



# **Computer Games and Learning**

**Why do we think it's worth talking about computer games and learning in the same breath?**

**A discussion paper**

**by Keri Facer**

The over-riding reason for interest in this field is that computer games seem to motivate young people in a way that formal education doesn't.

It is repeatedly pointed out, for example, that young people of their own volition choose to spend many hours playing complex computer games outside school. Games, it seems, 'have something', they seem to have a way of engaging and interesting young people. The desire to harness this motivational power to encourage young people to want to learn is the main driver behind an interest in computer games for learning.

Increasing numbers of researchers and teachers are also beginning to suggest that games play develops young people's thinking in a way that we need to pay attention to. A raft of books have recently been published arguing that young people's minds are now 'reprogrammed' through playing computer games. Tapscott's *Net Generation*, in particular, and research in educational psychology by, amongst others, Patricia Marks Greenfield, argues that young people's regular and intensive games play is developing in them a set of new cognitive abilities. These are summarised by Marc Prensky as:

1. Twitch speed vs conventional speed
2. Parallel processing vs linear processing
3. Graphics first vs text first
4. Random access vs step by step
5. Connected vs stand alone
6. Active vs passive
7. Play vs work
8. Pay-off vs patience
9. Fantasy vs reality
10. Technology as friend vs technology as foe

These ten characteristics could be explained as young people developing the ability to process information very quickly, determining what is and is not of relevance to them; the ability to process information in parallel at the same time from a range of different sources; the familiarity with exploring information in a non-linear fashion - ie by 'jumping' through a range of different information resources, creating links rather than following a 'story'; the tendency to access information in the first instance through imagery and then use text to clarify, expand and explore; familiarity with networked, non-geographically bounded networks of communication; a relaxed approach to 'play', viewing this as a valid activity and conceptualising the computer as primarily a 'play tool'; expecting reward for activities; and having a model of doing in order to learn, rather than learning in order to do. Finally, these characteristics also include a relaxed acceptance of fantasy as a valid space of experience and a view of technology as a friend, familiar through having grown up with it.

While it is important for us to recognise that the tools and technology young people are growing up with are likely to allow them to 'think differently' by providing different models for thinking, we also need to treat the assumption that we have a qualitatively 'new' generation growing up, with some caution. As Prensky argues, 'there are plenty of people who do not prefer games as a way to learn'. Similarly, we know that children's relationships with games vary widely from child to child, with some children playing regularly, others rarely at all, with preferences ranging from strategy games to shoot-'em-ups to puzzles. Further, we know that there are major differences in terms of regularity and types of games play between boys and girls. To lump all children together as a new 'net generation' and to assume we can find a one size fits all answer, is to ignore the diversity that exists amongst young people as it does amongst adults. As Toni Downes has argued, based on a significant study of children's use of computers and consoles in the home:

*[This study] would seem to contradict the assertion by several influential authors that computers (particularly game playing) are a central feature of children's everyday lives. While it would be fair to say that for many children today a computer is part of the furniture in their home, for the vast majority of children electronic games are a regular but not a central part of*

*their lives. This suggests that much of the rhetoric regarding fundamental shifts in children's world views and in their predispositions to learning and thinking needs to be carefully scrutinised.* (p201)

This does not, however, mean that we should turn away from attempting to explore what the features of games are that might provide interest and motivation for young people to learn, even though we may recognise that we need to provide a range of different environments for different groups of young people.

A second set of arguments that link games and learning together, however, are to do with trying to develop digital environments that support new forms of learning. It has long been argued, for example, that the lecture-based model of teaching in many schools and universities is a very ineffective method of ensuring that learning actually takes place. Other models of learning have been put forward, notably 'learning by doing' and 'situated learning', and games are seen as environments that could actively support these practices. Similarly, the games environment is seen as one that can support both the mundane 'acquisition of facts' through drill and practice, and the complex acquisition of process skills through simulation. Games, it seems, hold the potential to both motivate and encourage diverse ways of engaging with learning.

To date, however, many of these assumptions are purely theoretical, with evidence at best anecdotal. Around the western world academics, games companies and technology corporations are increasingly establishing research programmes to attempt to understand these issues: the MIT Games to Teach programme, Abertay University's 'Play to Win' research centre and, of course, Futurelab's own research and development programme, are just some examples of the attention increasingly being given to figuring out which of these 'theories' about learning with games might stand up to critically evaluated research.

The following summary highlights just some of the key issues and research in the field of computer games, learning and cultures of gaming:

1. Computer games and motivation
2. Computer games and learning
3. Assessment
4. Children's out of school games use
5. Gender and computer games

## **SO WHAT DO WE THINK WE KNOW NOW?**

### **Computer games and motivation**

For over 20 years, people have been trying to figure out just what it is that makes computer games motivating. In 1980 Thomas Malone argued that the key features that contributed to motivation to play games were 'challenge', 'fantasy' and 'curiosity'. He argued primarily that 'in order for an environment to be challenging, it must provide **goals** whose attainment is **uncertain**'. (p50)

Similarly, Prensky draws upon Malone and others to develop a set of key criteria that encourage engagement with the game. He argues that games are defined by a set of key characteristics:

1. Rules
2. Goals and objectives
3. Outcomes and feedback
4. Conflict/competition/challenge/opposition

5. Interaction
6. Representation or story

And again, Jones argues that the following characteristics are essential to the design of engaging environments:

1. Task that we can complete
2. Ability to concentrate on task
3. Task has clear goals
4. Task provides immediate feedback
5. Deep but effortless involvement (losing awareness of worry and frustration of everyday activity)
6. Exercising a sense of control over our actions
7. Concern for self disappears during flow, but sense of self is stronger after flow activity
8. Sense of duration of time is altered

All of the above draw on Csikszentmihalyi's (I can't pronounce it either) definition of 'flow'. Prensky describes this as:

*In the flow state, the challenges presented and your ability to solve them are almost perfectly matched, and you often accomplish things that you didn't think you could, along with a great deal of pleasure. There can be flow in work, sports, and even learning, such as when concepts become clear and how to solve problems obvious. (p124)*

While Malone cites Csikszentmihalyi's characteristics of 'flow' that are relevant to understanding how games might motivate as:

1. *The activity should be structured so that the actor can increase or decrease the level of challenges he is facing, in order to match exactly his skills with the requirements for action.*
2. *It should be easy to isolate the activity, at least at the perceptual level, from other stimuli, external or internal, which might interfere with involvement in it.*
3. *There should be clear criteria for performance; one should be able to evaluate how well or how poorly one is doing at any time.*
4. *The activity should provide concrete feedback to the actor, so that he can tell how well he is meeting the criteria of performance.*
5. *The activity ought to have a broad range of challenges, and possibly several qualitatively different ranges of challenge, so that the actor may obtain increasingly complex information about different aspects of himself. (p14)*

Importantly, Csikszentmihalyi characterises 'flow' as isolated from other stimuli, which links the pleasures of games play, the experience of flow, with another key important factor - 'play'. 'Play' has been described as 'optimal generic learning by experimentation in a relaxed field'. The separation out of action from 'real world' risk is seen as a central feature of play, and, also, as one of the characteristics that games hold that might best support learning (although this is contentious). The central point is the view that 'flow', perhaps 'play', allows someone to achieve things that they might not be able to achieve in another frame of mind.

Games, then, are seen to generate motivation, through rule-based, goal-directed challenging play. Importantly, these are seen to generate 'fun', or what the MIT group would describe as 'hard fun'.

Much of this research, however, does not recognise the social contexts in which games, fun and learning take place. They focus on the characteristics of the activity itself, on design issues, rather than on the player's experience, attitudes and interests. Importantly, what they

don't necessarily ask, when thinking about linking the motivation of games with learning, is 'how much of motivation is dependent upon context as well as upon activity?' A recent paper by Draper argues that we need to develop a more complex understanding of what makes things 'fun'. He points out, rightly, that 'most things that you find fun in the middle of a day on holiday you do not find fun when woken in the middle of a night during a work week' (p118).

What Draper adds to the discussion on the role of games as motivating and 'fun', is a recognition that 'fun is not a property of software, but a relationship between the software and the user's goals at that moment' (p121). In other words, that it 'takes two to tango' - it takes the user thinking that an activity is going to be 'fun' and appropriate for their interests at that point combined with some of the features in the software outlined above. This is linked to definitions of play, as play is often described as something that is 'freely chosen'.

What then, are the implications of this for using games for learning? Historically, 'having fun' and 'learning' have been seen to be diametrically opposed - learning, in most popular discussions, is seen as the complete antithesis of 'fun'. While this might not necessarily be the case, in particular when we talk with young people who report enjoying learning, this view is fairly well embedded culturally:

*Calvin and Hobbes (a five year old and his tiger) are on holiday, it's the summer vacation and they're running around getting into trouble as usual when they come across a snake. 'Is it dangerous? What does it eat?' Calvin asks. Hobbes' blank look in response leads them both to bemoan their lack of knowledge about reptiles - a solution is offered: Hobbes will find a book on snakes and then they'll 'know everything there is to know about them'.*

*Five minutes later they are lying on the ground in the sun reading said book when suddenly Calvin jumps up, 'hey, we're not supposed to be learning anything, it's summer.'*

*Hobbes responds with a tone of finality: 'if no one makes you do it, it counts as fun.'* (with thanks to Watterson, 1997)

The approach that Marc Prensky advocates - which is to address the learner not as a 'learner' but as a player - to make the experience one of games play rather than learning - in other words, to create an experience in which the player does not know that they are learning, is often held up as the solution to this problem. This has often been called 'stealth learning'.

Yet even an advocate for games-based learning such as Prensky, highlights that making a learner 'unaware that they are learning' will not, in itself, solve the problem of combining games and learning. As he argues, and as most educational researchers and practitioners would agree, knowing that you have learned something is often a key part of useful, generalisable and transferable learning. Or, as Prensky puts it:

*Reflection is what enables us, according to many theorists, to generalise, as we create 'mental models' from our experience. It is, in many ways, the process of 'learning from experience'.* (p50)

Similarly, Wegerif (2002) points out that the issue of 'transfer' remains a thorny one. Namely that when designing environments for learning we do not want learners simply to be able to learn how to 'work that particular environment', rather we want them to be able to learn from that environment and apply their learning when faced with new and different challenges. Without 'reflection' it is unlikely that this transfer from one experience to another is likely to take place easily. For a more detailed discussion of this subject see the Futurelab Series report on [thinking skills, technology and learning](#).

When considering games as a motivating environment for learning, we therefore need to ask:

1. What are the characteristics of games that encourage motivation?
2. What are the expectations and goals of a user when playing a game for learning?

3. How can reflection, knowing you are learning, be built into the learning environment - either within the game or within the context for using it?

## COMPUTER GAMES AND LEARNING

Recently, there have been a small number of studies in the UK of how existing computer games might support learning in traditional and non-traditional educational settings. The TEEM report, for example, trained a number of teacher evaluators to use games in a school setting and administered questionnaires to parents and over 700 pupils to determine what the learning outcomes might be from playing games. Reporting on the use of mainstream games such as *Sim City*, *Age of Empires*, *Rollercoaster Tycoon* and *Championship Manager*, the report outlined the following outcomes from using games in the classroom:

**Skills** - this was seen to be the key area in which games made a contribution to the curriculum, although these skills are not always recognised within the curriculum. Key skills identified were:

**Communication and working with others** - children playing games were required to communicate with other children playing games, to describe what is taking place, to share resources, to make arguments and debate actions.

**Problem solving** - the games provide a set of challenges that children must overcome in order to complete the game successfully.

**Mathematical development (application of number)** - many simulations require budgeting decisions, encouraging financial capability. Further, many games environments require learners to 'use everyday words to describe position'. (pp13-16)

Children using games outside the classroom also reported the following 'learning outcomes':

*Working as a team is the most commonly reported skill developed through game playing in KS2 and 3. At KS2 boys and girls report this more or less equally at 48%. At KS3 the overall figure is 64% but only 55% of girls as opposed to 75% of boys selected this option. At KS4 the most commonly reported skill is decision making, but planning and working as a team are also popular. Girls report more decision making and boys report more planning and working as a team.*

*At KS2 19% boys and 31% girls believe that game playing helps with school subjects and general knowledge. There are also reports related to ICT skills and spelling and reading. No specific school based learning is reported by secondary school pupils. This probably reflects the content of the games that are played at the different key stages, which does vary. (p27)*

Importantly, the motivational aspect of games play was again reported as a key factor to support learning, encouraging children's skills acquisition - in particular in terms of problem solving and team work. Teachers also reported that games play in the classroom provided a motivating stimulus for other learning activities.

The report on games and learning for Becta identified a similar range of outcomes in terms of using traditional games for learning:

1. ICT skills acquisition - need ICT skills in order to play the game.
2. Motivation/interest in activity - the games generated a lot of self-motivated play of the games. *'However, the teacher noted that a focus on curriculum learning objectives may be lost as the user becomes involved with the game. This indicates that schools would value versions of the game which combined game play with a focus on the aspects of the game which support*

*specified learning objectives.'* (p9)

3. Collaboration - children chose to work together to complete games. In particular, choosing to learn from and work with peers.

4. Thinking skills - reasoning, enquiry, creative thinking, evaluation of actions, devising strategies, considering options, taking rational decisions... Thinking logically, planning ahead, considering impact of range of factors.

With existing games, then, it seems that the key benefits are in the areas of skills development, team working and motivation to learn. Given that both of these reports studied the use of mainstream games not originally designed for learning, it was unsurprising that the 'content' aspects were rarely mentioned as key benefits. In fact, it was reported that the games content was sometimes problematic, relying as they did on models of reality that were at best undescribed, and at worst incorrect.

## **MANAGING LEARNING WITH GAMES IN SCHOOL**

Both of these studies identified features of games that caused difficulties in terms of supporting learning in the school setting and strategies that could be employed by designers to overcome these. These were a combination of content issues and classroom management issues. The TEEM report produced a list of factors that need consideration prior to developing games for classroom settings:

**Pre-set scenarios:** having pre-set scenarios that could be run would allow children to a) learn the basic elements of games play and b) allow targeted and direct relation to the curriculum, if teachers were allowed to edit these scenarios this would reduce teacher preparation time.

**Accuracy of content:** simulations need to be based on accepted conventional models, and the models upon which they are based need to be clearly identified. This is true for both historical and economic models, but also in terms of environments in which actions are based on rules of the 'natural world'.

**Saving and restarting:** need to be able to save and restart games where an individual or group has left off (or have navigation allowing easy return to last point). Need to have capacity to save the full class numbers.

**Information to the teacher:** need to give teacher synopsis, information on models, ideas of how to use. Teachers need a record of what each group has achieved in each session of gaming.

**Sound:** need to be able to control sound coming from resource in classroom setting.

**Progress:** tasks need to be progressive, games need to be adaptable to different ability levels. Games should offer 'non-identical' repeats. Suitable stopping points in complex games environments are needed to prevent student frustration.

**Interface:** user interface needs to be obvious with no need for written instructions. Reading age of any on-screen text needs to match reading age of target children.

**Challenge and collaboration:** developing environments that encourage collaborative problem solving - ie requiring time away from the computer to develop responses, or finding it helpful to work with someone else - so, moving away from less direct questioning towards the need for inference of possible actions.

**'Real world' expertise:** developing environments in which children's already existing knowledge and understanding can be drawn upon.

**Time:** building environments in which the length of time to complete is dictated by the user rather than the computer.

## **ASSESSING LEARNING THROUGH GAMES**

One of the thornier issues to face designers interested in making a role for games in learning is the question of assessment. At present we know that games allow players to rapidly evaluate their own progress through the game - indeed, the responsive and rapid feedback provided to players is seen as a key factor in enabling gamers to progress. However, at present there is little communication between the games industry and educational researchers that might enable further development of these mechanisms to enable evaluation of more complex acquisition of skills and understanding.

For example, if we consider that complex strategy games are supposed to enable the development of strategic thinking, planning, decision making and team working - how might we come to assess this from the feedback built into the game? How do we know, for example, what the decision to enable a player to progress to the next level of civilisation in *Age of Empires* reflects? What evidence is there within the game that the games designers build upon in order to accurately determine when an 'upgrade' to the next level is justified. More pertinently, for educators, how can we link the demonstrated behaviour of achieving a higher level of civilisation with understanding whether the player has understood the processes involved? And further, how do we know whether we are simply assessing the ability to play the game or the acquisition of skills that might be transferred to other settings?

At present, I would think it unlikely that the games play itself might serve as a basis for 'high stakes' assessment. Within a classroom environment where children are encouraged to reflect upon their achievement within the games environment, however, the current mechanisms for denoting success in games (feedback, levels, acquisition of points etc) might serve as a basis for formative and peer evaluation.

In future, as we develop our understanding of the limits and potential of games environments, and as we develop collaborations between educators, games designers and assessment bodies, it is possible to speculate that we might learn from games environments in the design of assessment mechanisms. Interestingly this might lead to a revision of what, in fact, we come to consider appropriate for assessment. At the moment, for example, we might argue that it is possible to get to the next stage through trial and error and through using cheats, and say to designers that their assessment mechanisms (rewards, points etc) are not sufficiently rigorous to enable assessors to identify these practices. In future, however, we might argue that trying things out, getting lucky, even finding cheats and using these opportunistically, are valuable strategies for children to acquire.

In this area at least, the future of games for learning is wide open to debate.

## **COMPUTER GAMES, CHILDREN AND CONTEXT**

A different take on games and learning is in evidence in a number of studies that have paid close attention to children's use of games as part of their leisure activities out of school. These studies are characterised by close attention to the ways in which games fit into children's day to day lives and home and family context. The first major study was conducted by Toni Downes in Australia. Downes reported that children's pleasure in computer games was mainly derived from the processes of games play (a finding broadly in line with the Malone and Prensky arguments above): *'variously, they liked the challenge, the creativity, the*

*unexpectedness, the discovery, the choices, the excitement, the complexity, overcoming obstacles, "beating the baddies" and, of most significance, winning'* (p203). According to Downes, these processes were rated by children as more important than either games features such as graphics qualities or content. Importantly, Downes also emphasised that *'children of all ages, gender and communities affirmed that pleasure and fun were not associated with ease. They enjoyed facing challenges and meeting complexity'* (p203).

Downes' major contribution, however, was in respect of exploring how children learn to play games. In contrast to the media view of children as games players sitting in isolation in a darkened room, she found that learning to play games often involved interactions with a wide range of resources, talking to parents, reading manuals, playing around, watching other people. Importantly, however, she provides evidence for some of Prensky's conjectures, that playing and practising are now part and parcel of the same activity. As one of the children in her study reported, *'every time you play a game... you always get up a level... you keep on doing it and doing it and you get better because there's clues and you've got to keep them in your head. And at the end you just keep going and start a new one'* (p206).

Finally, she concludes her dissertation by arguing that through computer games play, children have come to see the computer as 'playable' - whether using it for games play or for other activities such as writing or drawing or information seeking.

Jo Tobin's research in the US into his own son's digital activities outside school also emphasises the potential role of games play in generating interests and activities above and beyond the actual game. He argues that the games provide the motivation and incentive for developing an interest in learning more about the games and, in so doing, encourage the development of skills in collaboration with peers, mentoring and learning from other peers, developing ICT skills and problem solving abilities (Tobin, 1998).

## **GENDER ISSUES**

It would be impossible to conclude a review of computer games and learning without highlighting the key issue of gender that inevitably arises. Ever since the first computer game was developed it has been argued that games are predominantly a 'male domain', whether in terms of content or in terms of the degree to which games are a central part of boys/girls, men/women's daily lives. Henry Jenkins and Justine Cassell at MIT have published probably the key text in this area *From Barbie to Mortal Kombat*, exploring in detail the question of gender, games and identity. We would advise readers interested in these questions to turn to this text as it is impossible to convey in detail the issues in this area, and this book does so commendably. However, it is clear that there are two key areas of interest:

1. Representations - it is argued that many computer games simply represent a 'male' view of the world, relying heavily on stylised combat or traditional gender roles with female protagonists cast as victims to be rescued. This is, of course, not universally the case; Lara Croft, for example, is responsible for one of the greatest games success stories of recent years. Whether Lara represents a breakthrough or a throw back for female games engagement, however, is a matter for some debate.

2. Social cultures - games play, it is often reported, is not characterised only through playing the games, but through the systems of exchange and discussion that surround them - the purchasing of magazines, the swapping of software and cheats. All of these are seen as centrally important aspects of what makes games an important social activity. To date, however, these 'games cultures' seem to remain predominantly male. Certain commentators have argued, for example, that boys are more likely than girls to participate in these activities because games are seen as a 'safe' way for boys to maintain friendships, while girls are less reliant on these mechanisms (McNamee, 1998). Research for the Screen Play study reported

that boys tended to dominate classroom discussion of games and, even where girls were games players, boys tended to retain the 'authority' in the classroom and peer group for determining which games were 'good'. Similarly, in the home, boys were seen to be significantly more intense games players, with 33% of boys compared with 13% of girls reporting playing games every day and, in detailed observations, boys were seen to 'own' the games technology in the home on a more regular basis. (Facer et al, 2003 forthcoming)

We might also want to consider the relationship between gender and games from an alternative perspective. In his discussion of the relations between 'play' and games, for example, Prensky repeatedly argues that senior managers have always felt free to 'play' with ideas, to exclude themselves from the hassles of daily life and engage in free flowing exploration of ideas and enjoyment:

*In business, work and play mix regularly, starting at the highest executive levels. Deals are done on the golf course. Businesses have been bought and sold on bets. At Harvard Business School my fellow students played daily games of 'who gets called on bingo' and would shoot the person talking with water guns while the teacher was looking the other way during classes. They would, I have no doubt, do so as eagerly again 20 years later, many as multimillionaires' (p114).*

To some extent, and possibly unintentionally, what this quotation highlights is that play is often associated with privilege - that is, the privilege of knowing that someone else is 'taking care of the daily grind'. Historically, the freedom to 'play' on the golf course has been dependent on someone, usually a wife, taking care of the kids, house and cooking. This extends back to childhood as well, with girls often taking the moral high ground and describing boys and games play as 'childish', while they get on with the real work of figuring out how to become a 'sensible' grown woman. If we want to think through the questions of games and learning, then, we may need to pay some close attention to the questions of how boys and girls relate differently to, and are given permission to 'play', a question that brings with it a whole raft of value judgements about what we think play is - escape from the real world or valuable work? Importantly, we need to return to Csikszentmihalyi's argument that characteristics of 'flow' include the ability to: *'isolate the activity, at least at the perceptual level, from other stimuli, external or internal, which might interfere with involvement in it.'*

As Jenkins and Cassell have argued, there is no easy answer to the question of gender and games - it cannot simply be solved by replacing soldiers with Barbie dolls. Rather, we need to address a whole raft of questions about the values that boys and girls bring to play in general and to computer games in particular.

## **SUMMARY**

This discussion document was intended only to give a flavour of some of the key issues we need to think about when considering the role of games in learning. The papers, books, web articles and online discussion groups listed below will take the interested reader in a whole range of different directions, raising issues not addressed here, or exploring them in more detail. To summarise though, we face a whole set of challenges in bringing games and learning together - we need to ask what makes a good game, what makes a valuable 'learning experience', and do these two necessarily overlap? We need to consider how context and intention impact on that experience, we need to consider how gender plays a role in games play and games cultures, and we need, finally, to ask 'how do we know what is being learned?' These questions, and more, are currently being explored by Futurelab and other organisations around the world.

Watch this space and/or send your comments and suggestions to us here at Futurelab care of [research@futurelab.org.uk](mailto:research@futurelab.org.uk)

## FURTHER READING

**Beavis, C** (1998) 'Computer Games, Culture and Curriculum', in Snyder, I (ed) *Page to Screen: Taking Literacy into the Electronic Era*, London: Routledge

**Cassell, J, and Jenkins, H** (eds) (1998) *From Barbie to Mortal Kombat: Gender and Computer Games*, Cambridge, MA: MIT Press

**Cavallari, B, Hepburg, J, Harper, B** (1992) 'Adventure Games in Education: a Review', in *Australian Journal of Educational Technology*, 8, 2, pp172-184

**Choi, D, Kim, H, Kim, J** (1999) 'Toward the Construction of Fun Computer Games: Differences in the Views of Developers and Players', in *Personal Technologies*, 3, 3, pp92-104

**Csikszentmihalyi, M** (1990) *Flow: the Psychology of Optimal Experience*, Harper & Row, New York

**Davis, B, Sumara S, Luce-Kapler R** (2000) *Engaging Minds, Learning and Teaching in a Complex World*, LEA, New Jersey

**Dawes, L & Dumbleton, T** (2001b) *What Aspects of Games may Contribute to Education?* [www.becta.org.uk/technology/software/curriculum/computergames/index.htm](http://www.becta.org.uk/technology/software/curriculum/computergames/index.htm)

**DfES/Taylor Nelson Sofres** (2002) *Young People and ICT*, [www.becta.org.uk/research/reports/youngpeopleict](http://www.becta.org.uk/research/reports/youngpeopleict)

**Downes, T** (1988) *Children's Use of Computers in their Homes*, unpublished DPhil thesis, University of Western Sydney, Macarthur

**Draper, S** (1999) 'Analysing Fun as a Candidate Software Requirement', in *Personal Technologies*, 3, 3, pp117-122

**Dumbleton, T** (2001a) *Computer and Video Games as Children's Experience of Technology: an Overview of the Evidence and Implications for Teaching* [www.becta.org.uk/technology/software/curriculum/computergames/index.htm](http://www.becta.org.uk/technology/software/curriculum/computergames/index.htm)

**Edge** (2001) 'Learning Curve: is the Academic Community Finally Accepting Videogames?', in London: *Edge*, No 109. *Summary of Proceedings of Games Cultures Conference*, June 2001, Watershed and University of the West of England

**Facer, K** (2002) *Interactive Education: Children's Out of School Uses of Computers, Preliminary Analysis of 2001 Survey*, [www.InterActiveEducation.ac.uk](http://www.InterActiveEducation.ac.uk)

**Facer, K, Sutherland, R, Furlong, J, Furlong, R** (2002) "'Edutainment" Software: a Site for Cultures in Conflict?', in *Teaching and Learning where Worldviews Meet*, London, Carfax

**Facer K, Sutherland, R, Furlong, R, Furlong, J** (2001b) 'Constructing the Child Computer User: From Public Policy to Private Practices', in *British Journal of Sociology of Education*, Vol 22, No 1

**Facer K, Sutherland, R, Furlong, R, Furlong, J** (2003, forthcoming) *Screen Play: Children and Computers in the Home*, London: RoutledgeFalmer

**Green, C and Bigum, B** (1993) 'Aliens in the Classroom', in *Australian Journal of Education*, 37, 2, pp119-141

**Jenkins, H** (2001) Keynote Speech given at Game Cultures Conference, Bristol, UK

- Jenkins, H** (2002) 'Game Theory', in *Technology Review*  
[www.technologyreview.com/articles/wo\\_jenkins032902.asp](http://www.technologyreview.com/articles/wo_jenkins032902.asp)
- Johnson, C** (1999) 'Taking Fun Seriously: Using Cognitive Models to Reason About Interaction with Computer Games', in *Personal Technologies*, Vol 3, No 3 pp105-116
- Jones, M G** (1998) *Creating Engagement in Computer-based Learning Environments*, ITForum (e-mail list: invited paper posted 7 December 1998) and [WWW document] URL:  
[itech1.coe.uga.edu/itforum/paper30/paper30.html](http://itech1.coe.uga.edu/itforum/paper30/paper30.html)
- Kirriemuir, J** (2002) *The Relevance of Gaming and Gaming Consoles to the Higher Education/Further Education Learning Experience*, London: JISC Contact J Kirriemuir:  
[gaming@ceangal.com](mailto:gaming@ceangal.com)
- Kirriemuir, J** (2002) 'Video Gaming and Digital Learning Technologies: Relevance and Opportunities', *Dlib Magazine*, February 2002, [www.dlib.org](http://www.dlib.org)
- Klawe, M and Philips, E** (1995) *A Classroom Study: Electronic Games Engage Children as Researchers*, University of British Columbia, Vancouver: E-GEMS project,  
[taz.cs.ubc.ca/egems/homt.html](http://taz.cs.ubc.ca/egems/homt.html)
- Lawrence, S** (1992) *Video Games: Harmfully Addictive or a New Educational Environment? Taking children seriously*, 1992. [www.eeng.dcu.ie/~tcs/Articles/VideoGamesInterview.html](http://www.eeng.dcu.ie/~tcs/Articles/VideoGamesInterview.html)
- Livingstone, S and Bovill, M**, (1998) *Young People: New Media*, London: LSE/BSC
- Malone, T (1980) *What Makes Things Fun to Learn? A Study of Intrinsically Motivating Computer Games*, Palo Alto: Xerox
- McFarlane, A, Sparrowhawk, A, Heald, Y** (2002) *Report on the Educational Use of Games: an Exploration by TEEM of the Contribution Which Games Can Make to the Education Process*, Teem: Cambridge. [www.teem.org.uk](http://www.teem.org.uk)
- McNamee, S** (1998) 'Youth, Gender and Video Games: Power and Control in the Home', in Skelton, T and Valentine, G (eds) *Cool Places: Geographies of Youth Cultures*, London: Routledge
- Mumtaz, S** (2001) 'Children's Enjoyment and Perception of Computer Use in the Home and the School', in *Computers and Education*, Vol 36, No 1
- Nixon, H**, (1998) 'Fun and Games are Serious Business', in J Sefton-Green (ed) *Digital Diversions: Youth Culture in the Age of Multi-media* London: UCL pp21-42
- Papert, S** (1998) 'Does Easy do it? Games and Learning', in *Game Developer* June p88
- Pearce, C** (2001) Review of 'Entertainment in the InterActive Age' conference, including full transcripts of relevant sessions on games and learning. [www.annenberglab.org/interactive-age](http://www.annenberglab.org/interactive-age)
- Prensky, M** (2001) *Digital Game-based Learning* New York: McGraw-Hill
- Wegerif, R** (2002) *Thinking Skills, Technology and Learning: Literature Review for Futurelab*  
[www.futurelab.org.uk/lit\\_reviews.htm](http://www.futurelab.org.uk/lit_reviews.htm)
- Whitebread, D** (1997) 'Developing Children's Problem-solving: the Educational Uses of Adventure Games', in A McFarlane (ed) (1997) *Information Technology and Authentic Learning*, London: Routledge