report_en.pdf**

72.
Hanghøj, T and Brund, CE (2010) Teacher Roles and Positionings in Relation to Educational Games. Proceedings of the European Conference of Games Based Learning (EC), pp.116-122

Additional research[73] in the EU found that teachers did not use games because of:

- difficulty in integrating with curriculum (34%)
- insufficient computer availability (28%)
- negative attitude to games (24%)
- lack of time (20%)
- lack of information and support (17%)
- the students behaving inappropriately (15%)
- technical problems (12%)
- cost and lack of resources (10%)
- problems fitting within timetable (10%)
- too many students in the classroom (4%).

This is in addition to closed questions which also identified issues around the difficulty in identifying games, the content of games, the lack of evidence that digital games are beneficial, and the difficulty in assessment. The above recognises that teachers, even those that play games in their leisure time, face the same issues.

From this research the barriers in using games can be divided into two areas:

- the logistics of using games in the school, for example issues around expense and licenses, access to machines, and fitting games into lesson "chunks"
- how they can be used — the educational potential of games are not always obvious.

73.
Wastiau, P, Kearney, C. and Van den Berghe, W (2009) How Are Digital Games Used in Schools? Final report. **http://games.eun.org/upload/gis-full_report_en.pdf,** pp.78-82

The use of games

Recognising the role of teachers

The logistics of game use are straightforward to consider, however, supporting teachers to recognise when games will be more effective than other teaching tools is trickier. As Thorkild Hanghøj summarised in his keynote to the ECGBL 2010 conference: "We need to describe the messy reality of actual gaming and teaching practices". He argues that researchers have often looked at the learning outcomes and the actual inherent learning potential of particular game designs rather than the "actual practices of **teaching** with games".[74] In order to use games effectively they have to be considered in context and this means recognising the role of teachers.

Hanghøj argues teachers need a sense of ownership to use games effectively. They also need to have effectively integrated the game into the curriculum. If games are seen as treats, non-assessed, and used for short periods of time then there is no need for teachers to facilitate their use. Teachers need to have a clear understanding of what they want from using the game. This does not mean teachers need understand every nuance of the game, in fact, as pointed out by Aarsand[75] it is often beneficial if the student has to take the role of expert and explain to the novice adult. However, what is clear is that if the teacher does not take an active role when facilitating the game, and there is no purpose for using the game, then the learning will be ineffective.

Using games as a stimulus

Games are often used as a starting point for other activities. Tim Rylands has been using Myst since the year 2000 as a stimulus for creative writing; and for this work he won the innovative teacher award from Becta in 2005.[76] By playing the same game or scenario within a game as a variety of characters students can also be encouraged to develop an understanding of multiple perspectives that they can use within their writing.

Games need not only encourage writing. In a case study from the Consolarium evaluation[77] Guitar Hero was not used to teach purely music. Students wrote reports on fictional concerts for newspapers and their website, they built their own guitars in design and technology and then adverts to sell their guitar, they explored sound as a science topic following on from use.

74.
Hangoj, T and Brund, CE (2010) Teacher Roles and Positionings in Relation to Educational Games. Proceedings of the European Conferences on Games Based Learning, p132

75.
Aarsand, P (2007) Computer and Video Games in Family Life: The digital divide as a resource in intergenerational interactions. Childhood, 14(2), pp.235-256

76.
www.timrylands.com

77.
Groff, J, Howells C, and Cranmer S (2010) The Impact of Console Games in the Classroom: Evidence from schools in Scotland, **http://archive.futurelab.org.uk/resources/documents/project_reports/Console_Games_report.pdf**, p59

Using games to teach content

Although care must be taken about the accuracy of content with respect to the curriculum, games (educational, leisure, and educational leisure) can be used to illustrate concepts and materials to be taught. For example, in Endless Ocean students can explore marine life, or town planning in SimCity. Games may also illustrate more general principles; the creature creator aspect of Spore can be used to allow students to explore what adaptations are appropriate for certain environments, while physic principles can be determined from Soda Play[78].

Using games to teach social skills

The assumption that games automatically teach skills such as collaboration, turn taking, reflection and problem solving has been frequently challenged.[79] However, with mediation these can be addressed by games, as adventure games, action adventure games and strategy games all have opportunities for these skills to be used.

Creating games

Finally, a key aspect of understanding of a topic or a principle is to teach another. Creating a game to test the content knowledge of another or demonstrating that the principles of engaging game design has been understood has been used since before the arrival of digital technologies. However, software such as Scratch[80], or Sandbox Game Maker[81] allows students to easily make games, and as investigated by the London Knowledge Lab[82] this results in students:

- being competent in the grammars of different modes of representation, that is, understanding that narratives comprise visual design, sound, text, and voice rather than just one mode
- creating coherent 'texts' by using such modes in combination
- being competent and understanding the structure and format of conventions within games.

78. http://sodaplay.com

79. For example, the Teaching with Games project (Sandford, R, Ulicsak, M, Facer, K, and Rudd, T (2006) Teaching with Games: Final report, **http://www2.futurelab.org.uk/projects/teaching-with-games/research/final-report/**), or Egenfeldt-Nielsen, S (2005) Beyond Edutainment: Exploring the educational potential of computer games. Unpublished PhD, IT-University of Copenhagen, Copenhagen [accessed from **www.it-c.dk/people/sen/egenfeldt.pdf** on 15/01/2006, see also **www.egenfeldt.eu/public.htm**]

80. http://scratch.mit.edu

81. www.sandboxgamemaker.com

82. www.lkl.ac.uk/cms/index.php?option=com_content&task=view&id=162&Itemid=94

Digital gaming played by families

Parents and children across the world play leisure games together for fun. In the UK parents may play with younger children with a direct learning goal – for example, providing a context in which young children learn to recognise words, numbers, and basic economic principles like saving in order to buy better Lego gadgets. With older children learning is not a key element; although can be a secondary outcome. However, in leisure digital games the types of learning recognised are skills such as turn-taking, learning to lose gracefully, or simply that ''your parents are immature''.

The time spent playing digital games as a family in the UK is longer than the average school lesson: 45% of parents claimed each family gaming session lasted between half an hour to an hour, and 23% said the session was over an hour.[83] This suggests that understanding why games are played as a family and what they play may inform how games are used in formal learning environments.[84]

In a nationwide survey in 2009 it was found that of the 36% of parents that had played a digital game with their children in the last 6 months[85] — whereas 70% of children under 11 and 57% of young people over 11 reported playing with adults, predominantly parents and older siblings in the same time period.

Parents were more likely to play with primary school children (28%) than older children (8%). They were more likely to play puzzles and educational games with younger children (42% of 8-10 years old said they had played such games with adults in contrast to 22% of 11-15 year-olds), while adults were more likely to play fighting and adventure games with 11-15 year-olds (52% of 11-15 year-olds said they had played these games in the last six months with adults).

Unlike teachers, who facilitate and set up the games parents surveyed saw their role as being either an observer (89%) or competitor (81%) and they were equally likely to be taught the rules (63%) as to teach them (63%). However, the ages of children in the household appears to influence how often the adult teaches the rules of the game. Those who live with younger children, aged 0-9, are more likely than those with a child aged 10-15 to say they **always/sometimes** teach the rules (72% compared to 47%) and watch and referee the game (73% compared to 51%). In contrast young people would rather have an adult play with them; only 21% said they would like them to watch, with 13% seeing the adults' ideal role as a referee, and around 65% saying parents took the part of a referee.

83.
A representative sample of 558 parents or legal guardians of children under 16 were interviewed throughout Great Britain; and a representative sample of 737 children aged 5-15 were surveyed. The August 2009 survey focused on the types of games played, who played, and why, or not, family gaming occurred (Ipsos MORI 2009).

84.
It should be noted that playing in groups is not as popular as playing alone. Research by GameVision shows that across genders and ages the most common format is playing alone and offline. Approximately 70% of males and females aged 10-14 play alone offline, while around 10% of the males and 18% of the females play offline with friends, with the assumption this includes families. See 'A view from the marketplace: Games now and going forwards', a presentation at the 2009 Game Based Learning Conference in London, **www.gamebasedlearning2009.com/proceedings/presentations/904-presentations/226-sean-dromgoole-ceo-some-research**

85.
This value is higher than a 2010 ISFE survey which found of the 32% of UK adults classified as gamers, 72% of them (ie 23%) had played digital games with their children. See ISFE (2010) Video Gamers in Europe 2010, prepared for the ISFE by GameVision Europe, **www.isfe-eu.org/index.php?PHPSESSID=s2k50pje795c7h5rbtdhaui8t7&oidit=T001:662b16536388a7260921599321365911**

Also, unlike in schools, young people take a greater role in selecting what is to be played, especially as they grow older. Mothers and girls were more likely to play active technology, such as fitness and music games. Fathers and boys were more likely to play racing, sports, fighting and adventure games.[86] The breakdown of games is shown in Figure 1:

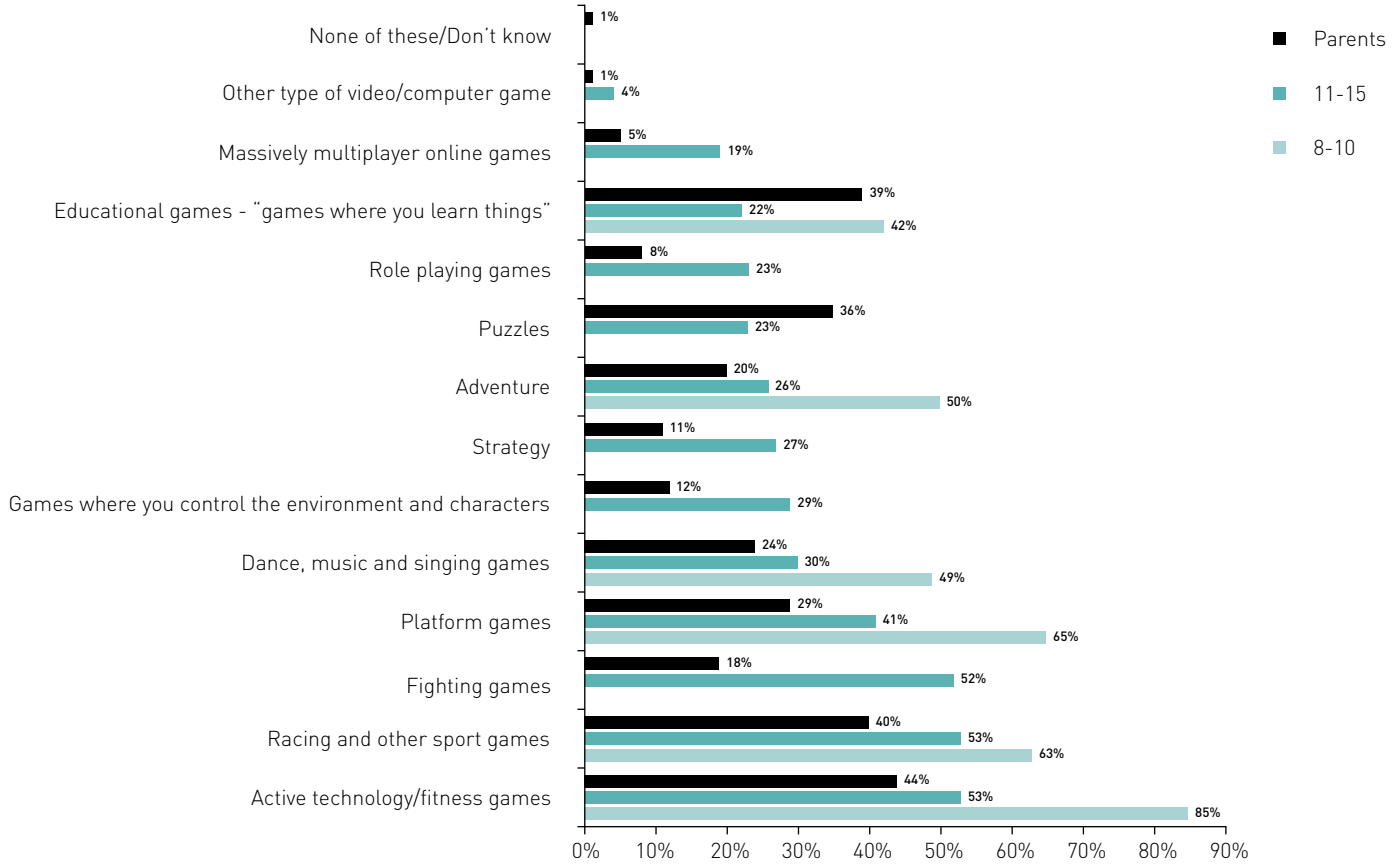


Figure 1: Games played in intergenerational family groups according to parents, 11-15 year-olds and 8-10 year-olds

86.
For a description of the game genres see page 63.

From this survey almost three in five adults who had played video games with a 3-16 year-old in the last six months played with a son more frequently (58%), while less than two in five play with a daughter the most (37%). The young people stated they were more likely to play with males: 41% said they had played with their father and 12% with brothers/stepbrothers over 16, while 38% said they had played with their mother and 4% with sisters/stepsisters over 16.

The technology that can be found in UK homes is more plentiful than at school. In 2009 the average home had: 2.4 TVs, 1.6 laptops/Apple Macs, 2.4 games consoles, 3 mobile phones and 2.2 MP3 players (O2 2009).[87] In 2008 around 88% aged 8-15 owned at least one games console, regardless of socio-economic status.[88]

Unlike schools, where age ratings are followed, some parents in interviews or workshops[89] were ignorant of what age ratings meant. Or they allowed their children to choose games — arguing that even if they set up parental controls their offspring would overcome any barriers.[90]

87.
O2 (2009). Digital Families: Exploring the role of technology in modern family life. **http://mediacentre.o2.co.uk/imagelibrary/downloadmedia.ashx?MediaDetailsId=658**

88.
Ofcom (2008). Annex 3 Media Literacy Audit: Report on UK children by platform. **http://stakeholders.ofcom.org.uk/binaries/research/media-literacy/cannex.pdf**

89.
These were conducted as part of the Futurelab Gaming in Families project in 2010.

90.
See page 65 for a description of game age ratings.

In the survey parents were asked why they played, and their unpromted responses were categorised as follows:

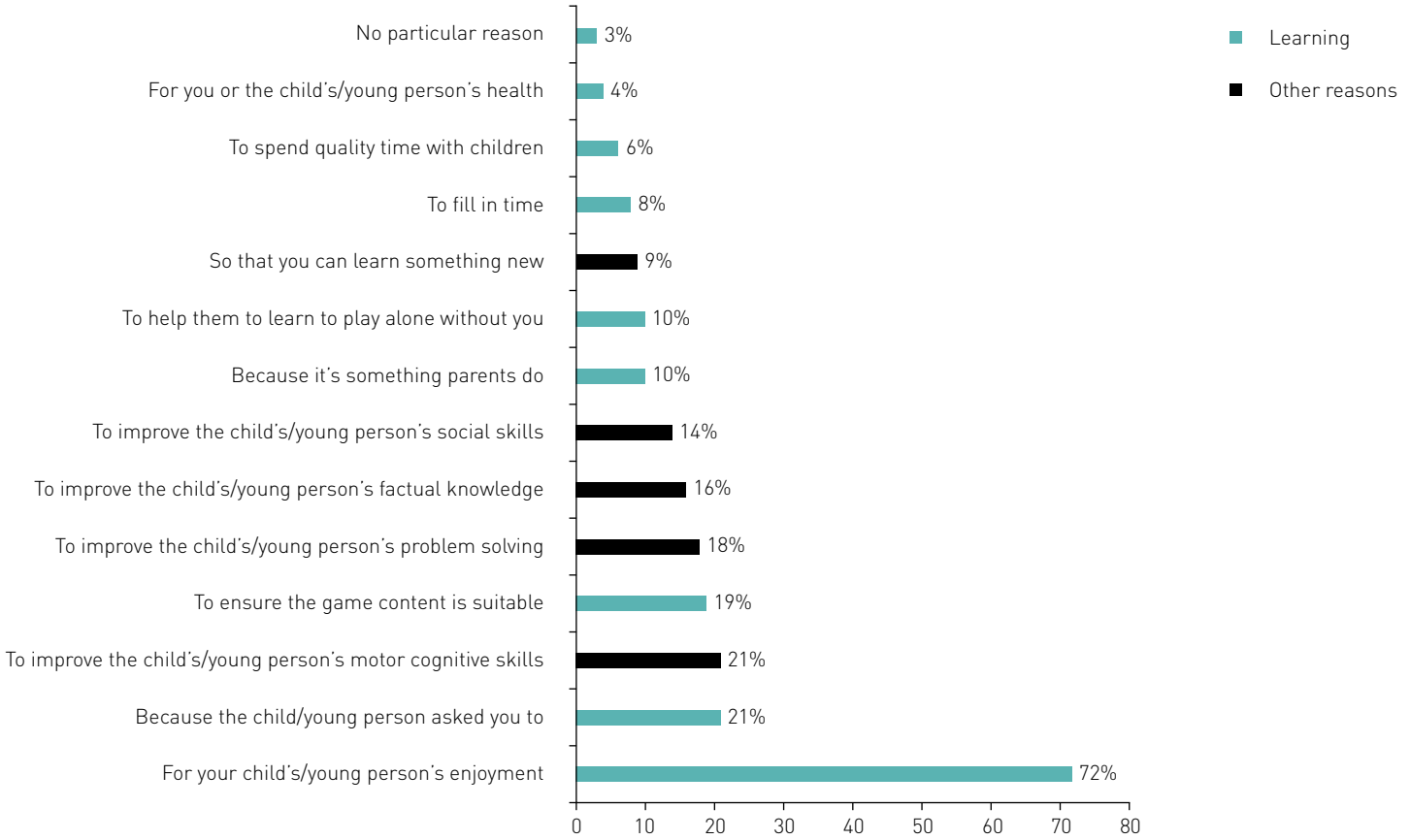


Figure 2: Reasons for playing computer games with children (light lines represent learning, dark, other reasons)

When asked, young people also spontaneously said that the most important reason for playing was fun. In their responses (which again were classified after retrospectively) it was clear learning was not a key consideration when playing games — unlike adults who felt games had learning benefits.

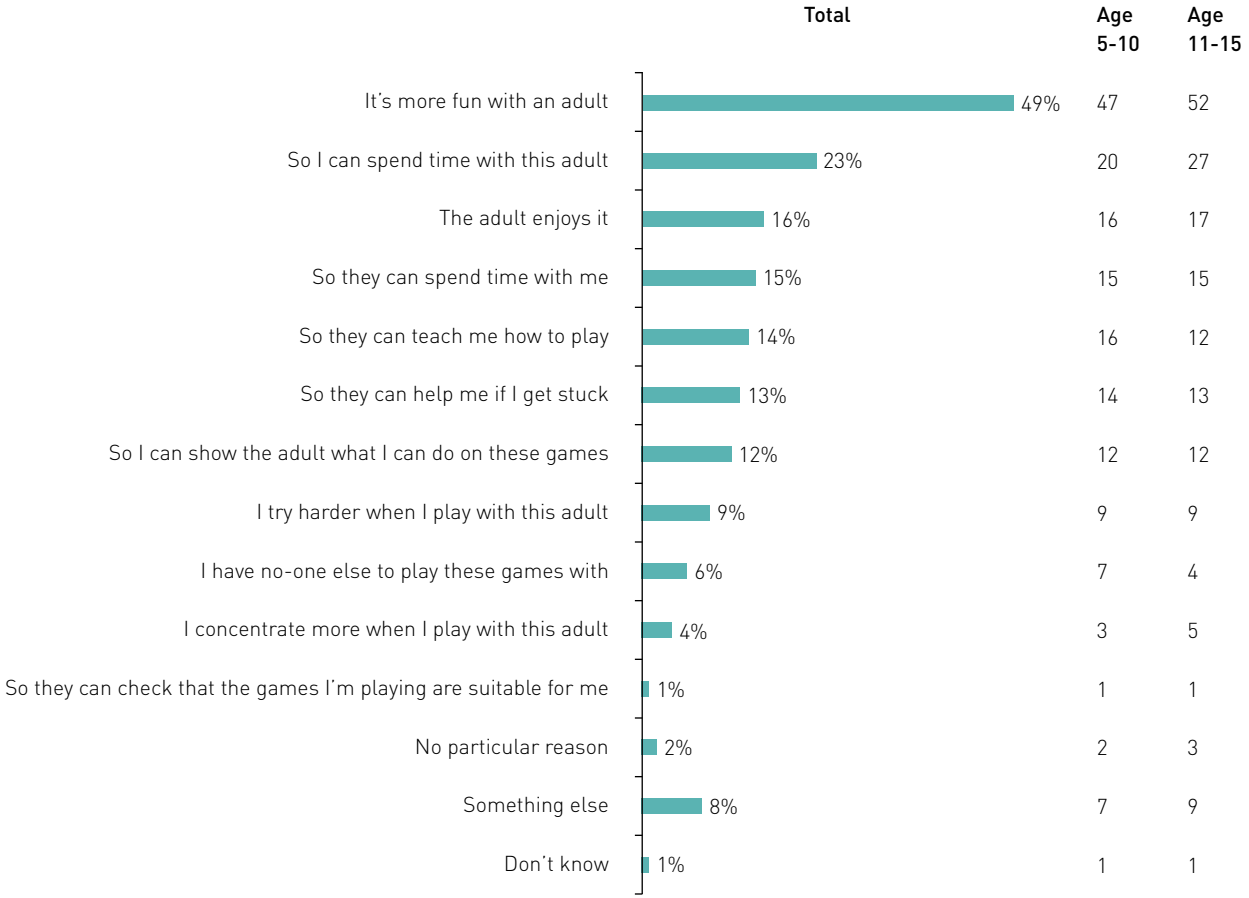


Figure 3: Reasons for playing computer games with adults

In separate interviews with parents and young people[91] who claimed to belong to gaming families, the most enjoyable games were those where they played as a full family, although they played more frequently in subsets. These games tended to allow many people to play simultaneously, or had short terms where people could watch — a sense of audience helped. These games tended to have intuitive controls, usually gestural, with simple rules and short games. Young people delighted in demonstrating their superior skills and laughing at their parents — there was an acceptance that games would make you look foolish. As a young boy pointed out when asked what made it so fun:

"... and mummy was very, very rubbish - she kept falling off the side."

Moving on to the length of play, the interviews correspond to the survey. The mothers would often have a quick go while doing some other task, or a father may have a race with a son on the Nintendo DS while the bath was running. The time spent playing was dependent on:

– **game genre** – adventure games were played for longer times than casual games

– **occasion** – family celebrations had gaming sessions lasting over an hour.

The interviews corroborated the fact that mothers were more likely to play educational games, but only with younger children. With older children it tended to be music or active games, if they played. As the child became older they became more dominant in choosing the game — and they liked games in which their parents often struggled. Parents also admitted to difficulty in the 'how to' aspect of game play: "you know you've got to press 16 buttons to get it right and it's not going to happen".

91.
Ten families were interviewed. These families did not display the same frequency in gaming either in the interviews or diaries. No family, or intergenerational subset, claimed to play together every day, although two families stated they played together a few times a week. Six of the remaining eight played a few times a month.

Unlike a school environment, games were not played for factual learning, to practice '21st century skills', or to provide a context for further exercises. The interviews confirmed that digital games were played because they were fun. In the interviews, learning was never mentioned unprompted. As a father of teenage boys said:

"They don't learn much from it [digital games] I don't think ... maybe how to laugh a little, you know ... how to get cross, you know, and how to handle that. So again it's more those sorts of things than learning anything ... school's for education."

However, with explicit prompting he extended his answer.

"It's a bit like sport in those terms — you can learn from it, how to interact with people. And what's important? Is it winning or is it the team, or is it both? Or is it how you play? Is it how you get there? Is it the strategy? Is it gloating in your friend's face? Or is it shaking hands with the other team at the end and actually meaning it?"

With prompting this idea of learning to lose gracefully occurred in conversations with older children — younger children just enjoyed winning.

Prompting was also needed to agree that adventure or strategy games, such as Halo, could enhance mental ability. While digital games could improve co-ordination, this was especially true of gestural games such as bowling or tennis. Other parents liked the fact that games made level playing fields. They felt their children could compete equally.

Mentions of factual learning when playing games were infrequent. Brain Trainer played individually was felt to improve mental arithmetic, and parents encouraged younger children to play educational games alone or with siblings. The two explicit examples given were:

– a 6 year-old boy was now better at reading, and he recognised large numbers and budgeting through playing Lego Batman; the latter because initially he spent his points as gained, but because he wanted better prizes he learnt to save points

– an 11 year-old boy used an ice hockey game with his stepfather to improve his tactics in real life, although that was not his only motivation:

> "I play Ice Hockey and it helps me learn positions and rules and … like you can start a fight sometimes on there."

This is not to say these families do not recognise the learning within games. However, when describing games they played, or games families who had never played should choose, few educational learning games were mentioned. The exception was The Sims, but it was never used as a family game nor seen a learning experience.

To improve learning using digital games, either individually or in groups, how they are introduced and how the learning is reviewed are important factors.[92] Discussion encourages reflection which can enhance learning in terms of facts and appropriate behaviour. However, according to the interviewees, discussion about games was rare. One of the mothers interviewed used to prompt her three sons to explain why they like a game. She found that explanation leads to them being more balanced when they play.

Mothers in particular state they are 'spoken at' rather than participating in conversations around games. They are aware that this is not ideal, but if they are not interested in the game or doing other chores they find it hard to continue the conversation and these conversations tend to be more factual — statements about reaching the end of a level, or describing a particular penguin house. The young people realise their parents are often uninterested; a 12 year-old boy said:

> "We try to [talk about games], but they just turn off. If you mention something they just go 'we don't know these games so it's pointless telling us'."

92. For example, Sandford, R, Ulicsak, M, Facer, K, and Rudd, T (2006) Teaching with Games: Final report, **http://www2.futurelab.org.uk/projects/teaching-with-games/research/final-report**, and Egenfeldt-Nielsen, S, Smith, JH and Tosca SP (2008). Understanding Video Games: The essential introduction (Routledge)

This does lead to children just not bothering to tell parents about their gaming experiences outside of family play sessions. If family gaming is to produce learning (and we are not advocating this as being the reason to play), there needs to be meaningful dialogue around the game, just as teachers need to deliberately encourage reflection about the learning experience.[93]

Not all young people like playing digital games.

For teachers, this survey indicates that:

– not all young people like playing digital games

– secondary-aged children rarely play educational games at home — which would explain the mismatch in expectations when playing educational games at school

– reflection is **not** instinctive in game play

– young people do not play games with the intention to learn, they play because it is fun

– young people are far more dominant than their parents when it comes to choosing what game they play

– older children are less happy with the idea of an adult acting as referee and 'teaching' the game.

93. Ibid.

Practical suggestions for using digital games

In this final section we address issues around the selection and use of games. Note that these are not definitive but can be viewed as a checklist of considerations.

Selecting games

Identifying what games, or what within a game, has relevant content for the desired learning is a key impediment to using games as learning tools in the classroom or home. As yet information around learning potential is rarely included in teacher training, or in sites such as **www.familygamer.co.uk**. Even if a game is selected or recommended, teachers still have to find time to learn the game, determine how to facilitate use (for example, the assumption that playing as a group leads to improved communication is a fallacy), and whether it is appropriate for their students. Kurt Squires found that some students felt their school-based expertise was not being recognised by playing a game — and more importantly such play would not help them in their exams.[94]

Information around learning potential is rarely included in teacher training.

From this research by Kurt Squires, along with the IMAGINE project[95] and the work of Sara de Freitas and Martin Oliver[96], teachers need to take account and schedule the following activities so they can effectively use games.

– What is the background of the player(s) (age, language, subject experience, digital game experience, prior knowledge, preferred learning styles, etc)?

– What are the learning goals for the lesson(s)? Are they ones which an existing resource would be more appropriate? For example, would students make a better presentation on the Seven Wonders of the World without experiencing them through Civilisation?

– Select an appropriate game, that is, one that:

  - maps to the curricular aims
    Note that this does not mean that the game structure necessarily equates to the curriculum objectives. It could mean using a few game elements, such as the sandbox for roller coaster creation which is one small part of Roller Coaster Tycoon, or that Guitar Hero might be the starting point for exercises in calculating the costs of going on tour, or for being interviewed in another language, or that you want a game to develop communication and problem-solving skills so the game goal is less important.

  - there is time for the teacher to learn sufficiently in order to be able to facilitate

94.
Squires found roughly 25% of students in school situations withdrew from his study (which used Civilization to teach geography and history) as they found it too hard, complicated and uninteresting. Squire, K (2005) Changing the game: what happens when video games enter the classroom. Innovate: Journal of Online Education, 1(6).

95.
See Chapter 3 in the EU report 'Digital Games in Schools — A handbook for teachers' **http://games.eun.org/upload/gis-full_report_en.pdf**

96.
EU report on games-based learning across European schools, **http://games.eun.org/upload/gis-full_report_en.pdf**; de Freitas, S and Oliver, M (2006) How can exploratory learning with games and simulations within the curriculum be most effectively evaluated? Computers and Education, 46(3), pp.249-264

- works on the school network (there are sufficient machines, memory, network capabilities, funds for licenses etc)

- has an appropriate age rating, that the art assets and copy are suitable, there is appropriate feedback and clear progression etc

- that the game has a suitable learning curve for the students, and that it is easy to get to the appropriate part of the game (ie you need not play for five hours to reach the relevant point, and you can save progress regularly and easily)

- can be used easily by all students, regardless of physical ability

- the game has appropriate fidelity, that is, a relevant degree of realism for learning.

– Learn the basic principles of the game, including how to appropriately facilitate the game.

– Create a robust lesson plan, including:

- how the game will be embedded in the overall curriculum

- how the young people will use the game (individually, in pairs, small groups, as a class)

- what other practices will support learning, either in the game such as reflection, or externally such as discussion

- the role of students who may be experts in that game or game genre (will they explicitly support peers, for example)
  Note that it is not enough to trust the self description of expertise. Teachers from the Teaching with Games project were surprised their students could use cheats effectively and revamp the environment, but might struggle to do a task that they thought relatively simple. There is no linear progression from novice to expert. Thus if relying on student experts it is important to check that they understand the relevant aspects of the game felt before they mentor other students.

- how to get to the relevant part of the game (if not a casual game)

- how the learning will be evaluated (which may not be within the game)
- how learning will be transferred beyond the game context
- how to promote the students' reflective thinking
- what activities can be done if the game does not work.

– Timetable the game within lessons.

Support in selecting games and integrating them into teacher practice is beginning. The Consolarium provides web materials with suggestions around how to use game based learning.[97] For those in Scotland, this includes sharing consoles and games, providing Developing Officers to talk to parents and teachers and develop schemes of work, and providing a forum for teachers to share experiences and materials. There are also blogs describing use, and games that have won the BETT awards, for example MP for a Week (from Lightbox Education and Parliament's Education Service) won the Secondary, FE & Skills Digital Content category in 2011. However, there is as yet no single resource that lists games along with possible fits to the curriculum and suggested practice.

97. www.ltscotland.org.uk/usingglowandict/gamesbasedlearning/index.asp

Supporting play at home

We do not advocate that digital games played as families should be seen as learning activities. They are, as the surveys and interviews showed, played for fun. However, workshops with families found that some very simple activities could be done to enable learning. The two most effective ways of facilitating reflection from the Gaming in Families workshop were encouraging discussion and defining roles.

Encouraging discussion

This was used with strategy and role playing games. The players were encouraged to ask why they did certain actions, for example, to explain why they chose a certain route, or how they identified appropriate strategies to achieve their goal. They were also asked to question how they felt taking certain actions and whether these actions would work if taken outside of the game environment.[98] The idea was to see if explicitly asking about problem solving strategies helps young people formalise them. Moreover, prompting players to reflect on the morality of the game may, as acknowledged in the interviews, help them to distinguish what is appropriate behaviour outside of the game.

Parents or young people who did not elaborate responses, ask for clarification, or generally engage in conversation found the questions less useful. However, when there was no expectation of a 'right' answer and when parents were genuinely interested in the answers and wanted to understand the strategies involved, young people and their parents rated this legitimising of game talk as motivating and useful.

Defined roles

This was used for active sports games, but would work well with either short games or structured so turns were short. The family chose one 'teacher' (usually most experienced player) and one 'technician' (usually the least experienced) as well as players. The 'teacher' had to instruct the 'technician' how to open the game, in this case Wii Fit hula hooping and, if necessary, how to choose a Mii[99], as well as keep score if required. This scored highly with all groups, although prompting was required to stop more experienced players taking over. Moreover, young people really enjoyed taking the role of teacher and everyone had an opportunity to learn how to set up the game. This strategy appeared to help develop skills such as giving, and receiving, instruction.

98.
This was actually given as a piece of card with a list of questions that were to be asked after the game had been played for fifteen minutes.

99.
A Mii is an avatar, or a customisable character, created by the player to represent them on the screen.

Further information

In this section we provide some links to sites showing how games are currently used, to other research sites, a glossary of game genres and links to sites hosting casual online games as a starting point.

Examples of how games are being used in schools	
Learning and Teaching Scotland: The Consolarium - **www.ltscotland.org.uk/usingglowandict/gamesbasedlearning/index.asp**	These pages describe game based learning and how the games are currently being used.
EU report on games-based learning across European schools - **http://games.eun.org/upload/gis-full_report_en.pdf**	This handbook has been written as part of European Schoolnet's Games in Schools project (2008-2009). The project's aim was to analyse the current situation in eight countries (Austria, Denmark, France, Italy, Lithuania, the Netherlands, Spain and UK) with regard to GBL. This handbook is a practical guide aimed at teachers, designed to provide theoretical and practical information.
Teacher TV video on games-based-learning - **www.teachers.tv/videos/computer-games-in-the-classroom**	A primary teacher is tasked with using two games in his lesson.
Suggestions for using games - **http://www2.futurelab.org.uk/resources/documents/project_reports/becta/Games_and_Learning_poster.pdf**	These are scenarios suggesting how games could be used in the current classroom.

Literature reviews of game based learning	
Pivec, P (2009) Game-based Learning or Game-based Teaching? **http://webarchive.nationalarchives.gov.uk/20101102103654/http://emergingtechnologies.becta.org.uk//upload-dir/downloads/page_documents/research/emerging_technologies/game_based_learning.pdf**	A summary of the role of GBL commissioned by Becta.
Pivec, P and Pivec, M (2009) Games in Schools. Commissioned report for ISFE by the European Commission (EC) — see the First Step: Literature Review on **www.isfe-eu.org/index.php?PHPSESSID=009ss40f6odr20vbnc2kl8u430&alias=x**	This document is a comprehensive literature review of research into game based learning.
Games in the Classroom Podcast duration: 14 min Transcript: 5 pages **http://media.futurelab.org.uk/podcasts/becta_talks/games**	In this podcast, Futurelab's Ben Williamson and Martha Wright discuss how computer games are being used in the classroom, and the benefits and challenges of using games to enhance the curriculum.
Whitton, N (2010) Learning with Digital Games: A practical guide to engaging students in higher education (Routledge)	Geared for lecturers in higher education; the principles for game design apply across ages.

Blogs	
Dawn Hallybone blog - **http://hallyd.edublogs.org**	Dawn Hallybone, a primary teacher well known for using Nintendo DS, has a blog with links to games and examples of their use.
Jen Deyenberg blog - **www.trailsoptional.com/category/games-based-learning**	Jane Deyneberg is a teacher who describes how she uses games and game based learning.
General research into GBL - **http://games.eun.org**	Predominantly documents academic work in game based learning.
Consolarium - **http://ltsblogs.org.uk/consolarium**	Discussion on projects from within the Consolarium.

Game sites

Games can now be found from some organisations that provide paper based lessons, for example research organisations like the:

- Wellcome Trust (eg **www.wellcome.ac.uk/Education-resources/Teaching-and-education/Big-Picture/All-issues/Genes-Genomes-and-Health/WTDV027163.htm)**

- Ordnance Survey **(http://mapzone.ordnancesurvey.co.uk/mapzone/games.html)**

- Science museum **(www.sciencemuseum.org.uk/onlinestuff/games)**

- Natural History museum **(www.nhm.ac.uk/kids-only/fun-games)**.

It is also worth looking at the BETT awards **(www.bettawards.co.uk)**. Although not deliberately focusing on games, they are often shortlisted for awards.

The following are a few suggestions of where games can be found on the internet for classroom use[100]:

Suitable for primary and secondary students

http://eu.spore.com/home.cfm?lang=en - The free Creature Creator download in Spore is a tool for creating your own creature based on the commercial game. You can assemble your creature from a wide range of parts using a drag-and-drop interface. Creatures can be animated and shared. It could be used as an exercise in adapting animals for certain habitats defined by the teacher as part of science, or as a stimulus for creative writing.

www.mathszone.co.uk - A site bringing together maths puzzles, games and quizzes in one place, catering for KS1-4.

www.linerider.com - This is a puzzle game with a large creative element, requiring the player to create landscapes around which the 'linerider' can travel.

www.miniclip.com - This site has lots of different games; some puzzle, some platform type. It could be aimed at a range of age groups. The games are not necessarily directly related to classroom subjects.

www.bbc.co.uk/schools/games - The BBC site has a wide range of quiz and simulation games categorised for different subject groups and age groups from 4-16+. Casual games commissioned by the BBC with strong curriculum links, often interactive quizzes.

www.ramogames.com - This site brings together various games with an educational value, whether in the form of testing specific skills (maths, reading) or integrating real-world learning. The games are categorised by subject (not age), and are not linked to the UK national curriculum.

http://kids.nationalgeographic.com/Games - The National Geographic site has an extensive range of quiz games, adventure/strategy games and race type games. These are mostly geography based. It is a well produced site with lots of variety.

100.
All links were working July 2011.

Note that Channel 4 Education publishes games to fulfil its government funded education remit. However, these are not necessarily found on the Channel 4 pages as research found the games were more likely to be played if hosted on US servers. Thus games like Sneeze, demonstrating how easy a virus can be spread, can be found on Miniclip (www.miniclip.com). However, some games associated with programmes, such as 1066, can be found on the relevant Channel 4 page. The policy can be found at **www.channel4.com/learning/microsites/E/education/index.html**. The site **www.e4.com/games** hosts games selected by Channel 4, but these were not necessarily commissioned by them or used for education.

Aimed at primary students

www.linguascope.com/preview - This is a selection of language quiz games including beginner and intermediate levels in French, Spanish, German, Italian and English. These are very simple games for learning vocabulary.

www.counton.org - This website has a variety of games for primary level, including code breaking, telling the time, memory games and maths puzzles.

www.tickettoread.com - A US based primary level reading challenge website where you read passages, learn words and answer quizzes about your reading to collect points. You build up points to spend on items for your 'clubhouse'.

http://mapzone.ordnancesurvey.co.uk/mapzone/games.html - The games on this geography based website are divided into three categories; action, logic and jigsaw. The games appear to be designed for older primary level (KS2).

http://CoolMath4kids.com - This website has a wide selection of maths based quizzes and games for primary level.

www.arcademicskillbuilders.com - This website has literacy and numeracy puzzles and quiz games (eg spelling, multiplication) for primary level.

www.interactivestuff.org/sums4fun/colquiz.html - Addition puzzle games where colours are filled in on a picture when you get a sum correct.

www.prongo.com/games - This website has a comprehensive selection of puzzles and quizzes for primary and pre-school age groups.

www.thekidzpage.com/learninggames/index.html - This website has a selection of puzzles and quizzes for primary and pre-school age including the following categories: maths and numbers, educational word games, picture games, Sudoku games and object matching games.

www.funbrain.com - This site contains a selection of mostly primary level puzzle and quiz type games for maths and literacy, as well as some purely 'fun' arcade style games. All the games are short and well produced with good graphics.

Aimed at secondary students

www.schoolhistory.co.uk - This site contains quizzes based on KS3 and KS4 history subjects. Students also have the opportunity to build their own quizzes.

www.catchmentdetox.net.au - This is quite a complex secondary level simulation game looking in detail at the geographic features of a river catchment.

www.stopdisastersgame.org/en/home.html - A simulation strategy game from the UN where you must stop disasters from occurring by building defences against natural disasters.

www.theproblemsite.com - A comprehensive site for downloading free puzzles daily. There are a wide variety and choice of subjects including general logic and puzzle games.

Game genres

Genre	Examples	Brief description
Action Adventure	Tomb Raider, Finding Nemo, Shrek	Having to control a character, often with high demands on the player's reflexes and coordination skills, and using ability to think logically to solve puzzles or tasks in order to complete a pre-defined mission.
Active technology/ fitness games	Wii Sports, and Wii Fit	Physically taking part in the exercise/activity.
Adventure	Monkey Island, Broken Sword	Being assigned roles and then completing a pre-defined mission based on puzzle-solving.
Alternate reality games	Majestic, Lostpedia	An interactive narrative that uses the real world as a platform, often involving multiple media and game elements. The story is controlled by game designers and affected by participants' ideas or actions.
Casual games	Tetris, Zoo Keeper, Cbeebies online games, Miniclip	Intuitive, accessible and easy to play, usually available on handheld consoles or PC via the internet. Often involves puzzles, quizzes or Wii games. Easily 'chunked' - in discrete parts allowing players to stop and start.
Creative games	LittleBigPlanet	These are between an adventure/platform game and a sandbox for making things.
'Drill and skill' games	MathBlaster!	Practicing a number of very specific skills repeatedly, often with an unassociated reward to mark achievement.
Edutainment (Educational games)	Global Conflict: Palestine, Zoombinis	Games with the primary intention of learning although with game aspects.

First person shooter, Shoot 'em Up and Fighting games	Street Fighter, Grand Theft Auto	Fighting or shooting objects and other game characters, often having to memorise button combinations and requiring fast reactions.
God games	The Sims, Black & White	Where the player controls the environment in addition to characters.
MMO or MMORPG (massively multiplayer online games or online role playing games)	World of Warcraft	Interaction with lots of people from all over the world, playing the same game at the same time in a virtual location, often working together to meet shared goals.
Platform games	Super Mario	The goal is to race to the finish, passing through various levels and often jumping from platform to platform, avoiding enemies and collecting points to gain skills or enter other areas.
Racing games	Burnout, Gran Turismo	Having to act as the driver and race against others or complete driving courses within a set time. The courses can be realistic or fantastical.
Rhythm/action games	Guitar Hero, Singstar, Dancemat	Requiring dancing, singing or playing music rhythmically according to instructions, with the challenge of being awarded a score.
RPG (Role Playing Games)	Final Fantasy	Players assume the role of characters based on a formal system of rules and guidelines, then collaboratively create or follow stories. Involves turn-based combat, strategy, and worlds to explore, often fantasy.
Self improvement games	Brain Training DS	Activities to improve mental, and sometimes physical outlook.

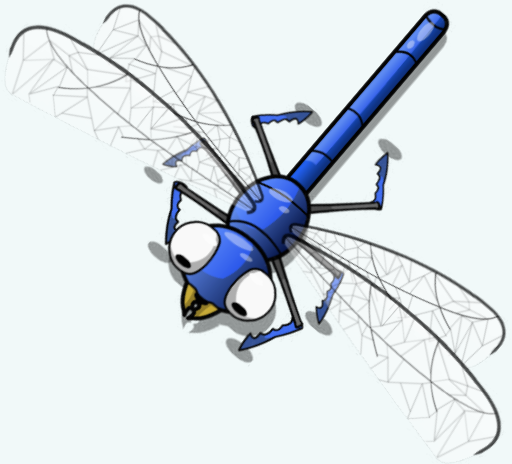
Serious games	Operation Climate Control	Games that have a primary focus of achieving a learning outcome, rather than being played purely for pleasure. It would include all 'edutainment' games.
Simulations	Microsoft Flight Simulator	Simulations of real activities where the player's ability to understand and remember complex principles and relations is vital.
Sports	Championship Manager or Tiger Woods Golf.	Participating in the sport or acting as the manager in a situation mimicking real life competitive activities.
Strategy	Age of Empires, Command & Conquer	Having to plan next move to beat the opponent, requiring quick thinking as often involves dynamic priorities.

Game ratings

In June 2009 the British Government decided to adopt the Pan-European Game Information (PEGI) age rating system. It is now law for all video games to be classified as part of the Digital Economy Bill 2011. This system was launched in 2003 to replace some national age rating systems. Games are now rated in the following categories: 3+, 7+, 12+, 16+ and 18+. PEGI also rates casual online games; if they have a marker PEGI OK it means the games fulfil the 3+ criteria. It will replace the BBFC ratings which were used by 4% of games in the UK. These categories correspond to film ratings, namely: U, PG, 12, 12A 15, 18 and 18R. In the US the ratings are awarded by the Entertainment Software Rating Board (ESRB). The categories are: EC - Early Childhood (3+), E - Everyone, E10+ - Everyone (10+), T - Teen (13+), M - Mature (17+), and AO - Adult Only (18+).

Case studies

The following are examples of how GBL can be used in education. They can be used directly as teaching tools; they can be used for assessment; they can be used as tools to create games and as tools for non-classroom based learning.



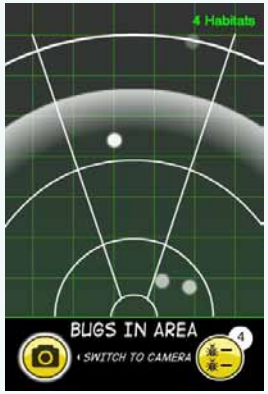
EcoBugs: interactive mobile learning

Learners set out with iPhones on a mission to track down virtual bugs which the teacher has simply placed around the school using printed out A4 symbols. They then try to bait, capture, classify and add the bugs to their collection.

EcoBugs is a simple to set up, location based game requiring no technical expertise. It combines digital technology, mobile gaming and scientific content. It can be used as a single lesson or used over a range of activities in the Key Stage 2 curriculum, including: science (habitats, food chains, branching key etc), numeracy (data handling, position, Venn and Carroll diagrams etc), literacy (non-fiction reporting), geography (maps and plans), sustainability (habitats and biodiversity) and physical education (orienteering).

The game supports 7-11 year-old learners working individually or in groups to explore their school environment and discover a virtual ecology. Play requires an iPhone application, A4 sheets of images that can be printed from the website, and a computer with internet access.

Once set up by the teacher, the students locate different minibeast habitats around their school. Children go out with the iPhone to find the habitats, either on their own or in up to ten teams to find the habitats. Once located, they can bait the virtual bugs with a variety of foods. If successful, they will be able to catch, name and classify the bugs. Teams can compete on how many bugs each has caught and correctly classified. Once back in the classroom, all the data about which bugs they have been collecting will be stored on the EcoBugs website.



All images: Futurelab Education and CX Partners

They will be able to compare the virtual bugs with real bugs and use the information to build branching keys, food chain diagrams, fact files, data handling diagrams and more. This data about the bugs and environments can support a range of learning activities which tie in to the English Key Stage 2 curriculum.

Video to illustrating the purpose and narrative of the game:
www.youtube.com/watch?v=mMpQjSoqPG4

Software and lesson plans can be found on:
www.ecobugs.org.uk

Futurelab Education and CX Partners

The potential for games based assessment

In 2008 the Scottish Qualification Authority (SQA) started to developed game based assessments for its Skills for Work courses. These focus on generic vocational skills for pupils aged 14-18 in areas such as construction, hairdressing and hospitality. The aim of the games based assessment is to provide the look and feel of being in a workplace environment and allow standardised interactions while assessing understanding.

In 2006 the SQA began to develop its Skills for Work courses. Initially they were aimed at students who were not engaging with school, so poor attenders and those that left with no qualifications. The qualifications had three internal hurdle tests that needed to be passed in order to continue with a final marked component.

SQA

These qualifications became very successful not only for the disengaged learners they were aimed at, but also for more motivated learners, who had a clear career focus and wanted an insight into the industry they wished to enter.

In 2009 with the support of European Socal Fund finding, SQA began to explore how computer assisted assessment could enhance the Skills for Work experience. Many students, however, felt that the writing that was expected from them to achieve success in these courses was out of kilter with the type of learning that they were doing in the workplace based setting and also the primary form of assessment which was folio based.

SQA therefore began to explore the potential for creating games-based assessments that would provide a more valid, engaging and relevant experience for learners. It has since developed games for a number of courses. The retailing game, for example, requires learners to respond to queries about consumer legislation, product recommendation given requirements, and deal with a customer complaint. All of this activity is undertaken on-screen in a simulated shopping mall. In the health sector game, the learner is in a simulated hospital and has to show they understood their personal responsibility for infection control, recognize and deal with

hazards around the wards, and be questioned by a radiologist.

A prototype of the game has been taken to schools and evaluated in context with Skills for Work candidates. All the candidates found controlling the character easy, but they did note that the game was slow and the graphics not as smooth as they were used to. More importantly, they said they would be happy to have their knowledge, skills and abilities tested through the games based medium, and they felt that it made the assessment more "fair". It also circumnavigated the need to imagine a context previously given in a written description, and was "less stressful", a fact the teachers corroborated.

SQA is continuing to refine the games it has developed to date and to trial them with real learners. Overall feedback indicates strong support for the use of the games-based approach to assessment where it is valid and appropriate. Learners particularly report valuing the ability to use technology as part of their assessment process rather than just the conventional pen and paper.

Taken from ECGBL paper, **www.sqa.org.uk/sqa/35182.html**, and **www.sqa.org.uk/sqa/36537.2262.html**

SQA

Kodu: game design

Game creation as a way of ensuring learning is well researched, not only in the domain of digital games.

Kodu is an environment for designing, building, and playing new games. Originally it was accessed through an Xbox, now it can be accessed on a PC. The programming user interface is a set of icons, which can be selected. It follows a simple programming structure of rules divided into conditions and actions, such as 'if... then... else' or 'while... do...'. The language is simple and entirely icon-based. It is based on concrete objects, like time, hearing and vision. Conditions are evaluated simultaneously. Lesson plans are provided.

In an Australian pilot, teachers and students reported that students were more engaged. Furthermore, creating games led to practice in problem solving, collaboration, communication, and gave the students a better understanding of the importance of sequencing. It also encouraged reflection.

http://research.microsoft.com/en-us/projects/kodu/

For details of the Australian pilots see: **http://csamarktng.vo.msecnd.net/kodu/pdf/web20_technologies_in_the_classroom_kodu.pdf**

Both images: Used with permission from Microsoft

Cyber Coach: exercise games

There has been a lot of research on the impact of exercise games on health — both as a treatment and preventative activity — with academic papers published in the fields of medicine, geriatric health care, and obesity. Within schools, such systems are used to encourage exercise and support teachers.

The Cyber Coach is a virtual fitness system that uses large 'dance mats' connected wirelessly to a projected video of a fitness instructor. Originally developed for use in health clubs and fitness centres, Cyber Coach has been an unexpected success in schools and was recently shortlisted for a BETT Award. It can now be found in 500 schools in the UK.

Cyber Coach is similar to the hugely popular Wii games console, but is designed to ensure children can't 'cheat' by nominally wiggling the control — instead, body weight needs to be transferred in order to register an action by the game. Cyber Coach allows up to 32 students to compete — and competition, as discussed, can engage students. Moreover, there are multiple dance styles which is intended to interest a range of students.

For full details see the VISION article: **http://archive.futurelab.org.uk/resources/publications-reports-articles/vision-magazine/VISION-Article1301**, the Cyber Coach website: **www.cyber-coach.co.uk/?P=NewsView&RecordId=51**

Both images: Cyber Coach

About Futurelab

Futurelab is an independent not-for-profit organisation that is dedicated to transforming teaching and learning, making it more relevant and engaging to 21st century learners through the use of innovative practice and technology.

We have a long track record of researching and demonstrating innovative uses of technology and aim to support systemic change in education — and we are uniquely placed to bring together those with an interest in improving education from the policy, industry, research and practice communities to do this. Futurelab cannot do this work on its own.

We rely on funding and partners from across the education community — policy, practice, local government, research and industry — to realise the full potential of our ideas, and so continue to create systemic change in education to benefit all learners.

To reference this report, please cite:
Ulicsak, M & Williamson, B (2011). Computer Games and Learning: a handbook. London, Futurelab.

www.futurelab.org.uk info@futurelab.org.uk Registered charity1113051

Key to Themes

Futurelab understands that you may have specific areas of interest and so, in order to help you to determine the relevance of each project or publication to you, we have developed a series of themes (illustrated by icons). These themes are not intended to cover every aspect of innovation and education and, as such, you should not base your decision on whether or not to read this publication on the themes alone. The themes that relate to this publication appear on the front cover, but a key to all of the current themes that we are using can be found below:


Digital Inclusion — How the design and use of digital technologies can promote educational equality


Teachers and Innovations — Innovative practices and resources that enhance learning and teaching


Learning Spaces — Creating transformed physical and virtual environments


Mobile Learning — Learning on the move, with or without handheld technology


Learner Voice — Listening and acting upon the voices of learners


Games and Learning — Using games for learning, with or without gaming technology


Informal Learning — Learning that occurs when, how and where the learner chooses, supported by digital technologies


Learning in Families — Children, parents and the extended family learning with and from one another