

Computer Games and Learning – where next? The Breadth and Scope of the use of Computer Games in Education

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1. Games as cultural phenomena

The computer game is here to stay and has become an integral part of the way that people socialise. Increasingly, it is a family pursuit; people play together socially, either on line or in real spaces, and the advent of computer gaming bridges racial and class divides. Gaming consoles are high specification devices that can equal and often surpass the computational functionality of PCs. Games have a wide demographic and the complexity of their use encompasses the time rich teenager and the time poor wage earner. However, gender, although no longer an issue in terms of those who engage with games, is reflected in the genre of game played and the length of time devoted to it. There are also issues of gender stereotyping within games that need to be addressed.

The games industry in Britain contributes over £1 billion to the nation's GDP and over a quarter of the world's top 100 games studios are located in the UK. In a significant step towards securing British talent in this area the games development industry was recently given a similar tax credit status to that of the film industry (2010 budget). Alistair Darling, then Chancellor of the Exchequer noted that creative industries, and the games industry in particular, made a "valuable economic and cultural contribution to the UK."

Richard Wilson CEO of TIGA also stated that: "Games tax relief will increase employment, investment and innovation in the UK video games sector. Over a five-year period it should create or protect 3,550 graduate level jobs, increase or safeguard £457 million in development expenditure and encourage developers to adopt new business models and create new intellectual property." Telegraph online (2010)

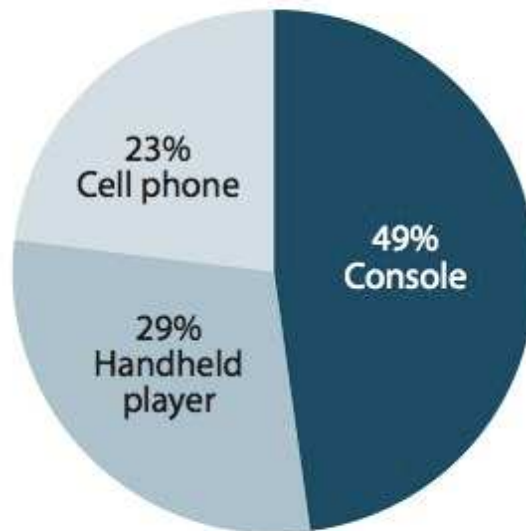
As well as being a major contributor to the economy, games are also increasingly integrated into the social fabric of existing digital networks. The advent of social gaming (games in social spaces such as Facebook), has created a revolution in the games industry. This has arguably altered the nature of gaming and widened its appeal still further. It is important that this phenomenon is examined from an educational standpoint as it really shifts computer games into a mainstream popular activity with broad appeal. Computer and video game companies posted record sales in 2008. The industry sold 297.6 million units, generating an impressive \$11.7 billion in revenue (ESA 2009). 2009 and 2010 are the years of the social game that is coupled to social networks, most notably, Facebook, and have seen the advent of non unit based revenue streams coming from online gamers. This shift from expensive to produce but often criticised formulaic console based titles to socially networked games has troubled the previously dominant game industry producers. One consequence has been that Electronic Arts (EA games) recently acquired Playfish, the social games developer of such titles as Restaurant City and Pet Society, in a deal worth \$400 million. Furthermore, the rise of smart phones and apps led by Apple's iPod is making gaming more accessible and mobile as people take advantage of down time – for example commuting and work breaks - to get their gaming fixes. The Kaiser Family Foundation report (2010) notes that it is mobile technology which is driving increased media usage.

"The increase in media use is driven in large part by ready access to mobile devices like cell phones and iPods. Over the past five years, there has been a huge increase in ownership among 8- to 18-year-olds: from 39% to 66% for cell phones, and from 18% to 76% for iPods and other MP3 players. During this period, cell phones and iPods have become true multi-media devices: in fact, young people now spend more time listening to music, playing games, and watching TV on their cell phones than they spend talking on them." <http://www.kff.org/entmedia/entmedia012010nr.cfm>

With specific regard to gaming they note the following in terms of the platforms people play on:

Video Game Playing By Platform

Among all 8- to 18-year-olds, proportion of video game time that is played on each platform:



Kaiser Family Foundation (2010:p25)

This movement away from consoles also opens the way for a more ubiquitous position for gaming within the population.

Youth and age

Although many studies have focused on young people's habits in terms of computer gaming - for example, Lenhart et al (2009) note that over 97% of US teens aged 12-17 play computer, web, portable, or console games - the demographic for gaming as a whole shows that the average age of a gamer is 35 and some three quarters of the gaming market is over 18, ESA (op cit). Nonetheless, gaming is a ubiquitous pastime amongst teens in the USA

“Fully 99% of boys and 94% of girls play video games. Younger teen boys are the most likely to play games, followed by younger girls and older boys. Older girls are the least “enthusiastic” players of video games, though more than half of them play. Some 65% of daily gamers in this age group are male; 35% are female.” Lenhart et al (op cit:2)

This is supported by UK research from Futurelab (2009:8) that notes:

Children are much more likely to play video/computer games; around four fifths of children play video/computer games *at least a few times a week* (79%). In fact, 37% play *every day*, differing markedly from adults, the majority (61%) of whom *do not play video/computer games*.

The KFF (Op Cit) reports that

“There has been a significant increase in video gaming over the past five years, but for the most part, that increase has been in cell phone and handheld playing rather than console gaming. Moreover, although playing video games continues to be popular among many 8- to 18-year-olds, average time devoted to playing is still relatively low compared to time spent with TV or music.”

However it is clear from the research Lenhart (op cit), BBFC (2006) that gaming is a predominantly social activity where games are played with others or on line with others. This is particularly true for boys and men, for whom;

“Gaming is an important talking point and sports games are played in pairs or groups with an atmosphere not unlike a ‘real’ sporting event. Players of online games feel they make significant connections with people they have not met.” BBFC (2006 :10)

Increasingly, as games producers seek to diversify their market, games and games consoles are being designed to engage families and groups (for example Nintendo Wii) and parents often play with children, finding that this activity is enjoyable for both adults and children (Futurelab/Ipsos Mori 2009). This is reflected in the genres of video games selected for play by parents and children, according to Futurelab (ibid), with **active technology/fitness games** (44%), followed by **racing and other sports games** (40%).

This ‘new’ ubiquitous nature of gaming and its reach to all segments of society seem to suggest a potential utility for educators, not only in engaging the hard to reach but also in gaming as an educational tool. This does not mean that computer gaming should be seen as a ‘silver bullet’ Squire (2005) for all educational ills but it should be considered as a medium and a tool through which people are engaged and can learn.

The gaming landscape is increasingly complex with a variety of genres, a variety of platforms for play and an expanding demographic base that can be segmented like any other market.

But there are also several myths about gaming that need to be debunked within a rapidly changing technical environment. This landscape is expanding quickly from game console based ‘Marquee’ titles like Halo3 and Call of Duty Modern Warfare, that have a similar cachet amongst hard core gamers, to blockbuster movie releases and to social gaming on a variety of platforms. Even within the high end production values of the ‘Marquee’ titles all is not as it would seem. The stereotyped demographic of boys in darkened rooms shooting things and emerging bleary eyed is simply not borne out by sales figures and preferences. Lenhart et al (op cit) found that the most popular game in the USA amongst teens was Guitar Hero and that a total of 14 different genres featured among the most popular offerings. They go on to note that:

“The range of genres spanned by the most popular games played by teens indicates they are not simply playing violent first-person shooters or action games.” (Lenhart et al: 3)

The range of genres and popularity of the games noted by Lenhart are worth listing here, in order of reported popularity, to illustrate the gaming landscape in which players are located.

Racing (NASCAR, Mario Kart, Burnout)
Puzzle (Bejeweled, Tetris, Solitaire)
Sports (Madden, FIFA, Tony Hawk)
Action (Grand Theft Auto, Devil May Cry, Ratchet and Clank)
Adventure (Legend of Zelda, Tomb Raider)

Rhythm (Guitar Hero, Dance Dance Revolution, Lumines)
Strategy (Civilization IV, StarCraft, Command and Conquer)
Simulation (The Sims, Rollercoaster Tycoon, Ace Combat)
Fighting (Tekken, Super Smash Bros., Mortal Kombat)
First-Person Shooters (Halo, Counter-Strike, Half-Life)
Role-Playing (Final Fantasy, Blue Dragon, Knights of the Old Republic)
Survival Horror (Resident Evil, Silent Hill, Condemned)
MMOGs (World of Warcraft)
Virtual Worlds (Second Life, Gaia, Habbo Hotel)

Equally, the question of gender is more complex and fluid than the received stereotype that video games are for boys as girls constitute a large (if not absolutely equal) percentage of total gamers: 99% of boys play games, as do 94% of girls. Lenhart (2009:9).

In terms of ethnicity (in the US) there appears to be little difference in playing habits according to race although Black and Hispanic Americans are more likely to do so using mobile applications whereas a UK report by Futurelab (Ibid) found that those of white ethnic origin were more likely to play computer games than those of other ethnicities. However this is probably worthy of further investigation.

What is largely apparent is the platform migration to handheld and mobile devices for gaming, not only amongst the gaming population as a whole but amongst Black and Hispanic populations in the US. The main reason cited for this is the difference in the cost of mobile computers and wire based lines.

“Young blacks and Latinos are migrating decisively towards mobile media, using the phone as their main access point or gateway to the Internet. In fact, something of a “mobile gap” has arisen, in which young African Americans access the web for gaming, watching videos and other social activities for 1.5 hours per day, compared with 30 minutes per day for white youth.” Watkins (2010)

Watkins also notes that:

“In our recent work with a group of black and Latino teens they talk passionately about the role of mobile phones in their lives. The mobile, quite simply, is the hub of their social and informational world. That’s true of a growing number of all young people. But African Americans are emerging as early adopters of the mobile web.”

Although PCs are largely used for gaming as well as consoles, it is the younger teen end of the market and amongst confirmed gamers that consoles such as the xboxlive/360 and PS3 predominate. The full potential of the gaming console is rarely recognised by non gamers or those who are not games aware. For fully functioning wireless web browsers and high end video players there is much potential for repurposing and multiple use that parallels the use of PCs in homes. Where an economic choice has been made between a PC and a gaming console, the power of the console with its lower maintenance requirements is often overlooked as a conduit into the homes of the disadvantaged. This may have resonance with Becta’s home access programme and any future expansion of it in terms of extending the specifications to include game console suppliers.

However, there has been a recent movement away from high end console gaming with the advent of social online gaming linked to the Facebook social network. As a result the ubiquitous Farmville is set to earn Zynga - the company that developed it - over \$300 million dollars in revenue this year, largely from in-game micro-transactions Liszkiewicz (2010). The key to social games such as Farmville is their reliance on social networks for the acquisition of improvements within the game. As a player you need to collaborate by acquiring neighbours so that you can get gifts to improve your farm. It’s a game based on

social obligation, according to Liszkiewicz (ibid), and that's why it works. It establishes a desire within players to be socially responsible towards their neighbours and to help them out. Social games like Farmville are massively profitable and it is argued that this is because of the socialization aspect. Jesse Schell (2010) likens such games to a slot machine where players put real money in and receive virtual money in return. In fact, according to Schell, revenue streams come not only from direct payments but also in the form of lead generation, where companies give game credits for taking up their services.

Farmville/Zynga also engage their communities in fundraising activity having recently raised over a million dollars for the Haiti relief fund, although Liszkiewicz (2010) argues that there are ethical considerations that come into play with gaming models that use social relationships to promote game engagement.

Farmville, although time consuming when played as a full on game, is attractive to the time poor (those in employment or full time domestic activity) by allowing participation to be managed at certain points of the day. Playing can be staged and managed, in contrast to the immersive bouts of intense play required in a console based 'Marquee' title. Players note that their motivations can be varied; they can be classified as players (intent on progression through levels) or home makers, a category that applies to both men and women who want to organize, personalize and enhance their farm space, while the more casual player uses it for relaxation, connecting with realworld friends in meaningful shared activity that offers stress reduction. Social gamers surveyed by ISG (2010: 20) gave five top motivations for playing games - fun and excitement, stress-relief, competitiveness, mental workout and connecting with others in a social network.

In the past, the key gamers were those with time on their hands, hence the previous predominance and early adoption and location of gaming among the young,(and also the predominance of sweat shop gaming where players gamed for hours to sell attributes to the time poor). Now games are more widespread and designed to fit into hectic lives. Even simple, level based, mobile located games are gaining in prominence. The problem solving angry birds game for example, sold over half a million copies in a month on its release at a cost of 99 cents per download.

Thus games are becoming part of the wider social fabric of society rather than being located exclusively or largely within youth and gamer markets. Liszkiewicz (op cit) notes that over seventy-three million people play Farmville and twenty-six million people play it every day. An adult dinner party or work conversation might centre around the playing of Farmville as easily as children talk about their favourite playground game at school. According to ISG (op cit: 57) social game players in the UK have an average age of 43 years. 20% are under 30 years old; 21% are 30 – 39 years old; 20% are 40 – 49 years old and a total of 38% are at least 50 years old.

With this wider social acceptance it is arguable that gaming has become part and parcel of the wider culture rather than a subject of specialist cultural study. It is neither a blockbuster film nor a niche art house movie. Gaming is now more like Coronation Street with millions requiring a daily fix. There is a pretty even split in the gender of social gamers with 55 percent being female and a large proportion (41%) in full time employment, ISG (ibid). The statistics on the access point to games are also interesting in that, currently, 49%, most often use desktop and laptop computers to play social, casual and/or hardcore games, while 23%use console game systems and 15% use handheld game devices. It is arguable that this division will disappear as the advance in computing power makes gaming of all types accessible through most devices and games are engineered to work across platforms in order to maximize profitability.

According to the ISG (ibid) survey some 39% of all logins to social networking sites are ostensibly in order to play games with others. The top five most played social games (played at least once a week) include

Farmville (69%), Bejeweled Blitz (65%) and Texas HoldEm (63%), followed by Café World (59%) and Mafia Wars at 59%. These games all require engagement with real people, friends and family and new friends from particular gaming communities in order to play.

As gaming widens its horizons and embeds itself within the digital world, the development of new markets is inevitable. Increasingly the pre teen and children's market for social networking plus gaming (social gaming) or edugame related activity in a social platform is being developed. Examples include, Club Penguin (recently acquired by Disney entertainment for \$700m), Moshi Monsters and a newcomer, Boaki, which mimics World of War Craft (a massively multiplayer on line game which has many academics in raptures over its labyrinthine addictions), but focuses on collaboration to solve problems rather than fighting. As the founder of Moshi Monsters notes:

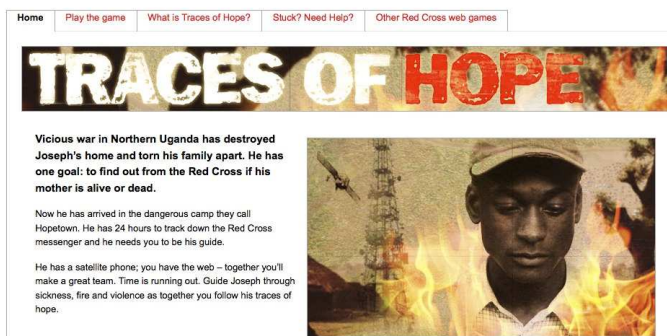
"The penny-drop moment for us was when we realised that kids loved communicating and showing off and being creative and chatting to their friends online just as much as grown-ups do." Ramboz (2010)

Most social games use a buy in model where users buy game credits to enhance their environment or characters. Although they are initially free the games use subscription models once players/users are established. In Boaki for example, membership is £3.95 a month or £37.95 a year and it gives players more opportunity to personalise their virtual characters. It is a similar model to that of the British online gaming world Moshi Monsters, in which children pick a monster and play games and puzzles to win "Rox" that can be used to buy items for their virtual pet, Guardian online (2010).

Improving real world engagement in 'civics'

There is some tentative evidence to suggest that young people who engage in gaming and social interaction on the web (and this may well extend to adults) are more likely to engage in what Lenhart et al (op cit) term 'Civics'. They note that gamers who play particular types of game are more likely to engage in political and civic activity. They are more likely to take an active part in society, vote and be generally more informed about current debates within the world. This idea is expanded by Gee (2009) who argues the notion of public pedagogy, where games can engage individuals in learning that cannot be achieved through formal schooling. Gee and Hayes (ibid) exemplify this latter point through their learning story around 'Jade' who developed graphic design and commercial skills through, initially, playing Sims and designing clothes for Sims' characters. They argue that the singular interest of Jade was nurtured and developed by the on line community. This is an interesting story but caution is necessary when trying to compare this activity with mass planned public education. It is perhaps the notion of pedagogy that is of interest to mainstream educators and the personal and community agency rather than the game itself. Similar stories abound where learners have developed interests in particular domains of study, initially through game based engagement. However, the notion of exploiting the digital spaces that individuals and groups inhabit for learning purposes is a complex one as Boyd (2007) notes in her work on networked publics. Social game developers seem to have no such qualms but educationalists eyeing the social networks as a ready made classroom should perhaps be more circumspect and explore the ethical dimensions that such an engagement might bring. One must consider game based learning from several angles to ensure that any engagement is fit for purpose and also morally and ethically responsible.

There are several online examples of games that also have 'civics' based subject matter and what might loosely be termed personal and social education at their core, attempting to engage teens and adults in social, moral and ethical issues through gaming. Examples include Darfur is Dying <http://www.darfurisdying.com/>, Evoke - a recent release by the World Bank <http://www.urgentevoke.com/>, Traces of Hope, from the Red Cross and the environment game enercities <http://www.enercities.eu/>, which is fully integrated with Facebook, to name but a few.



In addition there are also games directly targeted at teens in this area by **Channel Four**, which currently has four game based titles including smokescreen accessible at <http://www.smokescreengame.com/>. Even the parliamentary organisation in the UK is using games to reach a younger audience:

"Parliament's Education Service aims to interact with all school-aged children in the UK, whether visiting Westminster or playing a computer game. MP For A Week gives students an understanding of how Parliament works" O Leary (2010).

Online game gives young people taste of life as an MP

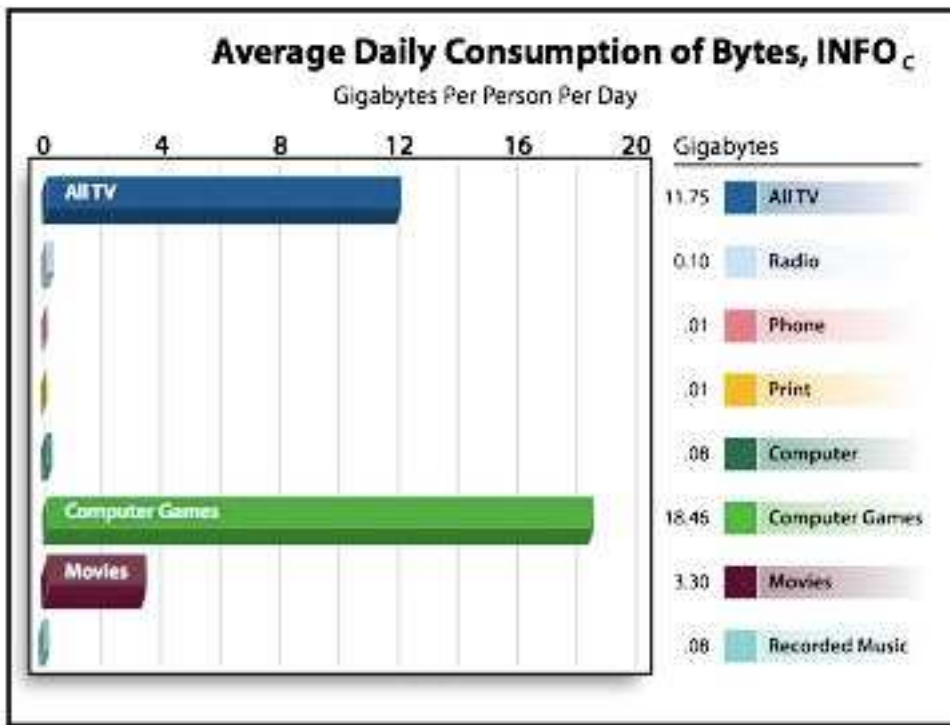


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With the cultural adoption of gaming, and in particular social gaming, by wider society several issues come to the fore as possible consequences of the new engagement. The first apparent, though widely unsubstantiated, consequence of this engagement is a decline in other offline pastimes and events amongst users. ISG (op cit:23) notes that:

“About one-fourth (27%) of social game players (surveyed) said they read less since they began playing social games, followed by 26% who watch TV/movies at home less and 24% who surf the Internet less. One out of five (21%) said they spend less time doing hobbies, while another 21% exercise less. 28% said their involvement in social games has not affected their involvement in other leisure time activities.”

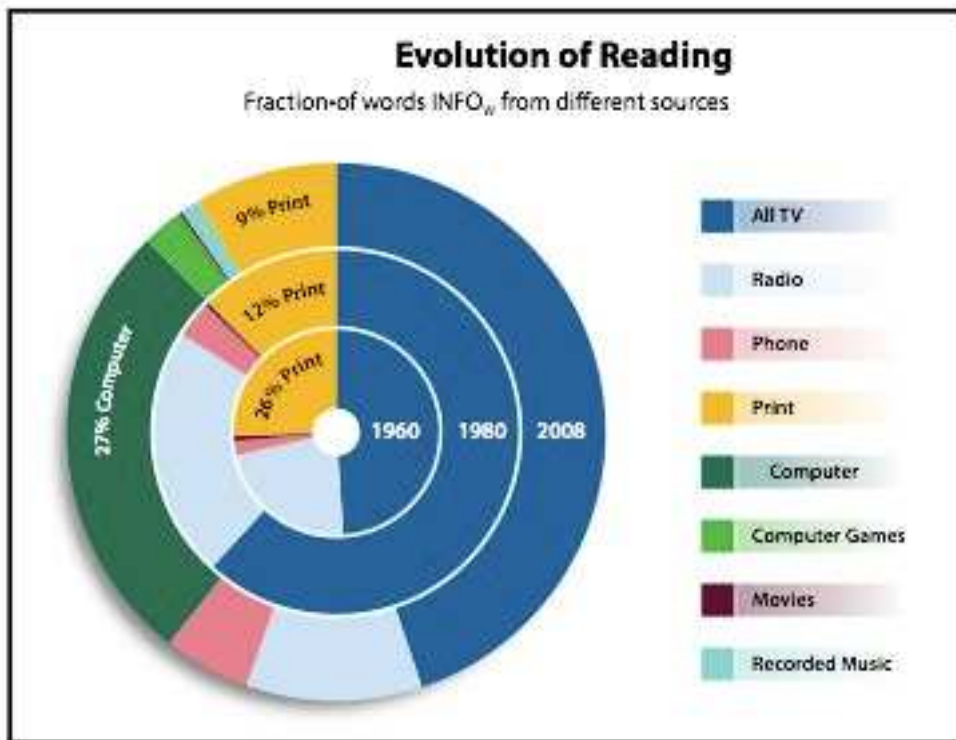
Whilst this is potentially worrying at first sight, particularly with regard to reduced amounts of time spent exercising - it is worthy of further interrogation before reaching banner headline conclusions. If the ‘read less’ finding is examined it may only point to a decline in the use of paper-print based media which may be a headline grabber for the popular press. This point realistically mirrors a change that has been occurring for some time in the nature of literacy events (individuals’ personal engagement with the reading/writing of media in any given time period) in terms of a move towards digital media. The nature of literacy appears to be adapting to include the interpretation and use of digital representations of text which are arguably dependant on mixed media and the interpretation of visual representations alongside text. Bohn and Short (2009) note that, for average Americans, the amount of digital information that is consumed per day is as follows.



. Bohn and Short

(2009:20)

These figures offer significant evidence that an increasing source of literacy and information is invested within game based engagement. This is something that cannot be ignored by educators or anyone who wants to engage a wide audience. Notably, Liszkiewicz (op cit :1) remarks that: “Senator Barack Obama became the first U. S. Presidential candidate to advertise in video games, when his “Early Voting Has Begun” ads appeared in Madden 2009, Burnout Paradise, and other Electronic Arts video games.



Bohn and Short (2009:18)

Bohn and Short (op cit) note further that the amount of reading (of information) that is required through a blend of media has actually increased over time thus creating further demands on the development of skills in decoding, synthesizing and analyzing information (see diagram above). Given that much of this information is accessed for particular purposes there is much to support Gee's and others assertions about the importance of public pedagogy. Equally, there is a 'job ' to be done by educators in engaging with literacy skills in their broadest sense from the most basic to advanced and sophisticated skills when faced with a burgeoning media environment that has little 'connect' with current literacy practices in schools. It is perhaps also incumbent on games producers to realize the power of some of their games for developing literacy (and other skills). A good example is the football game Fifa which, with associated print media football cards etc is a powerful tool for developing literacy amongst boys in particular. Equally, Animal Crossing has been anecdotally reported as developing beginners' reading skills. Schools perhaps need to consider using wider digital resources for reading in contrast to the predominant focus on books and print media. This is not to say that conventional practices are wrong in any way, just that the net of reading materials is widening and that this blend should be acknowledged by those in the system. Tim Ryland's work on literacy development through games is of note here in terms of writing development, although it is arguable that the same, perhaps with even greater validity, applies to developing reading opportunities. (See <http://www.timrylands.com/html/teachers-say.html>)

A further issue that arises through the study of gaming and its growing cultural prominence is its use of gender and cultural stereotyping. A recent study by Consalvo et al (2009) highlights this, arguing that the media in general is a mirror for "existing "social identity formation, social power and policy formation in daily life" p819. Furthermore, within Consalvo's study, despite the prevalence of users in many games being able to build in their own character preferences, the predominant finding was that

“The world of game characters ((Authors insert) in Marquee games) is highly unrepresentative of the actual population and even of game players. For developers, this is a missed opportunity. For players, it is a potential source of identity-based problems.” (Ibid:831)

In conclusion the widespread embedding of games into the culture and fabric of society presents both opportunities and issues for policy leaders in education. In fact it could be argued that there is a moral necessity for public intervention and for the development of games to aid literacy development. Not for profit games to promote well being could be introduced alongside private sector offerings or embedded within the product ranges of more altruistic commercial providers. In each case however caution is necessary as the ethics of gaming and intervention within gamer / user environments require further study before an embryonic public service gaming channel is developed. It is equally important to note the range of game genres available and the wide demographic of game players. Any educational project using games needs to be fit for purpose and highly targeted. In the world of gaming, just like the world of education, one size doesn't fit all.

2. Games and learning

There has been considerable interest in the use of computer games for learning, mainly owing to their ubiquitous appeal to learners and for their powers of motivation. In 2010 it is generally accepted that computer games as a leisure pursuit not only increasingly engage young people, as outlined previously, but also promote learning. Papert (1998) MacFarlane (2002) Gee (2003) Gee and Hayes (Op cit), Prensky (2000) and BBFC (Op cit) all advocate the benefits of computer gaming and note the skills and attributes that they offer to learning.

There is, as yet, a shortage of evidence from purely empirical research but this should not inhibit the important types of skills that children may learn informally from computer gaming, both alone and collectively (whether they are gathered on line or in the same physical space). The observed and anecdotally claimed skills developed by computer gaming engagement go beyond more commonly stated attributes, such as hand to eye coordination, and include: spatial navigation; resource management; team working and communication; literacy development; and a range of problem solving skills and metacognition through reflective practice. Gee's (2003) seminal work in this area 'What Video Games Have To Teach Us About Learning and Literacy' cites 36 learning principles associated with computer video gaming. These borrow heavily from Gee's earlier work on practice based learning where learning is a social activity, centred on participation in a community of practice or semiotic domain. That video games provide excellent communities of practice through which one can learn is undoubtedly true but it is the nature of the domain and its alignment with real needs and concerns that is crucial for real world or policy driven conceptualisations of learning.

Game pedagogy V 21st Century skills

In a later paper Gee (2007) sets out several attributes of a 'good learning game' which he contrasts with schooling that delineates an 'inbuilt' pedagogy of video games. These are summarised below. They are included here because the intrinsic pedagogy of gaming demands explicit recognition if these attributes are to be transferred to schooling and education. Note that these attributes apply to what Gee calls 'good learning games.' They offer a test to be applied to games before use in order to determine whether they are in fact 'good learning games'.

1. Identity. No deep learning takes place unless learners make an extended commitment to the long haul. Learning a new domain, whether it be physics or furniture making, requires the learner to take on a new identity: to make a commitment to see and value work and the world in the ways in which good

- physicists or good furniture makers do. Good video games capture players through identity.
- 2. Interaction.** Games do talk back. In fact, nothing happens until a player acts and makes decisions. Then the game reacts, giving the player feedback and new problems.
 - 3. Production.** Players are producers, not just consumers; they are “writers” not just “readers”. Even at the simplest level, players co-design games by the actions they take and the decisions they make.
 - 4. Risk Taking.** Good video games make allowance for failure; players can start from the last saved game when they fail. School too often allows much less space for risk, exploration, and failure.
 - 5. Customization.** Players can usually, in one way or another, customize a game to fit with their learning and playing styles. Customized curricula in school are not just about self pacing, but about real intersections between the curriculum and the learner’s interests, desires, and styles.
 - 6. Agency.** Thanks to all the preceding principles, players feel a real sense of agency and control. They have a real sense of ownership over what they are doing. Such ownership is rarer in school.
 - 7. Well-Order Problems.** In good video games, the problems players face are ordered so that earlier challenges are built to lead players to form hypotheses that help them tackle harder problems.
 - 8. Challenge and Consolidation.** Good games offer players a set of challenging problems and then let them solve these problems until they have virtually routinized or automatized their solutions. Then the game throws a new class of problem at the players (sometimes this is called a “boss”), requiring them to rethink their now taken-for-granted mastery, learn something new, and integrate this new learning into their old mastery.
 - 9. Just in Time and On Demand.** Games almost always give verbal information either “just in time”—that is, right when players need and can use it—or “on demand”, that is, when the player feels a need for it, wants it, is ready for it, and can make good use of it. Information should work the same way in school.
 - 10. Situated meanings.** Games always situate the meanings of words in terms of the actions, images, and dialogues they relate to, and show how meanings vary across different actions, images and dialogues. They don’t just offer words for words. School shouldn’t either.
 - 11. Pleasantly Frustrating.** Thanks to many of the above principles, good games stay within, but at the outer edge, of the player’s “regime of competence” (diSessa 2000). That is, they feel “doable”, but challenging. This is a highly motivating state for learners. School is often too easy for some students and too hard for others, even in the same classroom.
 - 12. System Thinking.** Games encourage players to think about relationships, not isolated events, facts, and skills. In our complex, global world, such system thinking is crucial for everyone.
 - 13. Explore, Think Laterally, Rethink Goals.** Games encourage players to explore thoroughly before moving on too fast, to engage in lateral (not just linear) thinking, and to use such exploration and lateral thinking to reconceive one’s goals from time to time.
 - 14. Smart Tools and Distributed Knowledge.** The virtual character or characters one manipulates in a game - and many other aspects of the game world - are, in reality, “smart tools”. Virtual characters have skills and knowledge of their own which they lend to the player. Smart tools and distributed knowledge are key to modern workplaces, though not always to modern schools.
 - 15. Cross-Functional Teams.** Players play in cross functional teams and have to use each other’s knowledge and skills in combination and collaboration to progress in the game.
 - 16. Performance Before Competence.** Good video games operate on a principle that is the reverse of what happens in most schools: performance before competence (Cazden 1981). Players can perform before they are competent and are supported by the design of the game, the “smart tools” the game offers, and often by the support of other, more advanced players (in multi-player games, in chat rooms, or in the same physical space).

These insights into gaming pedagogy have resonance with the literature on the skills needed for **twenty first century** learning (Jenkins et al., 2006) 21st Century Skills alliance (2007) and Kay et al Next Generation User Skills (2008). Although many of the included skills are not ‘new discoveries’ - for example analysis and synthesis of information have been around for a while - it is the predominance of these skills and the need for them within the digital age that is of paramount importance within

curriculum planning and learning and teaching. According to the partnership for 21st century learning (2007) these skills include: Learning and Innovation, Information, Media and Technology Skills and Life and Career Skills. If some of the subsets of these are examined the skills required for preparing students for “increasingly complex life and work environments in the 21st century” - such as: Critical Thinking and Problem Solving; Communication and Collaboration; Flexibility and Adaptability; Initiative and Self-Direction - are very much aligned with the world of computer game playing. Indeed, if computer games were given the status in the curriculum that their cultural pervasiveness perhaps requires then further 21st century skills such as Information Literacy, Media Literacy and ICT (Information, Communications and Technology) Literacy could also be developed through game design, application development and media study. Furthermore, if this thinking is extended to include the personal and social skills required of 21st century learners it could be argued that online and collaborative gaming can also develop: Social and Cross-Cultural Skills; Productivity and Accountability and Leadership and Responsibility.

Beyond that Jenkins et al (2006) note:

“Participatory culture shifts the focus of literacy from one of individual expression to community involvement. The new literacies almost all involve social skills developed through collaboration and networking. These skills build on the foundation of traditional literacy, research skills, technical skills, and critical analysis skills taught in the classroom.”

Jenkins’ key activities that relate to gaming are listed below.

Play - the capacity to experiment with one’s surroundings as a form of problem-solving

Performance - the ability to adopt alternative identities for the purpose of improvisation and discovery

Simulation - the ability to interpret and construct dynamic models of real-world processes

Appropriation - the ability to meaningfully sample and remix media content

Multitasking - the ability to scan one’s environment and shift focus as needed to salient details

Distributed Cognition - the ability to interact meaningfully with tools that expand mental capacities

Collective Intelligence - the ability to pool knowledge and compare notes with others toward a common goal

Judgment - the ability to evaluate the reliability and credibility of different information sources

Transmedia Navigation - the ability to follow the flow of stories and information across multiple modalities

Networking - the ability to search for, synthesize, and disseminate information

Negotiation - the ability to travel across diverse communities, discerning and respecting multiple perspectives, and grasping and following alternative norms

Visualization - the ability to interpret and create data representations for the purposes of expressing ideas, finding patterns, and identifying trends

Contrasting Jenkins’ list of skills required within a participatory culture with Gee’s “good learning game list” reveals the congruence. This has particular resonance with the move towards social gaming which takes place within a networked environment and also online gaming in “Marquee” titles. This is hardly surprising when one considers the fact that video games are a part of digital media and not separate from it. It is understandable that games would also be part of Jenkins’ participatory culture.

Problem based and purposeful pedagogies

There are several other identifiable pedagogic influences within gaming that are often quoted.

Vygotsky’s (1978) zone of proximal development is one such influence, defined as “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers” (p86). This is where learning occurs beyond an individual’s own problem-solving

capability, through dialogue with peers, teachers, or experts. Of course this fits well with the notion of game based learning as networked communities help each other to problem solve in game difficulties through personal contact. This leads to communities of practice (Wenger, 1998) Semiotic Domains (Gee, 2003), Problem based learning (Boud and Feletti, 1991) and Collaborative and dialogic learning (after Laurillard, 2002). All of these underpin the notion of learning within games, simulations and - when coupled with twenty first century skills - digital environments in general.

Reflection and creation

Games also engender several other learning strategies and approaches including: reflective practice (Schön, 1991) where players reflect on strategies developed; story telling in which they recount narratives and video their game play for comment by peers; and characterization, where they build personal in game identities. This last activity is perhaps underrated by educationalists as the character is the on screen identity. Its failures and successes are shared with the player but they are not invested in the player's identity. The failures are ultimately the character's and can be analyzed as such. One of the most powerful elements of game based learning is the provision of a context for learning. In gaming there are always a purpose for taking part, clearly defined goals and an achievable win state.

Personalisation

Games also promote the notion of personalised learning as described in Leadbeater (2004), where the users of an educational system are not just the receivers of learning, but active participants and co producers in the educational system. Structured content creation, in the form of character customization or other kinds of customization in games provides elements of personalization. Equally games also promote the learning potential of individuals in that they are: non discriminatory (if you have access an access point you can play); allow players/users to gain kudos and status within the game regardless of external constructions of identity (a 'bad' speller at school could be a champion player of FIFA 10); and are personalised at the point of use (where everyone's game is different whilst remaining similar) and can lead to deep and broad learning chain experiences. Gee and Hayes (ibid) exemplify this last point through their learning story about 'Jade,' who developed graphic design and commercial skills through initially playing Sims and designing clothes for Sims characters. Similar stories abound in which learners have developed interest in particular domains of study through initial game based engagement.

Authentic professionalism

An increasingly interesting perspective is derived from the concept of authentic professionalism. The idea is that games players (and simulation developers - particularly in the military - strive for a similar level of engagement) are able to engage with an environment that allows them to act and learn a particular role and identity from the safety of a games driven environment. Gee's (2005) discussion of authentic professionalism asserts that a good video game inducts the player into a professional domain made up of "facts, skills, and values in the service of performing a specific identity". Likewise Owen, Daimant, and Joiner (2007) note:

“The original conception of Racing Academy (a 'serious' game) was that through the game play and collaboration with other game players there would be an opportunity to act as a community of scientists and engineers, and use the language and practices of scientists and engineers. It was as much about developing identity as scientist or engineer as learning science or engineering.”

Taking this point to its conclusion would lead to real-time simulations that place players in identities and social situations as practice for real-world professional domain, a sort of virtual apprenticeship that supplies the skills and knowledge required for a particular vocation. For a game, however, believability is as important as authenticity: “The purpose of a video game is not to simulate real life, but to offer the gift of playing a game” (Poole 2000, 214). However as we shall see below, the integration of authentic content with gaming is not impossible. It is possibly highly desirable in an educational context.

Using gaming as the basis of pedagogy

Prensky (2009) talks of the digital enhancement of individual's lives and social practices. As gaming is quite pervasive in learners' lives outside formal education it follows that perhaps the skills habits and affordances that they acquire through this engagement should somehow be transferred into formal learning. There have been several attempts to do this, as the next section illustrates. What, however, seems to be apparent is that beyond using games in education per se (and perhaps more importantly) we should aim to transfer games based digital pedagogy and learning into analogue activity within classrooms. Magnussen (2007) and Royle (2010) have already touched on this by conceptualizing classroom based activities that use the pedagogy of gaming in face to face activities. Magnussen notes that:

“The game media is well suited for simulating complex rule systems and real-life settings. Game scenarios offer a medium equipped for complex simulations integrating many different aspects of real-life learning environments and framing them in a simulation the player can identify with and relate to. Access to a wide range of professional tools and representations supports authenticity and allows for players to tackle authentic problems in all their complexity and difficulty.”

She has introduced such elements of game play to create real investigations and scientific experimentation through a new generation of theory-based learning games that simulate professional environments. This really uses the attributes of game based learning as the basis of pedagogical processes and curriculum design. A key conclusion here is that we should look at the instructional grammar of gaming and the learning strategies that occur in digital environments and incorporate them into face to face learning environments. To some extent this is being trialled by 'Quest to Learn' (QtL), a new approach to schooling in New York. QtL uses game-inspired methods to teach both traditional and critical 21st century skills and literacies. Salen (2009) says that QtL firmly places technology in the position of digital tool whilst using a game based approach to learning, but also notes that digital technology as a whole:

“allows students new means of demonstrating their understanding. Students can express themselves as researchers, designers, filmmakers, photographers, songwriters, and engineers. These new means are compelling and assist in the development of skill sets necessary in contemporary professions.”

3. Games and education

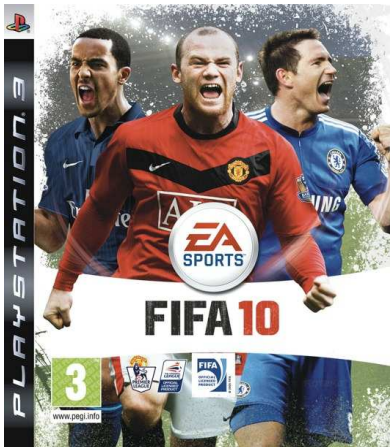
This section outlines the ways in which games are currently used in education by presenting several broad categories for consideration. It will also look at the problems that games have in integrating with the curriculum and with teaching and learning and consider new areas and unexplored avenues for gaming in education.

How games have been used in education.

The main approaches to incorporating digital games in education are as follows.

Educational games, sometimes referred to as "edutainment," which are games designed with specific curriculum objectives in mind. Educational games typically have clear educational content, explicit objectives, and feedback on learner progress in terms of learning content and skills. These games run the gamut from simple, platform-style games such as those offered through the Bristol Dyslexia Centre's Nessy Learning Program to Flash animations such as a jousting game sponsored by the British National Archives and to complex role-playing scenarios like Armoured Warrior, a World War II simulation game offered by the Canadian War Museum. More recently, learning systems like

<http://www.mathletics.co.uk/> and www.Footee.com offer games as rewards or motivators for completing tasks so are very 'game like' but not strictly games per se. Whilst these games don't offer the same level of engagement as commercial games, possibly because they are not part of the digital fabric patchwork of young people's lives they do provide a tangible link to learners' digital habits and are engaging for learners at school. Whilst Footee.com for example is not as culturally significant as the FIFA series (although endorsed by FA Learning) it still has a role to play in engaging young people through their interests and digital habits and bridging the gap between formal and informal learning. Equally, it also provides a gaming product alongside the educational content which attempts to build a community of practice around trading cards and other media such as weekly football magazines. What could be even more beneficial would be a combining the real world branding and gameplay of commercial entertainment games with those products with more direct educational intentions.



Schell (2010) contentiously notes that, everything in the world is becoming more real and authentic in terms of products and brands whereas schooling is essentially a construct or pale imitation of the authentic and real and is somehow perceived as second best. It is certainly true that children, teens and adults are brand conscious and can recognize authenticity and brands. For educationalists to engage with the learning that exists within commercial 'for entertainment games' and within learners' digital engagement in non formal settings, would be a step forward.

Serious games (or "real" games) use commercial game formats but have real educational content and often take the form of simulations of practice. An inspired example is the work of the small business game company which has developed a 'Sims' like online educational game where players run their own football retail store. <http://www.thsmallbusinessgame.co.uk/>. This retains the feel of a game and is firmly centred on student learning rather than instruction.

Many 'serious' games (which generally lean towards simulation rather than acting purely as games) have been developed for military purposes and as disaster simulations for emergency services. The difference here between a game and a simulation is that in simulations the key learning points must be drawn out through reflection on paths taken. The simulation must contain a debrief to be effective. In gaming you just fail and start again. The serious game is designed with learning in mind. A game will give you multiple attempts to achieve a level or win state, acquiring the necessary skills and content along the way. A good simulation also does this, just as a good game should also invoke reflection.

However, as with educational games, the educational content within serious games can sometimes get in the way of the immersive experience; the learner is never allowed to forget that the primary purpose is educational. Futurelab's Racing Academy project is one example of this kind of game that has had

good results. Still, the commercially produced Gran Turismo is clearly more enthralling, at least in visual presentation, than Racing Academy.

In both Gran Turismo and Racing Academy, the player chooses a car and earns access to upgrades with increased proficiency. Players in both games have access to progressively more complex upgrades of engine parameters; in Racing Academy, players may also win expanded telemetry capabilities. These additional capabilities help players design vehicles and race them on the more complex tracks available at these higher levels. However, Racing Academy, as Owen, Diamant, and Joiner (op cit) say, quickly becomes

"...a fairly tight directed experience closely tied to a specific item in the syllabus. This reflects the teacher's concern arising from the extent of the syllabus, the time available to teach it and the narrowness of the assessment of what is learned. These factors do not readily support a collaborative, open-ended problem-based curriculum".

More recent serious games however may have more mileage when tied to a particular curriculum. CityOne for example, commissioned by IBM is billed as:



A Smarter Planet game. □ Think you know what it takes to make the energy systems that serve a city more efficient? Given the opportunity, could you make the city's water cleaner and more plentiful, its banks more robust and customer-centric and its retail stores more innovative? <http://www-01.ibm.com/software/solutions/soa/innov8/cityone/index.html>

It is clearly based on developing problem/solution based learning and holistic system thinking in situated contexts that require professional knowledge.

Commercial off-the-shelf (COTS) games are created for commercial, entertainment purposes but used in education. This approach locates games usage alongside and within the school system. Research on the use of COTS games by Futurelab looked at the way in which three computer games – Roller Coaster Tycoon, The Sims, and Knights of Honour – were used by teachers in four schools (Facer et al op cit). This study illustrated that the extent to which games could be aligned with curriculum objectives depended on how the games were used within schools. The researchers also found that factors influencing the use of games in schools included the extent to which the games can be disaggregated and appropriated to meet specific learning needs, as well as the pervading cultural expectations surrounding children's attitudes toward and expertise in playing computer games. As they note:

“When considering how best to use a game in their classroom lessons, teachers, of course, have to consider the curriculum requirements of their particular domain. There arises from this imperative a possible tension between following the game designer's narrative and taking part in activities that address the curriculum needs of a lesson; the two are not necessarily in alignment.” (Facer et al. op cit,

A different approach has been used successfully in Scotland, mainly in primary education where the work of the Consolarium, otherwise known as the Scottish Centre for Games and Learning (from Learning and Teaching Scotland) has been proactively promoting the use of games in education and schooling. Their approach is one that uses games as the centre of a curriculum topic around which the game is used as a stimulus to support other media and learning investigations. Whilst some dismiss this initiative as similar to using film or video as a resource, it is in fact a lot deeper in its philosophy and thinking. Apart from tapping into learners' digital culture directly and thus making schooling more motivating and realistic they also intelligently link gaming skills and attributes into the Scottish Curriculum for Excellence

<http://www.ltscotland.org.uk/ictineducation/gamesbasedlearning/aboutgbl/gamesandcfe.asp> It is this reconceptualisation of learning approaches for teachers that is important in moving curriculum forward and linking school directly with digital society rather than through sanitized and restricted educational technology that is usually a poor second cousin to freely available web based products in both functionality and usability.

The Scottish approach is really an approach that uses **video games as curriculum**. Games of any type may be used as motivational tools within education. The use and adoption of games as a part of a curriculum that uses the culture of learners and their critical engagement with pervasive media within the classroom is a natural progression in the use of 'new' media in teaching.

Games-making software is another way to use games as, rather than with or against, the curriculum. [Thinking Worlds](#), Mission Maker, Little Big Planet etc. all tap into the desire to create and alter content that has been part of hard core gamer culture for a long time. Here the subject is games design, which is legitimized by its 'curricular' status - see also <http://www.immersiveeducation.com/missionmaker/>, a game design tool that is directly linked to an accreditation programme. There are also other emergent opportunities to develop a games design curriculum and in many places these exist as specialist routes. However, in a wider context, content creation is something that should be guided by teachers and there are several opportunities in this area around gaming practices and creativity. Some examples include actions where players adapt games for other purposes (reversion content), make videos of game play sequences, develop [machinima](#) and, at a basic level, develop commentaries on sports games.

The social aspects of gaming and their position, as mentioned earlier, as part of communicative digital collaboration lead to the development of process and publication skills to a wider audience. Gaming communities also produce learning events for others as noted below on Learn4life <http://www.l4l.co.uk/?p=1011>

"If gamers want to "cheat" or learn to navigate through a game (which can be a highly complex set of skills) - what do they do?

Well they discuss what they do on forums - they make transparent what and how they do things - they make walkthroughs for games for other gamers - they tap into a community of practice. They work together to evolve a little ecosystem of learning by making films, screenshots and putting them up on sites like YouTube and these help others learn those skillsets." Learn4life (2010)

Equally, the world of authoring content for Facebook quizzes at one end of the scale to designing applications for the App store at the other are all areas that could be developed within a school curriculum if the curriculum was sufficiently refocused to develop creativity, presentation and publication to a wider digital audience rather than just an exam board and a teacher.

Williamson, for Futurelab (2009), summarises some of these developments in terms of games as curriculum where:

“Games are useful resources that can be studied in terms of their significance in modern culture, in terms of their technological components, in terms of their art and design, and in terms of their narrative structures and rule systems.”

It would also be pertinent to go further here and also examine the critical use of games by players and how they deal with the ethical and moral considerations of the games that they play.

Reversioned or modified commercial games, such as the Beacon Award-winning modification of Neverwinter Nights Watamaniuk (2005) produced by the computer science department at West Nottinghamshire College, are COTS games that have been altered to integrate curriculum-related tasks into game play. This particular modification is similar to an educational game because educational content has been integrated alongside the game. The motivational driver is engagement with the game; the educational content is centred on accomplishing tasks that lead to favorable outcomes within the game. It provides an alternative mode of delivery that is motivating but, in essence, an educational game used within an educational context for a specific educational purpose. As with other games in the classroom, however, the teacher controls the experience and directs the learning, not the player. As the distributors of the Neverwinter Nights modification are careful to specify:

“The [game] environment is not designed to replace teachers. In fact, without teacher support a learner would not be able to progress throughout the game. Designed with ease of use in mind, the scenarios within the game can only be accessed by specially created and individualized passwords held by the teacher. Teachers are able to guide learners onto literacy, numeracy or problem solving scenarios as they choose and at a level appropriate to the learner.” (Altered Learning 2007)

Although, this modification recognizes the digital life of the learners it still presents only a ‘game like’ experience.

Other attempts at educational mods have taken a more radical approach in attempting to produce **game hybrids** that either fully embed learning within a game (see doom Ed, a half life two experimental project by Wolverhampton Uni and Desq.co.uk www.desq.co.uk/doomed).

It is probably this alignment with the needs and concerns of teachers plus the motivational aspect of using learners' technology that has led to the DS's success. In some cases full on gaming consoles have been used for motivational computer games leagues and the Nintendo Wii has been used successfully with students with physical and learning disabilities, in health related projects with Wii fit and for generating data for vocational classes that are learning to use spreadsheets (LSN Molenet, 2010). The Connect education company <http://www.connectededucation.com/> is also pioneering the use of the playstation portable PSP in education. Especially exciting here is their use of semacode technology to embed digital content in real locations. This simple, augmented reality technology offers exciting opportunities, alongside other similar developments, for gaming and education in outdoor environments.

Further unexplored avenues for games in education

There are several areas that could benefit from a game based approach to learning which remain substantially unexplored on a large scale. One of these is the area of gaming and disability where Bailey and Pearson (2007) and Garrido et al (2009) have studied the use of the Wii with disabled learners. A second area is in the area of socialization for those who find it difficult to integrate into society and a third is in work based learning, where there are examples from the private sector e.g. Renault Academy <http://www.youtube.com/watch?v=soziBQLgUKw> and from the military.



From the above, it is clear that there are several avenues open to the use of games in education. It is important that they should be seen as tools for learning that are either integrated within a curriculum for a specific purpose that in some way become the curriculum content. Another dimension is in the area of developing authentic professionalism. The IBM game, for example, offers the ability to interact with a complex model which includes national/global systems - something that other media would struggle to do. Perhaps this is the niche role for gaming within education. This would contribute to the integration of digital media into curriculum by doing something that conventional approaches cannot achieve. Here lies legitimacy and purpose. The playing of such a game allied to critical reflection would be an invaluable tool.

4. Mediating and moderating factors

Despite the positive aspects of gaming outlined above there are several moderating factors around their wider implementation. These factors are similar to those that inhibit the implementation of other informal digital learning practices in education. They are not insurmountable. However, the perception of gaming and its learning potential that this paper seeks to redress are possibly the most significant.

The most significant moderating factor is games' lack of fit with both the educational curriculum and the educational system's world view or conceptualisation of learning and consequently, the views and conceptualisations of teachers and their organisations. This extends beyond the area of just gaming to incorporate a wider view of digital engagement as a whole. There appears to be a disconnect, albeit a narrowing one, between schooling and the wider culture that, though it is being bridged in some areas, is not being addressed at system level.

For example, many innovative individuals have introduced games technology into formal learning. However, to make these initiatives part of a wider engagement with the digital age, systemic change is required that aligns curriculum objectives and outcomes with the process and product skills engendered by engagement with digital culture. Until this occurs we will, in the words of Marshall McLuhan (1967) be in a situation where we often find that:

“Our official culture is striving to force the new media to do the work of the old.”

Learning and teaching processes need to be reconceptualised to legitimise digital media access in order to: enhance what exists already, develop creative approaches to the process of content and learning creation and give teachers real things to teach that are relevant to the culture in which they and their learners find themselves. Teachers also need a safe space in which to take risks within a performative culture. They need personal development time to enable them to reinvent their identities as teachers.

In a world of on demand content and personalisation, subject knowledge, whilst important, is less so than it was. Teachers need to feel able to refocus their existing expertise on learning processes alongside the requirement to teach and test content knowledge. As Salen et al (2009:19) note under barriers to innovation, quoting Federation of American Scientists (2006):

“Standard approaches to pedagogy in the classroom differ significantly from models present in games. Effective use of games and other new technologies is likely to be limited unless educational institutions are willing to consider significant changes in pedagogy and content, and rethink the role of teachers and other educational professionals”

To return to the issue of games in education, there are certain obstacles to their wider adoption. Educators and academic commentators look wistfully at gaming, perhaps because they see within them an engaging pedagogy that works for individuals and groups, but there is no real research evidence to suggest that games, in and of themselves, are capable of raising educational attainment in areas of relevance to curriculum or 'ordinary' life.

“Gamers claim that playing is educational; it familiarizes you with ways of being and doing that you would otherwise not know about. It is sometimes laughingly conceded (by gamers) that much of this learning has little relevance to ordinary life.” (Cragg, Taylor, and Toombs [op cit](#), p10)

What is certainly true is that, when gamers are playing games, they are engaged in learning of a type that is a sort of Utopia for educators who are constrained by the limits of curricula, the standards regime and

the high-risk climate in which they operate. Hadfield and Jopling (2008) note that schools need learning, which is:

- deep (reflective, metacognitive, beyond course requirements)
- authentic ('real-world' contexts, meaningful to students' lives)
- motivational (task/goal oriented, inspires students to further learning).

These are arguably all qualities of engagement inspired by computer gaming.

Gee and Hayes (op cit), as part of their argument on public pedagogy based on interactive gaming integrate design (for learning), resources (that support learning) and engagement in practice through 'affinity' spaces. This approach echoes Wenger (op cit) who sees learning as integral to everyday engagement in practices of all kinds rather than a specialized practice undertaken in educational institutions, Thorpe (2004). Learning is something that **also** happens beyond school and the articulation that this kind of learning is both important and natural in and of itself, and possesses processes worthy of imitation within formal schooling is perhaps crucial in harnessing the *learning potential* of gaming for both teachers and learners.

As Wenger notes:

"The difference between mere doing and learning, or between mere entertainment and learning, is not a difference in terms of activity. It is not that one is mindless and the other thoughtful, that one is hard and the other easy, or that one is fun and the other arduous. It is that learning – whatever form it takes – changes who we are by changing our ability to participate, to belong, to negotiate meaning." (Wenger op cit: 226)

A movement towards designing learning within schooling that emulates the practices of informal learning should be a positive step for both learners and teachers and should remove the separateness from life relevance that many learners feel when faced with formal school based learning. Incorporating or tapping into the existing processes of learning within communities of practice around gaming or other practices would therefore seem to be a sensible plan of action and yet it is fraught with difficulty.

This difficulty originates in three main causes: firstly, games just don't fit naturally with the culture and practice of schooling; secondly, communities of practice create strong boundaries – the deeper the practice the stronger the boundary – and these boundaries are difficult to cross or broker, both for teachers who might want to incorporate games into their curriculum and for learners who might want to transfer their situated practice based skills to another context; and thirdly – this is connected to the second point – teachers just don't know enough about the **learning potential** within games as recent research by Futurelab (op cit :3) has shown.

"There is a persistent lack of knowledge in the profession about how games might be used for educational purposes and that many young people may not be able to make the connections between gaming and learning."

They also found that teachers aren't really into gaming;

"42% of teachers never play computer games for their own leisure; 34% play at least once a month or more frequently (21% play at least every week). Teachers are not therefore, in the main, a significant gaming population. The fact that over 40% never play games at all is likely to be a contributing factor to the lack of knowledge and skills in gaming often cited as a key reason for teachers not to use games in schools."

Yet, there are two important observations to make here, the first being that teachers don't have to be engaged within a practice to see or realise its learning potential and the second being that, even when deeply engaged themselves within a gaming practice, they still might not be able to see the connections between games and learning because of the strong boundaries created by that practice.

What teachers are good at is designing learning. Where they see a benefit for learning they will engage a strategy that can make it fit within a curriculum. All too often however, digital technology is added to an existing system where it doesn't fit well and has no space in which to develop. Too often, the technology itself is presented as a solution to a particular problem without examining the change in practice or pedagogy required to take advantage of the affordances of that particular digital tool. The iPad, for example, won't transform learning but the potential for pedagogical innovation that it can engender just might. If that is to happen teachers must be supported to explore its pedagogical potential through their own innovation and agency.

As Fisher, (2006: 301) notes, "Digital technologies provide the tools or mediational means to be used by teachers and learners. The key to this approach is that neither the teachers nor the tools may be understood in isolation."

In the case of games Caillois, (2001) outlines six formal qualities of games:

- Freedom
- Separateness (from events outside the rules)
- Uncertainty of outcome
- Non productiveness
- Games are governed by rules
- Make believe (not real)

Most of these qualities we could not really equate with use within a school environment or space that is structured in a conventional fashion and geared to formal learning without a considerable shift in **pedagogic** approach.

Games are generally; too time consuming, too complex for classrooms and too engaging so that any intended educational focus (by teachers) is hard to construct. Games in the classroom need to be controlled in terms of time, corralled into curricula and subject to the controls of an outcome led culture. Here we can see a fundamental conflict between the limits of curriculum design and learning itself within the practice of the game. As Wenger (op cit p229) notes:

"One can design work processes but not work practices; one can design a curriculum but not learning. One can attempt to institutionalise a community of practice, but the community of practice itself will slip through the cracks and remain distinct from its institutionalisation."

The problem of introducing games without also changing the design of learning within the institution is that they are heavily structured around Caillois' qualities and, as such, don't fit. Freedom of action and experience makes them too time consuming. An educational environment is currently too much like a production line; there are so many minutes for the transfer of particular knowledge and skills. This is not to decry 'conventional or transmissive' models of teaching. (Hamlyn Foundation, 2008), In the 21st century, the skills involved in scaffolding knowledge transmission by teachers will undoubtedly still be required, but a game, with its user centredness requires different time periods for different users to gain mastery. It requires a variation in approaches to learning and ultimately **a different pedagogical alignment**. The differentiation by skill level, often sought by educators within their own materials is built

in to the structure of a game; it's just that it takes people longer to practise and master those skills rather than to assimilate knowledge.

Separateness from events outside the rules is another quality of games that does not readily transfer to an educational environment. Teachers as supra mediators of learning have objectives that do not tally with the rules of the game. Likewise, formal learning has a certainty of outcome – if you do **x** then **y** will be achieved. Game based learning outcomes can be both expected and unexpected and are often tangential to the main objectives. For example, the main outcome of playing FIFA 10 manager could ostensibly be the win state of acquiring the in game skills of a successful manager but, in reality they might also include the socialisation that comes from playing together on line or even the literacy skills that accrue from the reading based problems that are sprinkled through the game play.

Equally, non-productiveness is a game quality that is directly opposed to the notion of education. A measurable product is essential to the educational process; it is how learning is assessed. The products of gaming have less worth in this regime, they produce process skills like collaboration and discussion which are notoriously non measurable.

The following qualities underlying the compelling nature of games can be added to Caillois' list.

- Immersiveness
- Indeterminate completion time
- Tendency towards complexity

These are all factors that have little to commend themselves to school based learning but they are attributes that learners find compelling. When ten year olds can play a computer game that allows them to manage Barcelona Football club at an operating profit and make complex decisions on a regular basis it is unsurprising that learning in school leaves them disappointed and less engaged. The real skill would be to engage with these game qualities and see how they might fit within formal school culture. Alternatively, it might be that games need to be designed with schooling in mind so that they become more like engaging simulations that can be played by teams across a longer time period. If this were the case, the gaming option could be utilised as another learning tool. It is, as mentioned earlier, not a case of gaming v. education or formal learning v. informal but of learning and digital tools being joined in a fit for purpose union and of closing the match or fit between learners' digital habits and their learning experience within education.

Solutions

There are three possible solutions to the issues outlined above. The first is a systemic change that reconfigures the curriculum around processes, skills and the publication of meaningful outputs for learners using digital technology. Given the advent of Diplomas, these are not things that are alien to the current system, but they need to become its main focus rather than just a part of an exam system. Secondly, the system needs to look at learning practices within digital engagement and so called public pedagogy and see how they might be utilised in schooling. Thirdly, teachers and learners need time and space in which to reconceptualise the learning that takes place and to re-define what it means to be a teacher in the digital age.

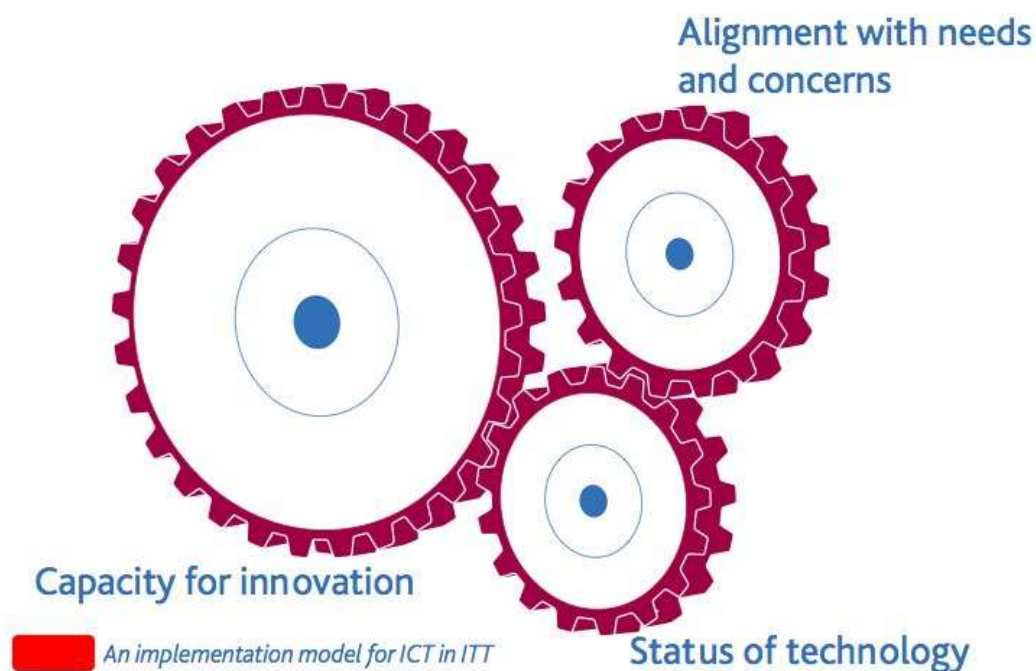
Futurelab's (2009) research highlights key barriers to the uptake of gaming technology, which confines them primarily to teachers' lack of knowledge about gaming, and logistics such as access to equipment and licensing costs. Futurelab suggests tentatively that, if these barriers were removed, the use of games would be more widespread. Whilst this is an encouraging finding their research also highlights a wide range of moderating factors such as objections from parents and governing bodies, inappropriate content, lack of transfer between game playing and school objectives and the difficulties of assessing

work. Thus it would seem that, to facilitate games as an **educational tool**, a more developed view of technology implementation is required that takes account of all of the interlocking factors that both mediate and moderate the implementation of technologies within formal education.

Whilst there are many examples of gaming infiltrating the school curriculum through inspired individuals and teams (Futurelab op cit) there are fewer explanations of the key factors that led to this occurrence and how that innovation might be taken to a wider scale. Hadfield et al (2009) describe three main interlocking aspects of successful engagement with technologies that are pertinent to the development of gaming in schools.

These aspects are:

- the status of the technology being introduced
- building and focusing the capacity for innovation
- the degree of alignment between the innovation and the needs and concerns of individuals and teams.



Of these, the factor that is particularly relevant to the implementation of game based learning, and therefore worthy of further examination, is the status of the technology being introduced, although it must be remembered that the other two drivers are equally important in effecting change. The status of the technology being introduced affects the likelihood that its implementation will be successful, and therefore may increase its chances of achieving wider impact. The research looked at three aspects - the **technical** status of the technology being introduced and the roles played by the **social** and **learning** status of the technology.

Here the **technical** status of a technology refers to its ease of use; its degree of compatibility with other forms of technology and existing ICT infrastructure, and its overall reliability and functionality (broadly the areas that recent research has focussed on as barriers to wider implementation). The **social** status of a technology relates to its popular image and the extent to which it has been taken up in wider society. This determines its initial acceptability and the degree to which individuals are familiar with it. Certain technologies vary widely in their levels of take up across different professional and social groups. Different groups can hold very divergent perspectives on whether a technology is 'good' or 'bad', useful or not useful. Such differences in perceived social status are particularly important in the implementation of ubiquitous technologies, rather than those with more specialised educational purposes. For example, the differentiated engagement of teachers and learners with the video facilities on their mobile phones, and the moral panics that have surrounded the sharing of 'happy slapping' incidents amongst learners, indicate how the problematic status of a particular technology can limit its uptake in schools. This has particular resonance with the 'social status' of computer gaming. For example the approach of the Consolarium in Scotland goes a long way to legitimising the use of game based learning in schools because it originates with the system conceptualisers, learning and teaching Scotland.

The **learning** status of a particular technology relates to its perceived utility and applicability to an individuals' own learning and its potential to support the learning of others. Learning status or potential are based on an individual's views of what constitutes 'learning' and effective teaching and learning processes. These views have to be attuned to the potential, or affordances, of each specific technology to support learning. In the case of computer gaming, this means attuning to the learning potential within the practice of gaming. For teachers the starting point for this process of attunement is an initial perception of how well a certain technology 'fits' with their existing pedagogical approach and curricula, before going on to a consideration of how it might support change and improvement. The closer teachers are to the digital habits (and therefore the potential within their communities of practice) used by their learners out of school, the more likely they were to recognize the role that particular technologies could play in supporting pupil's learning and how, by using this technology, they could improve the relevance of their teaching to learners. This is crucial. When teachers realise that the way their students like to learn, or are learning in informal situations, has little connection with what they do in school they start to reconceptualise the reconfiguration of learning for their students.

Under this aspect of the model successful innovations are characterised by:

- movement from consideration of the technical status of the technology in isolation to recognition of the role played by its social and learning status
- selection of technology which had a high social status
- challenging negative perceptions of a specific technology
- recognition of how differential prior engagement with a technology affects initial take-up and overall training and support needs
- utilisation of those with in-depth understanding of the learning potential of technologies to model to others.

In addition, **aligning with the needs and concerns of individuals' and teams** has a great influence on whether or not an implementation is successful. The technology being implemented and how it is designed to be used has to meet a significant number of individuals' needs and add substantively to the quality of the core activities of key groups and teams. Of particular relevance here is the notion that the intervention must either support or be supported by the overt core educational values of and teams within their existing community of practice.

This alignment may however be one of the biggest barriers of all to adoption. The curriculum is currently seen in some circumstances as an obstacle and a barrier. This is potentially just the way in which it has

been conceptualized but, essentially, it can work against innovation. In a recent project (Royle et al, op cit), teachers give their views on introducing the Nintendo DS into collaborative learning activities in the classroom.

“It’s a big job to integrate technology...sometimes it comes easily but at other times you think...actually how will the technology improve that? Am I using the technology just for the sake of it or does it add something to what I’m doing?” (Teacher interview, September 2009)

“Trying to find an activity that the DSs were useful for...in this structured activity...the fact that they were separate teams and that they had to communicate with each other gave a real purpose for using the DS where previously it had been difficult to fit it into the curriculum. There are so many limitations in terms of the curriculum...we had 8 sessions to cover a topic with so many learning objectives and we have to keep in sync with other classes for example.” (Class teacher interview, 2009)

Fisher et al (2006) - recently reprised for the Training and Development Agency for Schools (TDA) - have developed a conceptual framework for teachers’ purposeful use of technology. This framework describes areas of interaction with technology for teachers’ learning through and with digital tools. If this were coupled to the NGUS (op cit) competencies framework we might extrapolate a framework within which curriculum in a pervasively digital age could be defined for constructive and purposeful engagement by both learners and teachers. Fisher et al’s conceptual framework is given below.

<p>A. Distributed thinking and knowing</p>	<p>I. accessing resources; II. finding things out; III. writing, composing and presenting with artefacts and tools which may structure activities in particular ways</p>
<p>B. Engagement</p>	<p>I. exploring and playing; II. acknowledging risk, uncertainty and provisionality; III. working with different kinds and degrees of interactivity; IV. responding to immediacy.</p>
<p>C. Community and communication</p>	<p>I. exchanging and sharing communication; II. extending the context of activity; III. extending the participating community at local and global levels.</p>
<p>D. Knowledge building</p>	<p>I. adapting and developing ideas; II. representing understanding in multimodal and dynamic ways III. testing and exploring hypotheses . IV. evaluating ideas and understanding</p>

Unless teachers have the time and space to think about how things might be done differently, technology that enhances children’s lives and is seamlessly integrated into their lives at home will continue to be underutilized in education.

5. Research and enquiry gaps

There are several gaps in research and enquiry that need further investigation. In the first instance, the benefits of game based learning need to be studied. For example, can playing certain computer games such as Animal Crossing or Fifa manager improve literacy skills?

Secondly the pedagogy within gaming and within digital communication engagement demands as much study as games themselves. This could then inform a systemic review of learning within formal spaces to provide an improved match or fit between learners' digital experience and habits and their educational experience. This doesn't mean that we necessarily need more or less digital engagement in formal education just that we need to understand how people are learning.

Third, there needs to be a conceptual framework within which learning design can fit. This should interweave the notion of developing skills to interact with content and processes of collaboration and content creation that draw on the work of the various twenty-first century skills frameworks and personalisation initiatives.

Fourth, the myth of the digital native needs to be debunked. Engaging with digital environments does enhance certain tools and skill sets but it doesn't mean that learners know everything there is to know. There is still a massive role for teachers around developing content analysis skills, process and collaboration skills and content creation and review in digital environments.

Additionally, learning and teaching need to be reconceptualised for the digital age into a flexible pedagogical framework that drives purposeful, meaningful activity for schooling and education. As part of this process, we need to know more about teachers' and learners' digital habits, skills, abilities and practices. We also need to focus on how digital and real world environments can interact and to develop learning in these fields. Two areas that need exemplar methodologies are real time scientific data logging and geo caching.

Finally, we need to know more about our learners as individuals and as groups, in much the same way that companies engage in market research before launching a new product.

“Data from a variety of sources confirms that we have shifted from the “access gap” to what Henry Jenkins (op cit) and others describe as the “participation gap.” What is the participation gap? Well, it's a reference to the fact that as a more diverse population joins the digital world how do we begin to understand the different skills, interests, ethics, and cultures that produce different new media ecologies, literacies, and modes of participation in digital media culture?” Watkins (op cit)

There are several areas requiring further research, for example, to discover how those with learning disabilities respond to game based learning and how it might also be used to access more hard to reach groups.

In conclusion, educationalists should work together to design a system flexible enough to accommodate a range of digital tools for our 21st century learners in a digital age.

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