

# GAME ON!

HOW VIDEO GAMES AND GAME DESIGN PRINCIPLES CAN HELP TO  
MAKE ADULT EDUCATION MORE ENGAGING FOR THE LEARNER

DAN MCLAUGHLIN

Submitted in part fulfilment of the requirements for the MEd

In Adult and Community Education



Department of Adult and Community Education

National University of Ireland Maynooth

2012

Supervisor: Michael Murray

## **ACKNOWLEDGEMENTS**

I would like to express my gratitude to Michael for the support, encouragement and seemingly limitless patience he exhibited during the course of this research. Thanks too, to the faculty staff of the Adult and Community Education Department.

I thank my family, and love them for the support they have shown, for creating a productive space and talking me down from the ledge, when things were tough. In particular thanks are due to my sister, Ruth, for the time she spent discussing my ideas. Special thanks are due to my long-suffering mother, without whom the words that follow would not make anything near as much sense as they do.

Finally my thanks to Emer, Liam and Conor who have given me purpose.

## **ABSTRACT**

The recent technological revolution has produced a new type of adult learner. This thesis will examine the educational needs of this new learner, and suggest ways in which adult educational practice can adapt in order to meet these needs. In doing so, it will examine the concepts of digital game-based learning and the 'gamification' of adult education and training, in the context of Howard Gardner's theory of multiple intelligences and Paulo Freire's problem-posing approach to education.

## TABLE OF CONTENTS

Acknowledgements.....	ii
Abstract.....	iii
Table of Contents.....	iv
Glossary.....	vi
Introduction .....	1
Chapter 1: Research Methodology and Methods.....	4
1.1 Ontological Stance .....	4
1.2 Epistemological Stance and Core Methodology .....	6
1.3 Research Methods .....	7
1.4 Research Ethics .....	9
Chapter 2: Setting the Context: Why Is It Important?.....	11
2.1 Digital Natives and Digital Immigrants.....	11
2.2 Video Games and Theories of Learning .....	14
Behavioural learning theory and video games .....	15
Constructivist learning theory and video games .....	18
Experiential learning theory and video games .....	21
2.3 Philosophical Approaches in Practice .....	24
Freire: banking versus problem-posing .....	24
Gardner: individualisation and pluralisation .....	27
2.4 Conclusion.....	29
Chapter 3: Games for Learning .....	30
3.1 Cognitive Capacities and Traits Enhanced through Game Play .....	31

3.2	From Edutainment to the Serious Games Initiative: A Brief History of Game-Based Educational Software .....	36
	Time and resources.....	45
	Attitudes .....	47
3.4	The Role of the Educator in Digital Game-Based Learning .....	48
3.5	Conclusion.....	51
Chapter 4: Learning from Games.....		52
4.1	Philosophy of Gamification .....	52
4.2	Gamifying Adult Education .....	57
	MDA Framework for Adult Education .....	57
	Narrative .....	58
	The Freedom to Fail.....	60
	Feedback.....	61
	Collaboration and Competition .....	61
4.3	Gamification in Practice .....	62
	Gamifying the Grading System .....	62
	Alternate Reality Games .....	66
Conclusion.....		68
Bibliography .....		70
Media Bibliography.....		81

## GLOSSARY

ARG	Alternate Reality Game
FPS	First-Person Shooter
GPS	Global Positioning System
MMORPG	Massively Multiplayer Online Role Playing Game
RPG	Role Playing Game
RTS	Real-Time Strategy
Sim game	Simulation Game
VR	Variable Ratio

## INTRODUCTION

In the *Phaedrus*, Plato famously decried books as passive (Gee, 2005 p. 34). One cannot interact with a book, and thus books do not permit the dialogue that education theorist, Paulo Freire, later described as an important facet of critical education. In today's world, the learner is surrounded by all sorts of interactive media: tools which are, in effect, 'books' that provide and facilitate dialogue. In the last thirty years, in particular, advances in technology have changed the way we work, communicate and play.

In this new digital age, the video game medium has become hugely popular; a measure of this popularity is the fact that the game industry now generates more revenue than either the cinema box office or DVD sales (Chatfield, 2009, p. 27). Video games have thus become a leading form of entertainment, and not only for children. In fact, in the US, the average gamer is thirty-seven years old, and 82% of video game players are over the age of eighteen (ESA, 2011, p. 2)<sup>1</sup>. This new phenomenon has many implications for the principles and practice of adult education.

The central hypothesis of this thesis is that educators have much to learn from video games, and game design principles. The underlying notion here, is that if educators understand what motivates us to play games, they will gain new and better insights into what motivates us to learn, in this new age of technology. Games can provide spaces for experiential learning and complex problem-solving, can support collaborative learning, and provide for multimodal delivery of information. This research posits that, when digital game-based learning is applied in a thoughtful way, and when pedagogical thinking informs game design, a variety of benefits can arise, for both educators and learners.

---

<sup>1</sup> Entertainment Software Association

This research will set out to explore the nexus between the world of game play and the world of adult education. It is an exploratory, cross-disciplinary investigation, involving a critical evaluation of many different types of secondary sources, pertaining to both the video game industry and the adult education and training sector. Because the growth in popularity of gaming is a relatively recent phenomenon, it is important to note that many of the sources explored have been published in the last ten years. For this reason it is particularly important that a reflexive and critical approach is taken in this research. While much of this early research has been done in the United States, the subject matter is nonetheless very relevant, and likely to be of increasing relevance, to the Irish adult educator.

In conducting any research, it is crucial to address the ethical issues that arise (Creswell, 2009). Video games are a powerful, immersive medium. They are popularly regarded as promoting anti-social, misogynistic and violent behaviour, or, at best, as innocuous playgrounds for killing time (Anand, 2007; Baek, 2008; Giumetti & Markey, 2007). While there is little evidence to support these social constructs (Crocco, 2011; Kutner & Olson, 2008), and much evidence to show that games can, in fact, have positive effects, nonetheless, it is doubly important in this research to be alert to the ethical issues which arise, by virtue of the powerful nature of the medium. Some of these ethical issues, such as the potential for the medium to be misused as a propaganda tool, and its potential to encourage compulsive behaviour, will be flagged in Chapters 2 and 3.

Because of the exploratory nature of the research, qualitative textual analysis will be adopted as the research method. A social constructivist methodological approach (that of challenging assumptions to create new meaning) will be taken. This approach will be outlined in Chapter 1, with consideration to my own ontological and epistemological stances. Chapter 2 will introduce the concept of *digital natives* and will consider the

educational needs of a generation of adult learners brought up in today's digital world, as well as the needs of those learners who have been left behind by the new wave of technological advances. Video games will be discussed in the context of the three major theories in education (behavioural, constructivist and experiential) and some examples will be considered to show how video games can help to reify some theories of education in practice. Chapter 3 will examine the ways, both successful and unsuccessful, in which digital game-based learning has been applied in education, to teach a wide range of skills and subjects. This chapter will also consider some of the practical barriers to the adoption of digital game-based learning in adult educational settings and discuss the implications for the role of the adult educator.

The final chapter will explore the possibilities for the 'gamification' of education, and ways in which the principles (as distinct from the applications) of game design can be used to benefit adult education practice. This chapter will discuss how we might take advantage of the motivational aspects of video games to promote learning, without the high resource demand required for the development of content-specific, educational software. It will attempt to identify what it is, in essence, that makes video games engaging, both from a game design perspective and a pedagogical perspective. Finally, this chapter will propose a working model to facilitate the incorporation of engagement into the teaching process, and discuss some of the ways in which the motivational aspects of video games can be successfully applied to adult education.

## CHAPTER 1: RESEARCH METHODOLOGY AND METHODS

Creswell (2003) asserts the importance of demonstrating the research approach to effectively increase the validity of social research. The purpose of this chapter is to outline the approach of the research, declare the dominant methodology and detail the research methods used. Crotty (1998) suggests that there are four stages in social research: *epistemology*, *theoretical perspective*, *methodology* and *methods* with each element informing the next (pp. 2-4). This approach was adapted slightly for this research, so that the ontological and epistemological stance informed the methodology, which in turn influenced the methods that were adopted. It is necessary, then, at the outset, to examine and outline my own personal ontological stance.

### 1.1 Ontological Stance

My interest in the use of video games in education began at a very young age. In 1989, when I was seven years old, my school had one computer, an already somewhat outdated Apple Macintosh, with one educational title installed called *The Oregon Trail* (MECC, 1974). *The Oregon Trail* was originally developed in 1974 by three student teachers in Minnesota for a history class, with the objective of teaching students about the realities of 19<sup>th</sup> century pioneer life in America. Players assumed the role of wagon leader, guiding a party of settlers from Independence, Missouri to the Willamette Valley. The game was created as a simulation to help students develop decision-making skills, to see the consequences of decisions, to learn to effectively manage limited resources, and to encourage students to work together (Glenn, 2002, p. 180). Although aesthetically crude and simplistic by modern video game standards, the experience made a lasting impression on me and my classmates. We found ourselves totally immersed in the story, and the fact that we could immediately see the effects of our decisions within the virtual world, instilled in us a level of involvement, uncharacteristic

of our more traditional lessons. Every lunch break, throngs of students formed around the machine, eager for a chance to play: in other words, we were hooked.



Figure 1.1 - *The Oregon Trail* (MECC, 1974)<sup>2</sup>

As I progressed through my adolescent and adult education, I began to wonder why I so seldom experienced this level of engagement in my studies. At school, I found myself struggling with certain concepts, when they were presented through the usual logical-linguistic methods; the two abilities most valued in the traditional school setting (Gardner, 1983). This experience was alienating, and I would often become frustrated and discouraged. Like many of my generation, I looked to the world of video games for escape. I found great motivation in the challenge-versus-reward dynamic offered in games, and I often wished I could find learning in formal settings as engaging as the learning that takes place within the video game world. I believe my educational experience to be more typical than unique; today we are witnessing the emergence of a new generation of adult learners, who have been surrounded by digital media since birth (these young adults will be examined in greater detail in the next chapter). I believe that video games, as a medium, have huge, and largely untapped, potential as learning tools for this new generation of adults (and subsequent generations). By examining the learning principles found in good games, I believe that it may be possible to expand the toolset available to the adult educator, and help to make learning more engaging, and thus more effective, for the adult learner.

<sup>2</sup> Source: <http://prezi.com/mkroh1her6c7/what-adult-education-has-to-learn-from-video-games/>

## 1.2 Epistemological Stance and Core Methodology

This thesis required a critical evaluation of many different types of secondary sources (books, reports, quantitative and qualitative studies, journal articles, reviews, and so on) pertaining to the educational software industry and the adult education sector. To this end, it was crucial to determine the epistemological stance adopted by the author of this research. Epistemology can be defined as the study of beliefs about the acquisition of knowledge (Hofer, 2004, p. 130). The epistemological approach taken in this research is in line with that set out by Lindsay Prior (2003), who argues that we must consider the ‘field of action’ in which a document is produced. Fields of action “engage and involve creators (agents, writers, publishers, publicists and so on), users, (readers or receivers) and settings” (p. 2). It is also important for the researcher to acknowledge that he or she is actively interpreting documents, and therefore, the researcher is “producing the data rather than discovering it” (p. 5). Creswell (2003) describes this process as a filtering through one’s “personal lens” and stresses the importance of “acknowledging that all inquiry is laden with values” (p. 182).

The notion of the researcher as a producer and interpreter of data, led me to consider the various philosophies underpinning social research. I chose to adopt ‘social constructionism’ as the most appropriate methodology for this particular research, because the concept underlying the research, that of researcher as producer and interpreter of knowledge, is in line with the key concept of social constructionism, that of challenging assumptions to create new meaning. “Knowledge, and therefore, all meaningful reality as such, is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted within an essentially social context” (Crotty, 1998, p. 42). This holds that meaning is not discovered, but rather constructed by the researcher.

What constructionism claims is that meanings are constructed by human beings as they engage with the world they are interpreting... From the constructionist viewpoint, therefore, meaning (or truth) cannot be described simply as 'objective'. By the same token, it cannot be described as 'subjective'... Objectivity and subjectivity need to be brought together and held together indissolubly. Constructionism does precisely that.

(Crotty, 1998, pp. 43-44)

Social constructivist ideology is an important paradigm for the purpose of this research, as it will encourage the reader to challenge many of the common attitudes towards video games as a medium and social practice: for example, the idea that games are a waste of time, games are for children, games are anti-social, games encourage violent behaviour, games reinforce misogynistic social ideologies, and so forth.

### **1.3 Research Methods**

Qualitative textual analysis is the central method of research employed in this thesis. According to Scott (1990), textual analysis involves 'mediation' between the frame of reference of the researcher and those who produced the text (p. 110). A qualitative approach to document analysis attempts to mediate between the 'meaning' and context of a piece of research. According to Prior (2003), the content of a document is "never fixed or static, not least because documents have always to be read, and reading implies that the content of a document will be situated rather than fixed" (p. 4). In his practical handbook for qualitative research, David Silverman argues that the aim of qualitative textual research is to

...understand the participants' categories and see how these are used in concrete activities... The constructionist orientation of many qualitative researchers thus means that they are more concerned with the process through which texts depict "reality" than with whether such texts contain true or false statements.

(Silverman, 2005, p. 160)

Willmott (2011) identifies two types of literature review: the exploratory review and the synoptic review. An exploratory review examines the expansiveness of the literature and how the topic has been addressed, in terms of “angles, disciplines, themes, theories and key contributions” (p. 17). A synoptic review, on the other hand, is a more comprehensive study, “a concise and thorough review of all material that is assessed to be relevant to your study” (p. 17). This latter type of review is concerned with identifying and exploring ‘gaps’ in existing research. While this research inclines more towards a synoptic approach, it also includes a strong element of exploratory review: to my mind, different texts require different levels of analysis. In the conduct of this research, when approaching a potentially useful text, the first step was to read the abstract, introduction and conclusion, to ascertain whether to conduct a closer analysis. After that, rapid scanning or selective reading of the text helped form an impression of the potential relevance of a paper; sometimes, it was sufficient to read the bibliography, in order to find more relevant sources of information. Following this exploratory review, selected documents then required more attentive and repeated reading and analysis.

Alan Thomas (2004) suggests that the following criteria should be considered when evaluating documentary sources.

1. Is it authentic?

Is the document actually written by the author to whom it is attributed? For example, can it be assumed that the leader of an organisation produced the document rather than the public relations office? Does it matter?

2. Is it credible?

Is the author an impartial and/or an expert witness?

3. Is it representative?

Has the author been selective about what data to present in the document? How much confidence can be placed in the integrity of the data? It is always a good idea to seek corroboration from another source.

#### 4. What does it mean?

What do the contents of the document mean to its author? What are the implications of the research?

(Adapted from Thomas, 2004, p. 197)

The criteria listed above serve as a useful guide, when engaging in the ‘critical reading’ of secondary sources. Critical reading requires the reader to reflect on what the author is conveying, in an “active, rather than a passive way” (Murray, 2011, p. 1). In order to do so, the reader is required to have a clear understanding of the meaning of the text. A reader should also question whether the ideas presented are logically consistent, and be alert for flaws and contradictions. In the course of critical reading, the reader should be able to assess the relevance of the argument and whether the evidence is convincing. The researcher should compare the text to the work of other authors in the field, to find corroboration or contradiction.

### **1.4 Research Ethics**

When engaging in critical reading, one must always be aware of issues of power. Hidden agendas and political viewpoints invariably inform the production of texts. It is important for a researcher to be aware of the prejudices of others, as well as of his or her own. A document can tell us a lot about the social setting in which it was produced. Due to the open nature of qualitative textual analysis, it is important to be cognisant of bias at all stages of the research. Authors rarely declare their assumptions, so the researcher must expose them, if possible (Bell, 2005, p. 132). In this research, I made a concerted effort to continually verify that the authors’ evidence supported their claims. The backgrounds of the authors themselves were considered, where possible, to check if they had any stake in the findings. Contrary evidence was always sought, in order to test the truthfulness of a document’s claims.

Due to the interpretative nature of qualitative textual analysis, it is important to maintain a reflexive approach to research. “Researchers are reflexive when they are aware of the multiple influences they have on research processes, and on how research processes affect them” (Gilgun, 2010, p. 1). Creswell (2009) writes that in order to ensure reflexivity, the researcher must always be mindful of his or her own biases, values and personal background (p. 177). In the words of Judith Bell (2005) “It is tempting to reject evidence that does not support our case, but [one must] try to resist the temptation” (p. 133). The golden rule in textual analysis is that everything should be questioned.

## CHAPTER 2: SETTING THE CONTEXT: WHY IS IT IMPORTANT?

There is a new type of learner entering our adult education system today. This chapter will introduce the concept of *digital natives* and will consider the educational needs of this new generation, a generation brought up in today's digital world. The change in the way this new type of student thinks and learns will be explored, and the learning preferences of this generation will be considered, with a view to adapting adult educational practice accordingly. In doing so, it will consider the case for the introduction of video games and video game design principles, into the practice of adult education and training.

Many social commentators regard video games as a breeding ground for anti-social, misogynistic and violent behaviour (Berger, 2002; Giumetti & Markey, 2007), or, at best, a waste of time (Anand, 2007). However, when considered in the context of the key theories in adult education, there is a strong case to be made for the efficacy of digital game-based learning. Games and education will be discussed in the context of three dominant theories of learning: behavioural, constructivist and experiential, with some examples of how these three theories have application in video games. Finally, it will reflect on how games can help to actualise two philosophical approaches to adult learning, namely Freire's problem-posing approach to learning, and Gardner's ideas on individualisation and pluralisation in education.

### 2.1 Digital Natives and Digital Immigrants

The world in which we live has changed exponentially in the last thirty years. Advances in technology have profoundly transformed the way we work, play and communicate. We are now faced with a generation of young adults, for whom the internet has *always* existed. Many recent theorists believe this new generation, raised in the information

age, learn differently from previous generations (Jukes, McCain, & Crockett, 2010; Pink, 2005; Prensky, 2001; Steinkuehler, 2008).

In 2001, educator and game designer, Marc Prensky first coined the term *digital natives* to describe people who have spent their entire lives surrounded by, and using, computers, video games, portable music players, video cameras, smartphones, and all the other toys and tools of the digital age (Prensky, 2001, p. 1). The rest of us, he refers to as *digital immigrants*, and, while we learn, "...like all immigrants, some better than others, to adapt to [our] environment, [we] always retain, to some degree, [our] "accent", that is, [our] foot in the past" (p. 2). Prensky posits that "today's trainers and trainees are from totally separate worlds" (p. 13) and it is incumbent on the educator to invent new ways of learning that mesh with the capabilities of this new generation (p. 18).

Since their earliest years, the workers now coming in to our companies have ... built and run cities (*Sim City*), theme parks (*Roller Coaster Tycoon*), and businesses (*Zillionaire, CEO, Risky Business, Startup*); built civilizations from the ground up (*Civilization, Age of Empires*); piloted countless airplanes, helicopters, and tanks (*Microsoft's Flight Simulator, Apache, Abrams M-1*); fought close hand-to-hand combat (*Doom, Quake, Unreal Tournament*); and conducted strategic warfare (*Warcraft, Command and Conquer*) – not once or twice, but over and over and over again, for countless hours, weeks and months, until they were really good at it.

(Prensky, 2001, p. 38)

Prensky argues that such students are likely to be frustrated by the current approach to education "and, worse, the many skills that new technologies have actually enhanced (e.g., parallel processing, graphical awareness, random access, etc.) ... are almost totally ignored by education and training" (pp. 64-65).

Recent studies suggest that the fast, vivid, graphical, and intense media this generation was raised on has changed the way they think and learn (Prensky, 2001, p. 40-46). Prensky cites numerous neurological studies, which support the belief that exposure to

stimulation of various kinds can physically alter brain structures. An early study into the effects of video games on cognitive skills by Greenfield (1984) found that video games helped develop skill in reading visual images, hypotheses testing and “divided attention” (monitoring multiple locations simultaneously). Durkin and Barber (2002) found evidence to suggest playing video games may have cognitive benefits, “stimulating spatial skills, decision making, and reaction times” (p. 388). These studies will be examined in more detail in Chapter 3.

So how can we best present knowledge to this new type of learner? Jukes (2010) identifies eight key preferences of the digital learner:

1. receiving information quickly from multiple multimedia sources;
2. parallel processing and multi-tasking;
3. processing pictures, sounds, colour and video before text;
4. random access to hyper-linked multimedia information;
5. to network simultaneously with many others;
6. to learn “just-in-time” rather than “just-in-case”;
7. instant gratification and immediate rewards;
8. learning that is relevant, active and instantly useful and fun.

(Adapted from Jukes et al., 2010, pp. 10-14)

While it is important to develop new teaching styles for *digital natives*, this is not the only problem that the information age presents to educators. Adult educators must also find ways to orientate *digital immigrants* to their new, unfamiliar surroundings. They need to learn how to use new technologies: knowledge which is becoming ever more essential with society’s increased dependence on digital literacy. From my own work in the IT training sector, I have witnessed, at first hand, the frustration experienced by some of these students, as they try to come to terms with the world of e-commerce and e-government, which has emerged so suddenly, leaving them feeling confused and alienated. Using the medium of play to familiarise learners informally with the concepts

presented by new technology, may help to ease the anxiety felt by these learners. Just as infants learn to read and speak through absorbing the sounds and images in the world around them, digital natives learn the language of technology through immersion in video games. In the same way, I believe that video games can help digital immigrants develop computer literacy, essential in the information age.

In summary, there is a clear case for adapting education practice to meet the needs of both *digital natives*, with their new way of thinking, and *digital immigrants*, to ease their transition into the new digital world. This research will focus on the usefulness of the video game medium to help both *natives* and *immigrants* to fulfill their potential.

## **2.2 Video Games and Theories of Learning**

In this section, the research will consider a variety of different ways in which learning can be approached through video games. In order to identify these approaches, games will be discussed in the context of three major learning theories: behavioural, constructivist and experiential. Each of these theories has implications for a particular pedagogical approach and for the extent to which the employment of video games in adult education is beneficial. The application of these theories through the use of educational games will be more appropriate in some circumstances than in others, depending on the subject matter being taught. For example, repetition-and-reward, behavioural software may be well suited to learning particular skills such as typing, or driving, but has limited application in teaching creative subjects, such as philosophy or art appreciation.

## *Behavioural learning theory and video games*

Behaviourism, a concept first proposed by John B. Watson in the early twentieth century, supports the view that learning is manifested in a change in behaviour, caused by external stimuli in the environment (Merriam & Caffarella, 1999, p. 251). In 1911, Edward Thorndike proposed two laws to explain all learning (Thorndike, 2000, pp. 245-252): the *Law of Exercise* states that repetition is crucial to learning, and the *Law of Effect* states that we can strengthen a response by providing timely rewards (Egenfeldt-Nielsen, 2006, p. 191). B. F. Skinner built on Watson and Thorndike's ideas, and his work on "operant conditioning", in particular, has had significant influence on both education (Kohn, 1993) and video game design (Egenfeldt-Nielsen, 2006). Simply put 'operant conditioning' means you "reinforce what you want the individual to do again; ignore what you want the individual to stop doing" (Merriam & Caffarella, 1999, p. 252). Skinner believed that a change in behaviour demonstrates learning, and learning can be reinforced through conditioning: "a positive reinforcer strengthens any behavior that produces it... [while] a negative reinforcer strengthens any behavior that reduces or terminates it" (Skinner, 1974, p. 51).

Skinner invented the "operant conditioning chamber" (popularly referred to as the Skinner box) in order to investigate this relationship between reinforcement and behaviour. In its most basic form, a Skinner box consists of a chamber, large enough to accommodate the animal to be tested, with a button or bar, which, when pressed, dispenses food into a tray, to reward the subject (Hunt, 1993, p. 271). Equipment connected to the apparatus automatically records the frequency with which the animal (Skinner commonly used a rat or a pigeon) presses the button. Skinner could programme the box to simulate approximations of real world situations for the animal. He could, for instance, "study the learning of a response when it is regularly rewarded; the extinction of a learned response when the reward is abruptly discontinued; ... the effects of mixed results of bar pressing (such as reward coupled with an electric shock); ... and so on" (Hunt, 1993, p. 271).

One evening, a shortage of food pellets prompted Skinner to experiment with different schedules of reinforcement (Schultz & Schultz, 2008, p. 345). In an attempt to reduce the consumption of pellets, he began to schedule the rewards intermittently, regardless of the number of times the rats pressed the bar. He found that the rats would persist in pressing the bar, even after the food-dispensing apparatus was switched off (Hunt, 1993, p. 271). From this he concluded that intermittent and irregular reward (or a variable-ratio schedule of reinforcement) is a stronger incentive than predictable reward (fixed-ratio schedule of reinforcement). Skinner even made a connection between the variable-ratio (VR) schedule of reinforcement and gambling addiction, stating that "the efficacy of such schedules in generating high rates [of response] has long been known to the proprietors of gambling establishments" (Skinner, 1953, p. 104).

The influence of behavioural psychology on formal education is ubiquitous (Kohn, 1993). The "drill-and-skill", "repetition-and-reward", "carrot-and-stick" approach to teaching and learning is evident at every level, from our ABCs and multiplication tables, to the university grading system. Learning objectives are generally conveyed in behaviourist terms, identifying which behaviour is desirable and therefore, which behaviour is rewarded. In the training sector, practical skills are learned through a process of demonstration and repetition, using reinforcements to refine behaviour. In education, reinforcements can take the form of praise, rewards or activities; however, some video games have taken the idea of operand conditioning further still. Games are designed specifically to maximise reward, and most games use behavioural reinforcement mechanics to some degree. Experience points, achievements, and even encouraging "voice-overs" are used for positive reinforcement, while "Game Over" screens, diminishing health bars, loss of points, or chiding "voice-overs" are employed to discourage certain behaviour in the player. Sophisticated schedules of VR reinforcement are often used in certain types of games, (for example, puzzle games like *Angry Birds* (Rovio, 2009) or role playing games (RPGs) with levelling systems) to motivate a player to perform well. In fact, VR schedules of reinforcement are so

pervasive in massively multiplayer online role playing games (MMORPGs) like *World of Warcraft* (Blizzard, 2004), that gaming culture has coined the phrase “grinding”, a term used to describe the process of engaging in repetitive tasks, for long periods of time, to acquire skill points, or virtual, in-game goods (Bojin, 2008, p. 69). Even Microsoft’s *Solitaire* (1990), reportedly the most used Windows application of all time (Trefry, 2010, p. 2), relies heavily on the infrequent and unpredictable win for player incentive, with an estimated 36.6% success rate for expert players (Yan, Diaconis, & Van Roy, 2004).

However, behavioural incentives have been subject to much criticism in recent years, in both the education (Kohn, 1993; McLeod, 2003) and gaming communities (Portnow, Floyd, & Theus, 2010). Alfie Kohn (1993) argues that there are many problems with what he sees as the over-reliance on artificial inducements to motivate students. He suggests that “the more you want what has been dangled in front of you, the more you may come to dislike whatever you have to do to get it” (p. 83). He lists many ways in which incentives can impede performance: their negative effect on the teacher-student and student-student relationships, their failure to uncover and deal with the reasons behind problems, and their long-term negative effect on intrinsic motivation (pp. 49-95). He cites numerous studies that support the idea that rewards have a tendency to actively discourage risk-taking (pp. 64-65). McLeod (2003) suggests that, since behaviourism is stimulus-response based, it is dependent on the classroom “maintaining the appropriate stimuli to continue the intended behaviour. Thus, if a certain incentive is not present, or does not occur, then the expected and desired performance may not take place” (p. 37). Furthermore, systems of reward and punishment, place the teacher in the role of arbiter over the work of the students, thus reinforcing the power dynamic that Freire warns us about, between teacher-and-student, as oppressor-and-oppressed (Freire, 2000).

Similarly, in the gaming community, some game developers have been criticised for an over-reliance on Skinner box techniques, as an incentive to play. “Too many games are

using RPG<sup>3</sup> elements as a crutch. Bland, uninspired games will include reward systems, simply to delay your realisation of how terrible they are” (Portnow et al., 2010). With video games, there is the additional danger that, in seeking to create an engaging learning experience, educators and game designers will inadvertently develop educational software which encourages compulsive behaviour. Many players of MMORPGs<sup>4</sup> will tell you of late nights, spent grinding over a mouse and keyboard, in order to advance “just one more level”, long past the point where the activity has ceased to be enjoyable. Jon Radoff, a veteran game designer, writes that the behaviourist approach to games “channels inquiry away from the harder problems of immersion, cooperation and competition, that [are] so important to creating successful game experiences” (Radoff, 2011). There is a balance to be struck between crafting a compelling experience and creating a compulsive one.

While behavioural psychology certainly has its place in both education and gaming, there are other ways to engage learners and players. Good games use many techniques to provide engaging experiences for the player, either by fostering a sense of mystery to pique the player’s curiosity, by providing the player with an engaging narrative, or by giving the player the opportunity to master a skill, and then ultimately to demonstrate that mastery (Portnow et al., 2010). Chapter 4 will discuss some of these other means of engagement used in video games, with a view to adapting them for an adult learning environment.

### *Constructivist learning theory and video games*

Constructivism, as a theory of learning, maintains that “learning is a process of constructing meaning; it is how people make sense of their experience” (Merriam &

---

<sup>3</sup> Role playing game

<sup>4</sup> Massively multiplayer online role playing games

Caffarella, 1999, p. 261). Therefore knowledge is not simply passed from teacher to learner, rather it is constructed individually by the learner (McLeod, 2003, p. 40). Dimock and Boethel (1999) outlined six major concepts of constructivist learning theory, summarised below:

1. Learning is an adaptive activity that requires the construction of concepts and explanations, which allow an individual to function effectively in a given context. Knowledge is not fixed and it is not possible to determine objective truth with absolute certainty.
2. Learning is situated in the context in which it was created. Learning is never independent from its context. Memorising formulae and definitions, divorced from the applications that give them meaning, reduces a student's capacity to apply that knowledge out of context.
3. Knowledge is constructed by the learner. The learner is a producer of knowledge, not a passive recipient of information.
4. The role of experience and prior understanding is central to constructing meaning. The process of building new meaning is rooted in what we understand from experience. An opportunity for learning occurs when we encounter something that appears inconsistent with our existing understanding.
5. The learner is resistant to change. Knowledge stemming from an individual's experiences is deeply rooted, and the individual will resist the need to examine or doubt that knowledge.
6. Social interaction has a role in the learning process. *Cognitive constructivism* emphasises individual problem-solving and construction of ideas, while *social constructivism* holds that an individual's capacity to produce knowledge is, in part, dependant on social interaction.

(Adapted from Dimock & Boethel, 1999, pp. 2-7)

As an illustration of how educational video games might fit with the constructivist theory of learning, let us consider the video game *Spore*. *Spore* is a "god game", combining many other established game genres, such as action, role playing, real-time strategy and simulation (often abbreviated to "sim"). In the game, players control the development of new species, from humble beginnings as single cell organisms, to space-faring civilisations of sentient beings. Throughout each stage of a species' evolution (cell, creature, tribe, civilisation and space), players are provided with a variety

of tools to fashion the world around them (flora, creatures, buildings, spaceships). Once a species has finally developed space travel, players are able to explore other universes, created by other users, inhabited by other species, which follow different sets of rules. At this point, the role of the player is to determine how his or her species will interact with these alien species, created and governed by other players.



Figure 2.1 - Some of the possible creations in *Spore*<sup>5</sup>

Games like *Spore* exemplify constructionist learning theory in action. At every stage of a species' development the player is building upon knowledge and experience, to advance his or her civilisation. The player constructs a set of assumptions about how the universe operates, based on his or her experience in the game. All knowledge created is situated in context, as the user can immediately see the consequences of actions. When players ultimately venture into space, they find themselves presented with new rules that do not fit into the knowledge they have thus far established. Players are taken out of their "comfort zones", and forced to re-evaluate their previously

<sup>5</sup> Source: [http://www.spore.com/what/spore\\_ge](http://www.spore.com/what/spore_ge)

constructed knowledge. Social interaction plays a role, as players interact with other players' creations, choose whether to trade, fight or collaborate, and witness the social repercussions of these actions.

In keeping with constructivist learning theory, god and sim games<sup>6</sup> of this type provide a unique environment for learners to construct knowledge for themselves. It is suggested that there is scope for developing educational software, based on this genre (games like *Spore* (Maxis, 2008), *Minecraft* (Mojang, 2011) and *Civilization III* (Firaxis, 2001), where every game played constitutes a unique creation by the player. Educational games that adhere to a constructivist approach are often referred to as “microworlds” (Egenfeldt-Nielsen, 2006, p. 199). Games such as these may even be able to provide a space for transformative learning to occur. Transformative learning only occurs in situations when our prior assumptions are “found to be distorting, inauthentic or invalid” (Mezirow, 1991, p. xiv). If game worlds can simulate these situations, in a controlled environment, they may provide learners with the opportunity to critically reflect on their assumptions and beliefs, and ultimately, transform their frames of reference. More research is needed on this subject, but some studies have already shown that microworlds can provide strong learning experiences (Egenfeldt-Nielsen, 2006; Kafai, 1996).

### *Experiential learning theory and video games*

American philosopher John Dewey made many progressive observations about the relationship between experience and learning (Merriam & Caffarella, 1999, p. 223). He proposed that “all genuine education comes about through experience” (Dewey, 1938, p. 13). The process of understanding, according to Dewey, is *learning by doing*, or more precisely “learning by trying to do something, making mistakes, and then figuring out how to fix them” (Shaffer, 2006, p. 124). Some theorists maintain that Dewey’s claims

---

<sup>6</sup> Simulation games

are valid, but have not been adopted in mainstream education due to the expense and dangers involved in providing an environment for the learner to experiment (Monke, 2009; Shaffer, 2006). Merriam and Caffarella (1999) agree that creating the right environment is key to experiential learning. "Developing a welcoming and comfortable atmosphere, providing the right materials, and linking these materials to learners' past and future experiences is critical in assisting adults to learn" (p. 224). As Albert Einstein famously observed "I never try to teach my students anything. I only try to create an environment in which they can learn" (Prensky, 2001, p. 71). Shaffer (2006) suggests adopting video games in classroom settings, to support experiential learning, because games "can be used to create progressive learning environments where ... people learn by doing things they are interested in" (p. 126). Turkle (1997) observes that games are a natural fit for experiential learning, because "in video games you soon realize that to *learn to play*, you have to *play to learn*" (p. 70).

Merrill (2002), echoing the approach suggested by Paulo Freire (discussed below), believes that effective experiential learning has problem-solving at its core. He argues that to learn to solve a complex problem, students must start with a simpler problem. A student, who has solved the simpler problem, can then attempt problems with incrementally more complexity, until the skills needed to solve the complex problem have been mastered (p. 46). A video game is, at its very core, a set of well-ordered problems, each one more complex than the last (Gee, 2005). The player approaches these challenges in succession, learning new skills and abilities with each one, gradually feeling more confident and powerful, until he or she has mastered all the skills needed to solve the ultimate puzzle or "defeat the final boss". This is a classic example of Shaffer's dictum that we "learn by trying to accomplish some goal in the face of obstacles. When we bump into an obstacle, we have to step back and try to figure out what we know, and what else we need to know, to help us get past it" (Shaffer, 2006, p. 125).

Merrill (2002) also acknowledges that presenting problems to the learner, without appropriate guidance or support, can be damaging to the learning process (p. 46). Game designers have become expert in providing well-timed information, either right before player needs it (“just in time”), or when the player feels it is needed (“on demand”) (Gee, 2005, p. 36). Often, in traditional training settings, students are presented with all the knowledge required, without providing them with the context in which that knowledge has meaning. Thus, it is not until they enter the real world, that they get the opportunity to apply that learning, often in “sink or swim” situations. If video games can provide context, to facilitate experiential learning, in safe, simulated worlds, students will be better prepared to apply their knowledge when required to, in the real world.

It is important to remember that, while Dewey (1938) argued that learning stems from experience, he was careful to stress that this “does not mean that all experiences are genuinely or equally educative” (p.13). In fact, some experiences can “mis-educate”, in that they actually “distort growth..., narrow the field of further experiences..., [and land people] in a groove or a rut” (Merriam & Caffarella, 1999, p. 223). This is a particularly important warning for those educators who intend to employ digital game-based learning in their practice; there are myriads of bad educational video games on the market (as will be discussed in the next chapter), which certainly have the potential to mis-educate and can do more harm than good. In order to ensure that an experience has educational value, Dewey suggests that the experience must exhibit two principles: continuity and interaction. “The principle of continuity of experience means that every experience both takes up something from those which have gone before and modifies in some way the quality of those which come after” (Dewey, 1938, p. 27). No learning experience is isolated in time, and for learning to occur, the individual must be able to connect a new experience with prior experiences, as well as possible future implications (Merriam & Caffarella, 1999, p. 223). The principle of interaction states that a learning experience must involve a transaction “between an individual and what, at the time, constitutes his environment” (Dewey, 1938, p. 41). Game designers and educators must

be mindful of these principles of continuity and interaction, when designing experiential learning environments.

### **2.3 Philosophical Approaches in Practice**

Having established the relevance of video games in the context of three major learning theories, this section will consider the writings of two influential educational theorists, namely, Paulo Freire and Howard Gardner. In order to meet the needs of both *digital natives* and *digital immigrants*, it will examine how the video game medium can give practical application to the theoretical approaches put forward by these philosophers.

#### *Freire: banking versus problem-posing*

The works of Brazilian educator and theorist Paulo Freire have had a far-reaching influence on adult and community education. In his seminal work, *Pedagogy of the Oppressed* (Freire, 2000), Freire condemns what he calls the “banking concept” of education. He describes how the minds of students are treated as “containers” or “receptacles” to be “filled” by the teacher. “Education thus becomes an act of depositing, in which the students are the depositories and the teacher is the depositor” (p. 72). In this model, the best teachers are those who can fill the minds of their students with the most information, and the best students are those who meekly submit their minds as empty vessels to be filled. The teacher throws as much information at the students as possible and the students, for their part, receive, memorise and repeat the information without questioning it. Freire stated that, without inquiry, knowledge is detached from reality, and true knowledge “emerges only through invention and re-invention, through the restless, impatient, continuing, hopeful inquiry human beings pursue in the world, with the world, and with each other” (p. 72). If students file away knowledge bestowed upon them, without questioning it, they miss out on the opportunity to develop the

critical consciousness needed to become creative, active individuals, with the power to transform the world around them (p. 73).

As an alternative to the banking concept, Freire advocates “problem-posing” education (Freire, 2000, p. 79). In the problem-posing approach, teacher and student work together, in order to solve a problem. When presented with problems, students “feel increasingly challenged and obliged to respond to that challenge... Their response... evokes new challenges, followed by new understandings; and gradually the students come to regard themselves as committed” (p. 81). This requires students to discover truths for themselves, rather than merely absorbing the truths of others; thus, they are free to construct their own meanings. Malcolm Knowles (1970) suggests that adults are, in fact, more problem-centered than children, because they “tend to have a perspective of immediacy of application towards most of their learning” (p. 48).

Video games have the potential to facilitate this problem-posing type of learning. As previously mentioned in this chapter, a video game is, essentially, a set of well-ordered problems, which encourage the player to explore, think laterally and experiment, in order to discover creative solutions (Gee, 2005). Alternate reality games (ARGs), in particular, provide opportunities for the student and the teacher to work together to solve problems (ARGs are discussed in further detail in Chapter 4).

Freire emphasises that problem-posing education is dialogical from the outset (Freire, 2000, p.86) and stresses that “only through communication can human life hold meaning” (p. 77). Video games can not only support this dialogue between student and teacher, they can, due to the interactive nature of the medium, also provide opportunities for discussion with other students and virtual characters. Freire also stated that, in problem-posing education, students develop the power to “perceive critically *the way they exist* in the world *with which* and *in which* they find themselves; they come to see the world, not as a static reality, but as a reality in process, in transformation” (p.

83). Video games can demonstrate effectively that an individual has the power to transform the virtual worlds depicted, thus helping to foster a sense of agency in the player (Portnow, Floyd, & Theus, 2011).

Freire believed that all educational practice is inherently “political and never neutral” (Freire, 1998, p. 67). While politics are rarely discussed in game-based learning, many games aim to raise social and political consciousness. In *3<sup>rd</sup> World Farmer* (3rd World Farmer Team, 2005), for example, the player takes on the role of an African farmer on a small holding, and is confronted with many of the difficult decisions that poverty and conflict can cause. The game seeks to illustrate some the problems farmers face in Sub-Saharan Africa, thus creating a starting point for discussing issues of poverty in developing countries, and motivating positive social change.

Another Freirian concept adopted in critical gaming pedagogy is the technique of “codification”, where themes are explored through physical representations in media (Freire, 2000, p. 114). “This practice helps develop a sense of criticism, so that people will react to newspapers or news broadcasts, not as passive objects of the “communiqués” directed at them, but rather as consciousnesses seeking to be free” (pp. 122-123). Crocco (2011) claims that the learning principles used in video games can be used, either to reproduce existing social conditions, or to foster critical thinking about education and society. He coins the term “critical gaming pedagogy” to describe when games are used to promote critical thinking about hegemonic ideas and institutions, rather than to propagate them (p. 29). Crocco states that, when a game is used as the medium for codification, “it is treated not as a simulation of the real world, but as an artifact to be critically examined for the ways that it reifies hegemonic ideology” (p.30). In effect, Crocco is warning educators that, in view of the power of games to raise political consciousness, we should be aware of their potential to be misused as instruments of propaganda, and always be prepared to question motivation.

### *Gardner: individualisation and pluralisation*

Howard Gardner, in his theory of Multiple Intelligences (MI), argues that traditional education is too concerned with producing, what he has refers to as, “the law professor mind” (Edutopia, 1997), with a strong focus on logical and linguistic ability, the two abilities most highly prized in the traditional school setting. Gardner (1983) suggests that this model of intelligence is not sufficient to allow assessment of human potential across all societies and cultures. “Only if we expand and reformulate our view of what counts as human intellect, will we be able to devise more appropriate ways of assessing it and more effective ways of educating it” (p. 4). All the intelligences, as a whole, must be able to account for the entire gamut of abilities valued by human cultures (p. 62). Gardner defines intelligence as “a biopsychological potential to process information in certain ways, in order to solve problems or fashion products that are valued in a culture or community” (Shearer, 2004, p. 3). This definition highlights Gardner’s belief that, while intelligence includes the ability to solve problems, it is not limited to this; it also encompasses the ability to create products and provide valuable services (Shearer, 2004).

In order to identify the different intelligences, Gardner (1983) established a set of criteria to determine which mental capacities should be considered distinct forms of intelligence (pp. 62-67). With these criteria, he initially identified and defined seven intelligences: *linguistic*, *musical*, *logical-mathematical*, *spatial*, *bodily-kinesthetic*, *interpersonal* and *intrapersonal* and has since subsequently added an eighth: *naturalist intelligence*. Gardner believes that all human beings possess the eight intelligences in some capacity, and that a combination of both heredity and training will cause some individuals to develop certain intelligences over others (Gardner, 1983, p. 278), therefore, every individual should develop each intelligence to some degree “given the opportunity to do so” (p. 278).

Gardner (2009) promotes pluralisation and individualisation in education. Pluralisation involves presenting important content in a variety of ways, addressing the relevant intelligences. Individualisation involves finding out as much about each learner as possible, in order to tailor the learning experience for each individual, playing to his or her strengths (Gardner, 2009). While it may be true that current teaching methods would benefit by adjusting to these principles, several theorists have identified difficulties in doing so (Klein, 1997; Morgan, 1996; White, 2005). One practical difficulty in implementing Gardner's theories of pluralisation and individualisation, arises out of issues of funding and a scarcity of resources (Howland, Fujimoto, Ishiwata, & Kamijo, 2009). In order to facilitate individualisation, Gardner (1993) writes that "it should be possible to identify an individual's profile... and then draw upon this knowledge to enhance that person's educational opportunities and options" (p. 10). According to Gardner's paradigm, educators must begin by testing each student to determine individual intelligence profiles, thus finding where each student's strengths and weaknesses lie. They must then develop an individual learning plan, adapting the teaching methods to maximise the student's learning opportunities. Within the time and budgetary constraints of current education systems, the implementation of such in-depth testing and tailoring of learning material is highly problematic.

The video game medium would seem to be an ideal tool for educators who wish to incorporate Gardner's MI principles in their teaching methods; game technology can aid the development of individual learning plans in adult education. The pluralisation need is met because the gaming medium is multi-modal, in that content can be represented using text, visuals (photographs, videos, animations), audio (music, narration, sound effects), and even dramatic or artistic performances (drama, dance, dialogue) (O'Brien & Scharber, 2008, p. 66). Early studies into the effectiveness of digital game-based learning have found that some puzzle games can actively enhance spatial, logical-mathematical, interpersonal and bodily-kinesthetic intelligences (Chuang, Su, & Tsao, 2010).

Furthermore, after an initial investment, video games can help to individualise the learning experience, without putting huge demands on limited resources. Just as commercial video games offer varying difficulty levels, depending on a player's expertise, educational games can test to determine the learner's aptitudes and tailor the experience to suit his or her strengths, without the demand for the additional resources needed to implement individualised teaching using traditional methods.

## **2.4 Conclusion**

Ubiquitous technology and exposure to fast-paced, vivid, intense media have changed the way in which a new generation of adults process information (Prensky, 2001). The former president of the European Lifelong Learning institute, Norman Longworth (1999), writes that the future of adult education and lifelong learning must prepare for "a new era of learning in which education has to be brought to all people in the way in which they want to receive it" (p.4). Although not the only way to effectively present learning content to *digital natives*, the fundamentally interactive nature the video game medium gives it certain advantages over other media. Furthermore, some believe it can provide *digital immigrants* with a safe environment to gain vital technical knowledge, in an informal and unthreatening way. As shown above, games can facilitate behavioural, constructivist and experiential learning and may help to reify certain pedagogical theories of learning. When all of this is considered, there is a case to be made for the efficacy of digital game-based learning in adult education and training. The chapter that follows will examine how video games can be adapted for instructional purposes, with a view to identifying some of the pitfalls and drawbacks in doing so.

### **CHAPTER 3: GAMES FOR LEARNING**

This chapter will identify the skills that can be developed by playing video games, and consider how the application of digital game-based learning in adult education may enhance and expand the development of those skills. Firstly, it will present evidence, drawn from various studies, that recreational games, in general, develop specific skills in players, namely, spatial understanding, divided visual attention and multi-tasking, quick reaction times, lateral and strategic thinking, systems thinking, collaboration and leadership. It will go on to outline the history of educational gaming software, and the attempts that have been made by designers and educators, with varying degrees of success, to build on this skill set. While this chapter will outline some successful implementation of educational video games, it will also outline some failures in this regard. It is not suggested that the introduction of video games will always be beneficial to learning, but this research finds that when digital game based learning is applied in a thoughtful way, and when pedagogical thinking informs game design, benefits can arise for both educators and learners.

The chapter will also discuss some practical barriers to adopting digital game-based learning in an educational setting. These barriers fall into two broad categories, namely, scarcity of resources, such as time and money, and the attitudes of both educators and learners. Some consideration will be given as to how these barriers can be overcome. Finally, there will be a discussion on the changed role of the adult educator in the new digital world; this will require a fundamental shift in the way educators approach their practice.

### **3.1 Cognitive Capacities and Traits Enhanced through Game Play**

Every video game constitutes a learning experience (Gee, 2007; Turkle, 1997), “even if only to determine what buttons to push” (BECTA, 2010, p. 28)<sup>7</sup>. In order to play any video game, there are things one must learn: the user control set, the game mechanics, the rules of the world depicted in the game, the problems which need to be solved in order to win, etc. “You cannot play a game if you cannot learn it” writes John Paul Gee (2007, p. 3). According to Gee, it is essential to the success of any game, that it incorporates “good learning” in its design. If a game is not built on good learning principles, the game will not be played and therefore the game will not sell (pp. 3-4). Gamers enjoy a challenge and “will not accept easy, dumbed-down, or short games..., challenge and learning are a large part of what makes good video games motivating and entertaining” (Gee, 2005, p. 34).

This research has identified a number of skills and cognitive abilities that can be developed through game play, even through the use of recreational video games: skill at spatial understanding, divided visual attention and multi-tasking, quick reaction times, lateral and strategic thinking, systems thinking, hypothesis testing, collaboration and leadership skills.

There have been a number of studies to suggest that playing video games can enhance spatial reasoning (Green & Bavelier, 2003; McClurg & Chaille, 1987; Spence & Feng, 2010; Subrahmanyam & Greenfield, 1994). Recreational video games can “induce changes in a number of sensory, perceptual, and attentional capacities that are important for many tasks in spatial cognition” (Spence & Feng, 2010, p. 92). These capacities include spatial resolution, multiple object tracking and “visuomotor coordination” (p. 92). Games can help develop players’ abilities to read images such as

---

<sup>7</sup> British Educational Communications and Technology Agency

pictures, maps, symbols and diagrams (Gros, 2007, p. 29). In Bruner's terminology, a capacity for iconic representation is demonstrated through the use of images to express and comprehend ideas (Greenfield, 1996, p. 3). Greenfield found that the act of playing computer games can shift a player's representational style from verbal to iconic. "Both iconic and spatial representations are crucial to scientific and technical thinking; these representation ways take part in the utilization of all kinds of computer applications" (Gros, 2007, p. 29). These skills should prove useful in the modern workplace, where work increasingly centers around manipulating images on a screen. According to Durkin & Barber (2002), these skills are "pivotal to contemporary educational and occupational demands" (p. 377).

Another skill, linked with spatial reasoning, and often cited as developed as a consequence of playing games, is the increased capacity for divided visual attention (or parallel attention). Gros (2007) defines divided visual attention as "the skill of keeping track of a lot of different things at the same time" (p. 29). Often a game will require a player to perform a certain activity, while simultaneously monitoring a number of other variables on screen, in order to be prepared to switch attention, when needed, to some other activity. In an interesting study, Greenfield, et al. (1994) asked a sample of college students to perform one of two tasks, depending on activity from two separate locations on a computer screen. The study showed that experienced video game players "had significantly faster response times than novices" (p. 105) for both expected and unexpected stimuli. This study suggests that experience of playing games can increase a player's capacity for divided visual attention.

Closely linked to the skill of divided visual attention is the skill of multi-tasking, and there is research which shows that game play develops this ability too. Gamers are often required to perform many actions simultaneously. For example, in real-time strategy (RTS) games, such as *Command and Conquer* (Westwood, 1995) (a military simulator), players may be required to give multiple orders concurrently, and monitor the progress

resulting from these actions. Paul Kearney (2006) used a program called *SynWin* (ARS, 2005) to assess the ability to multi-task in a sample of 38 people, both male and female, aged between 14 and 60. He found that volunteers who played the game *Counter-Strike* (Valve, 2000) for eight hours a week, for three weeks, improved their capacity to multi-task, showing “statistically significant increases in multi-tasking ability” (p. 42). These findings are important, because skills at multi-tasking and parallel processing are highly valued in the modern workplace (Pink, 2005; Prensky, 2001).

The ability to react quickly is another valuable trait that can be enhanced through game playing, where players often need to “process information rapidly and think quickly to succeed” (Byron, 2008). Training for certain sectors (such as vehicular and equipment operation, military activities and air traffic control) places great emphasis on developing fast reaction times, as well as the ability to monitor multiple inputs simultaneously (BECTA, 2010). But are quickly-made decisions more error prone? Dye, et al. (2009) reviewed a number of studies that claimed that the “act of playing action video games significantly reduces reaction times without sacrificing accuracy” and concluded that “video-game training may therefore prove to be a helpful training regimen for providing a marked increase in speed of information processing to individuals with slower-than-normal speed of processing, such as the elderly, or victims of brain trauma” (p. 325).

Gee (2005) suggests that good recreational video games require the player to think laterally, and explore and rethink goals. Games often provide incentives for players to attempt different, creative solutions to problems, “to think laterally, not just linearly; and to use such exploration and lateral thinking to reconceive one’s goals from time to time” (p. 36). Furthermore, Gee argues that certain video games can even teach the player the process of systems thinking. “Games encourage players to think about relationships, not isolated events” (p. 36). In RTS games, such as *Civilization III* or *SimCity* (Maxis, 1989), players observe social systems’ behaviour over years, even centuries (Squire, 2003, p. 52). Players need to consider how their actions will affect

their future opportunities, as well as those of other players, as their civilisations develop. In addition to promoting lateral, strategic and systems thinking, Greenfield (1984) found video games to enhance the cognitive process of ‘inductive discovery’ (or hypothesis testing), that is, “the process of making observations, formulating hypotheses and figuring out the rules governing the behavior of a dynamic representation” (Prensky, 2001, p. 45). These skills are critical for scientific disciplines (Gee, 2005; Pink, 2005).

Finally, studies have found that gamers can learn the interpersonal skills of collaboration, leadership and teamwork through games (Beck & Wade, 2004; Jansz & Martens, 2005; Keating & Sunakawa, 2010). One of the most common social constructs surrounding video games is that gaming is a solitary, anti-social pursuit. A major criticism of video game culture is that it contributes to social isolation (Jansz & Martens, 2005, p. 334). However, contrary to this widely-held belief, the most popular way to play games is by logging on to the internet and playing with, or against, sometimes thousands of other players, from all over the world (Gee, 2007, p. 180). A good example of this ability to develop interpersonal skills is to be found in Blizzard Entertainment’s *World of Warcraft*.

*World of Warcraft* is the world’s most popular MMORPG<sup>8</sup>, with a subscription base of 10.2 million players, at the time of this research (Holisky, 2012). In the game, players move through beautiful, fully realised, three-dimensional worlds with multiple continents and numerous cities (Gee, 2007, p. 180). The game requires players to work in teams, and converse with each other using headsets or by typing messages. In *World of Warcraft*, the first thing a new player must do, is create a character (or “avatar”), of a particular species (Human, Orc, Elf, Dwarf, etc.), with a particular “profession” (warrior, priest, etc.). Each species and profession has unique strengths and weaknesses, and on quests, no character can survive without collaborating with others (Squire, 2003, p.

---

<sup>8</sup> Massively multiplayer online role playing game

57). For this reason, players band together into 'guilds' and share knowledge to succeed. To run a large guild, a 'master' must recruit new members, create apprenticeship programs, orchestrate group strategies and settle disputes. Indeed, becoming a guild master "amounts to a total-immersion course in leadership" (Glazer, 2006, p. 946). In *Got Game* (Beck & Wade, 2004), a book about how gaming culture is shaping the future of business, a survey of 2,100 young professionals revealed that "those with extensive gaming experience were better team players, put a high value on competence and had more potential to be superior executives" (Glazer, 2006, p. 946).

In summary, even without adapting video games for overtly educational purposes, this research has found that certain recreational video games have the ability to increase skill at spatial understanding, divided visual attention and multi-tasking, improve reaction times and promote lateral and strategic thinking, systems thinking, collaboration and leadership skills. This is not to say that all recreational video games are beneficial for the player. Like film, literature, and any other artistic medium, the game market is littered with poor products, "banal commercial distractions" with little or no learning value, but it does indicate that positive outcomes are possible in certain circumstances (Durkin & Barber, 2002, p. 377). Having considered the potential of games developed purely to entertain, let us now explore the world of educational video games, to see whether the development of game-based educational software can expand on the skill sets detailed above.

### 3.2 From Edutainment to the Serious Games Initiative: A Brief History of Game-Based Educational Software



Figure 3.1 - *Math Blaster!* edutainment software<sup>9</sup>

The idea of adapting video games specifically for an educational setting is not new. In the 1980s, marketing departments of a number of video game companies adopted the term “edutainment”, primarily to strengthen the appeal of their products to parents (Egenfeldt-Nielsen, 2007). “There is a distinct tendency for both educators and parents to cast ‘play’ in [purely] developmental terms. Children should not just play for the sake of playing, but in the process, preferably nurture other skills” (p. 264). Well-known edutainment titles include *Math Blaster!* (Davidson, 1983), *Where in the World is Carmen Sandiego?* (Brøderbund, 1985) and *Number Munchers* (MEEC, 1986). These games, once touted as the future of education because of their potential to educate and entertain simultaneously (Charsky, 2010), were primarily influenced by behavioural learning theory and were based on the assumption that learning occurs when the student has the opportunity to practice certain skills enough times (Gros, 2007, p. 25). Mostly aimed towards children, edutainment is often referred to as the first generation of educational video games (BECTA, 2010; BinSubaih, Maddock, & Romano, 2009; Egenfeldt-Nielsen, 2007). While the practice of using game elements to encourage

<sup>9</sup> Source: <http://www.superkids.com/aweb/pages/reviews/math1/blaster1/mbe.gif>

repetition has its problems (as outlined in Chapter 2), in some areas of adult education and training, this approach can be quite effective, for example typing tutorials, like *Mavis Beacon Teaches Typing* (The Software Toolworks, 1987), or driving simulators, like *DriveZone* (Figure 3.2). However the edutainment approach had many limitations.



Figure 3.2 - *DriveZone* driving simulator<sup>10</sup>

One drawback of many edutainment titles was the use of rewards as a way to push the learning forward “without really being related to the learning experience as such” (Egenfeldt-Nielsen, 2007). They suffered, therefore, from a disconnect between the game and the learning (BinSubaih et al., 2009, p. 20). Activities were repetitive and did not support progressive understanding (Gros, 2007, p. 25) and edutainment software garnered a poor reputation for repetitive “drill and practice activities masked with less than entertaining game play” (Charsky, 2010, p. 177). Professor Seymour Papert describes these edutainment titles as ‘Shavian reversals’, that is, “offspring that inherit the worst characteristics of both parents” (Van Eck, 2006, p. 18). As Dr. Henry Jenkins, Director of the Comparative Media Studies Program at the Massachusetts Institute of Technology, puts it, these games had “all the entertainment value of a bad lecture, and all the educational value of a bad game” (Gunn, 2005). Furthermore, most of these games were produced on limited budgets, and were, consequently visually inferior to,

---

<sup>10</sup> Source: <http://drivezone.ie/>

and more simplistic than, their counterparts in the entertainment games industry (Egenfeldt-Nielsen, 2007). Due to the glut of low-quality titles, released under the banner of edutainment, the genre fell out of favour, with consumers and publishers alike (Charsky, 2010; Gros, 2007).

Another reason for the commercial failure of edutainment may be found in the growing dissociation from the entertainment games industry. Broadly speaking, the educational games industry and entertainment games industry split into separate entities, with neither industry capitalising on the innovations of the other (Portnow, 2008). Both industries lost something valuable in this breach; to some extent, edutainment lost the element of fun, while recreational games did not capitalise on the opportunity to educate their audience. Many argue (Portnow, 2008; Van Eck, 2006) that the poor standard of edutainment titles can be attributed to the fact that they were designed by academics who had “little or no understanding of the art, science, and culture of game design” (Van Eck, 2006, p. 19). On the other hand, if educational games were to be developed by experienced game designers, without access to the rich theory and practice of adult education and learning, it is likely that the games created might be fun to play but ineffective in an educational context. “The answer is not to privilege one arena over the other, but to find the synergy between pedagogy and engagement” (p. 19).

In the 1990s, educational games started to move away from a purely behaviour model, towards a more “learner-centred” approach (BinSubaih et al., 2009). Developers began to take advantage of the medium’s multi-modal potential, taking early steps towards facilitating individualisation and pluralisation (previously discussed in Chapter 2). Working with the assumption that “people are not black boxes: they have previous knowledge, ideas, concepts, [and] different schemata” (Gros, 2007, p. 25), these games enabled the player to apply past learning to identify and analyse problems (BECTA, 2010, p. 29). This second generation of educational games was influenced by constructivist learning theory. The aim here was to immerse the learner in a virtual

world, similar to the real world, and allow the learner to construct his or her own knowledge, rather than to acquire it through positive and negative reinforcement (BinSubaih et al., 2009, pp. 21-22). The student learns by interacting with the virtual environment and observing the results. *Rocky's Boots* (Robinett & Grimm, 1983) is an example of this type of game (Figure 3.3).

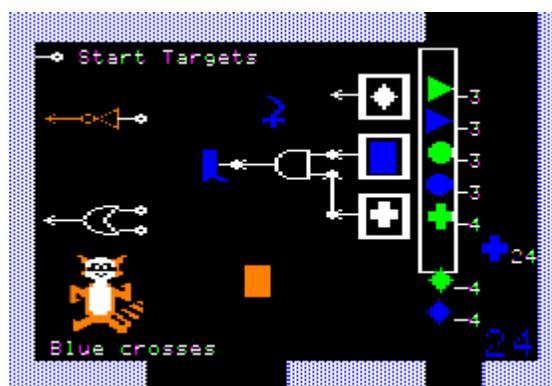


Figure 3.3 – A logic puzzle in *Rocky's Boots*<sup>11</sup>

The third, and most recent, generation of educational video games coincides with the “serious games” movement, which seeks to incorporate multiple models of learning: behaviourism, constructivism and experiential, among others (as discussed in Chapter 2). In 2002, the Woodrow Wilson Center for International Scholars founded the *Serious Games Initiative*, with the aim of helping to organise and accelerate the adoption of digital game-based learning, so as to address a number of challenges facing the education and training sectors (Metcalf, Riedlinger, Pisarski, & Gardner, 2006, p. 162). This initiative has led to the mainstream adoption of the term “serious games” by many of the key theorists in educational gaming. While definitions of the term vary, it is widely accepted that serious games are games designed with the intention of teaching specific, predefined skills and knowledge, through game play (BECTA, 2010; BinSubaih et al., 2009). These are games which have a learning model embedded, and “content is integrated into the game, so [that] learning is intrinsic to play” (BECTA, 2010, p. 27). The serious games movement attempts to redress the limitations of the edutainment

<sup>11</sup> Source: [http://media.giantbomb.com/uploads/0/2957/247187-rocky\\_screen\\_large.jpg](http://media.giantbomb.com/uploads/0/2957/247187-rocky_screen_large.jpg)

software of the eighties and nineties: the lack of intrinsic motivation and integrated learning experience, the over-reliance on drill-and-practice learning principles, the simplistic game play, and the inadequate budgets (Egenfeldt-Nielsen, 2007). Most serious games use experiential learning theory to facilitate the learning of higher order thinking skills (Charsky, 2010). They can be applied to a broad spectrum of sectors, including military, corporate, emergency services, healthcare, etc. (BECTA, 2010; BinSubaih et al., 2009; Susi, Johannesson, & Backlund, 2007).

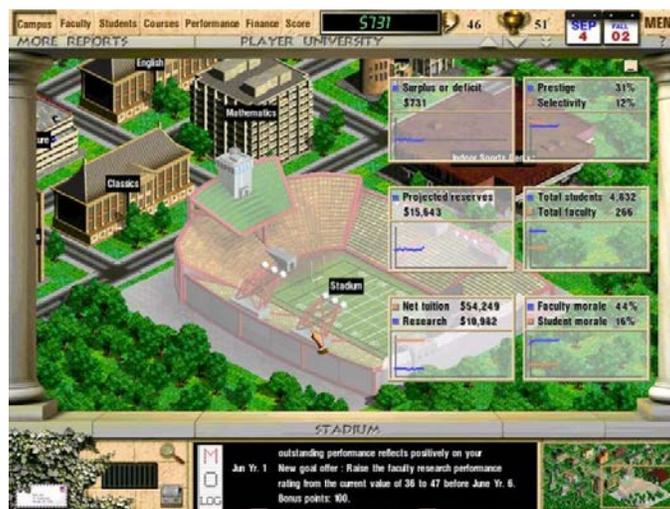


Figure 3.4 - *Virtual U*<sup>12</sup>

To illustrate how game play and learning can be merged seamlessly to create an engaging learning experience, let us consider two serious games, *Virtual U* (Enlight, 2003) and *America's Army* (Wardynski & Zyda, 2002). Created by Dr. William F. Massy, *Virtual U* is a powerful, user-friendly computer simulation that “introduces users to the complexities of running a college or university and promotes thinking about colleges and universities as systems” (Rainwater, Salkind, Sawyer, & Massy, 2003, p. 1). The goal is to teach the player about the management practices required for higher education institutions. *Virtual U* demonstrates experiential learning theory by incorporating an

<sup>12</sup> Source: <http://www.freegame.cz/public/reviews/images/f/f9/f94/resized/2-virtual-u.jpg>

underlying simulation model, common in other sim games<sup>13</sup>, such as *Civilization III* and *SimCity*, that students must decipher, through experimenting with different variables and evaluating the results (Charsky, 2010, p. 181). During the course of the game, the player creates a fictional university and must make administrative decisions, which impact on the college's success. However, the definition of a successful university is not prescribed by the game itself; it is the player who decides how success is to be measured. For example,

...one learner may feel a successful university is one that is well endowed and fiscally robust; another learner may define success as a university having a very satisfied and happy faculty and student body. Regardless of the learner's definition of success, students can learn the complexities of higher education administration while achieving vastly different goals.

(Charsky, 2010, p. 181)

*Virtual U* not only facilitates the learning of complex administrative practices by situating learners in an authentic context, it can also foster a sense of agency in the learners; players can rethink their goals at any time, and the game shows them that their choices and decisions have real weight and consequences. This learning is seamlessly built into the mechanics of game play, and it results in a highly engaging experience.

The United States Department of Defense is what Marc Prensky (2001) refers to as a "true believer" in the potential of serious games, having invested billions of dollars in the research and development of games and simulations in the last thirty years (pp. 295-306). In 2001, it sponsored a project, proposed by Colonel Casey Wardynski and Michael Zyda, to design a video game that would double as a training and recruitment tool. The original proposal for the game stated:

Games hold their audience because they are attractive on the outside (what the player sees and hears while playing) and gripping on the inside (what the player

---

<sup>13</sup> Simulation games

thinks and feels while playing). Sound, music, image, and animation all play their part in satisfying the ears and eyes. Inside a computer game identifiable characters and a dramatic story both play key roles. In addition, because one *plays* the computer game, a smooth, uninterrupted sequence (or loop) of actions and decisions must be present. When a game works well, the player must execute this inner loop for hundred of cycles. If it is smooth enough, the effect is compelling.

(Prensky, 2001, p. 305)

The project resulted in the phenomenally successful *America's Army*, perhaps the best known example of a serious game application (BinSubaih et al., 2009; Susi et al., 2007). *America's Army* is a free-to-play first-person shooter (FPS), which aims to compete with big budget, mainstream commercial titles, such as *Call of Duty 4* (Infinity Ward, 2007) in terms of features and graphical capabilities (Andersen & Kurti, 2009). The game design has a focus on realism and authenticity; all weapons and equipment in the game are meticulously modeled on their real world counterparts. Guns, for example, behave in authentic ways, with realistic recoil, reload times and bullet trajectories (Zyda et al., 2003). The player can choose from a variety of 'career paths' (such as sniper, marine, combat engineer, medic, and so on) and, after 'basic training', which includes the same marksmanship and physical tests as 'real' army training, the player can undertake missions, inspired by real-life events, which involve joining a team playing against other teams (Prensky, 2001, p. 304). All scoring in the game is built around the U.S. Army's seven stated core values: loyalty, duty, respect, service, honor, integrity, and courage (Zyda et al., 2003). Players' actions are mapped onto these values and they are rewarded with new equipment, skills and missions, for successfully completing challenges in an "honorable" way (Charsky, 2010, p. 191). Conversely, players are punished for not adhering to these values, and those who consistently violate the rules "wind up in the brig" (Prensky, 2001, p. 305).

*America's Army* was a hugely popular video game. Within two years of its initial release, the game had been downloaded 17 million times and had a community of 4 million registered players (Susi et al., 2007, p. 11), making it "the most successful game launch

in history at the time” (Andersen & Kurti, 2009, p. 49). By 2007, players had logged 212 million cumulative hours. *America’s Army* represents the first example of a serious game reaching a large, mainstream audience (Prensky, 2001, p. 305)



Figure 3.5 - America's Army<sup>14</sup>

When discussing a recruitment tool such as *America’s Army*, one must always be mindful of the many ethical issues that arise. Crocco (2011) writes that “while the gamer is immersed in the thrill of play, the game is busy imparting basic military training and the ideology of benevolent imperialism. The successful player thus masters the game, but not before adopting its intrinsic values, attitudes, and beliefs” (p. 27). While one must always be aware of the ethical issues, and potential for misuse as propaganda, one cannot argue with the effectiveness of the game as a learning tool. From a training perspective, the military have found game play to result in marked improvements in hand-eye coordination, the ability to multi-task, the ability to work in a team using minimal communication, and a willingness to take immediate action (Susi et al., 2007, p. 11).

---

<sup>14</sup> Source: <http://demiurgestudios.com/games/americas-army-rise-of-a-soldier/>

Both these serious games, *Virtual U* and *America's Army*, although geared towards radically different sectors, demonstrate that when learning is built into the core game design, outcomes can be highly successful, both commercially and educationally. Serious games have been developed and successfully implemented in many fields of adult education, to teach a wide range of subjects: science (*Supercharged!*), history (Kurt Squire's adaptation of *Civilization III* in a classroom environment), mathematics (*AquaMOOSE 3D, Dimenxian*), medicine (*Re-Mission, Interactive Trauma Trainer*), law (*Objection!*), customer support (*Where in the World is Carmen Sandiego's Luggage*), architecture (*The Monkey Wrench Conspiracy* to teach Computer Aided Design software) and corporate training (*Straight Shooter!*)<sup>15</sup>.

Before the inception of the serious games movement, there were many different names used to describe the development of video games for educational purposes: "edutainment", "interactive learning experiences", "immersive game-based education", etc. These overlapping initiatives have now been amalgamated under the banner of the serious games movement, a movement which has been endorsed by many of the most influential theorists in the field: John Paul Gee, Marc Prensky, Henry Jenkins and Kurt Squire, among others. The combined influence of these theorists is, I believe, likely to bring about wider acceptance of these radical ideas in education. While some dismiss serious games as a mere rebranding of edutainment, designed to move away from the negative connotations associated with the genre (BinSubaih et al., 2009), others argue that serious games are fundamentally different from edutainment because they target a different audience (Michael & Chen, 2005). While edutainment is aimed primarily towards young children, serious games target a much wider and more diverse audience (all types of education, for all ages). However, it may be that the term itself has the potential to further divorce the educational and entertainment game industries. As with

---

<sup>15</sup> Examples are too numerous and varied to discuss in any great detail here; for those interested in reading more about the adoption of serious games in these areas, see *Digital Game-Based Learning* by Marc Prensky (2001).

the term 'edutainment', the designation 'serious games' implies a separation of recreation from education. Instead of uniting the two, this terminology may further widen the divide between "games that educate" and "games that are fun", and I believe there is no reason why good educational games cannot be both. For this reason, I will use the term digital game-based learning to describe all types of educational gaming software.

### **3.3 Practical Barriers in Adopting Video Games for Educational Settings**

While video games may have significant potential as tools for education and training, many theorists ignore the more practical problems encountered by educators who seek to use these tools. This section will consider the obstacles that arise in the practical application of digital game-based learning in adult education. This research finds that the practical difficulties fall into two broad categories: obstacles that arise as a result of scarcity of certain resources, such as time, space and equipment: and those that stem from the attitudes and level of technical expertise of both student and teacher.

#### *Time and resources*

In most formal educational environments, lessons are split into forty-five minute or one hour periods, which are spread apart throughout the week. These short spans of time are insufficient to facilitate digital game-based learning (Baek, 2008). Often, video games, particularly the more complex games, can take at least an hour before the player becomes familiar with the game mechanics, so that real, valuable learning can begin (Egenfeldt-Nielsen, 2004). A gap of several days between lessons further compounds this problem: students are likely to forget information in the initial introduction or tutorial, because they have not had long enough to familiarise themselves with how the game behaves (p. 19). Furthermore, as will be addressed in the section below, it is vital to allow time for discussion in order to enable students to transform their experiences in the game into concrete knowledge (BinSubaih et al.,

2009; Gros, 2007). There may also be a lack of time available to teachers to familiarise themselves with the game and methods of producing the best results from its use (Gros, 2007, p. 35).

Technical difficulties present another, probably unavoidable, barrier to digital-game based learning for adult education. From personal experience in the IT training sector, I can testify that many institutions in Ireland have outdated or neglected computer facilities. Some of today's high-end educational gaming software may require powerful processors and advanced graphics cards, and will, therefore, not run on older machines. There is also the logistical problem, that at the start of each session, a student must become familiar a different machine, and technical issues will inevitably eat into the time allocated for the session (Egenfeldt-Nielsen, 2004).

To overcome these issues of time constraints and technical difficulties, this researcher makes two recommendations. The first is that courses incorporating digital game-based learning in adult education should be scheduled for intensive bursts, of week-long periods. This will allow time for sufficiently extended bouts of game play and, crucially, post-game discussion. It will also reduce the amount of time lost in addressing familiarisation and technical difficulties at the beginning of each session. The second recommendation is to have a technical support technician on hand to support the teacher and the students when technical difficulties arise.

It is recognised that resources to fund technical support are limited. It is also important to remember that an increased reliance on technology in adult education can further exacerbate the inequality created by the "digital divide" (DiMaggio & Hargittai, 2011), between the those who can afford access to the technology and those who cannot. "The more affluent and better educated adults, with home computers, have the access to information and instructional packages that make them even more informed" (Merriam & Caffarella, 1999, p. 18) thus increasing the divide between the 'haves' and the 'have

nots'. This is also true at a global level, where the wealthier countries have better access to the latest technology presenting a "global divide" (DiMaggio & Hargittai, 2011, p. 16). "On the other hand, technology's potential for increasing access to learning for people of all ages and possibly all economic levels is unlimited" (Merriam & Caffarella, 1999, p. 18).

### *Attitudes*

It is far easier to change timetables and equipment than it is to change attitudes of educators and learners. Many educators remain sceptical of the value of game based-learning (Egenfeldt-Nielsen, 2006, p. 188). Clifford Stroll (1999) voices the concerns held by many of these educators. Criticising "the obsession of turning the classroom into a funhouse" (p. 13), he argues, in *High-Tech Heretic*, that computers

...direct students away from reading, away from writing, away from scholarship. They dull questioning minds with graphical games where quick answers take the place of understanding, and the trivial is promoted as educational. They substitute quick answers and fast action for reflection and critical thinking... Turning learning into fun denigrates the most important things we can do in life: to learn and to teach. It cheapens both process and product: Dedicated teachers try to entertain, students expect to learn without working, and scholarship becomes a computer game."

(pp.13-14)

These critics hold that the adult education should deliver quality education and not entertaining experiences. Others argue that quality education and entertaining experiences are not mutually exclusive, and that intellectual challenge should be enjoyable as well as instructional (Smith-Robbins, 2011).

In addition to these concerns, many educators, unfamiliar with the medium of video games, are informed by social constructs, perpetuated by sensationalist news coverage

(Monke, 2009). This media bias promulgates the idea that video games cause violent, anti-social behaviour, despite a lack of evidence to support these claims (Baek, 2008; Crocco, 2011; Kutner & Olson, 2008). Furthermore, teachers informed with negative attitudes convey those attitudes to their students. Dorn (1989) found that the educator's attitude towards video games influences the effectiveness of educational video games in an educational environment.

Similarly, Egenfeldt-Nielsen (2004) found that the extent of an educator's familiarity with technology is a factor, which can help or hinder the effective application of digital game-based learning. He found that teachers with limited experience of computers have difficulty addressing questions from learners, which arise as a result of game play, and also have difficulty structuring the lesson to effectively balance game play with other activities (p. 20). In common with their teachers, many learners experience similar misgivings, for similar reasons. In general, these learners and educators are from the *digital immigrant* generations (Prensky, 2001). This issue raises a dilemma for professionals in adult education: should the profession continue to support *digital immigrant* ways of learning, while neglecting the needs of the new generation, or focus on creating engaging interactive learning experiences for *digital natives*, leaving teachers and learners from previous generations to fall behind? A debate is needed among professionals to find a balance between these two approaches.

### **3.4 The Role of the Educator in Digital Game-Based Learning**

The adoption of digital game-based learning in adult educational settings has major implications for the teacher's place in the learning experience. As educators, we must be prepared to examine and re-examine our role, in order to be ready for the challenges that this new learning environment will present (Prensky, 2001). One significant difference from traditional pedagogical models is that digital game-based learning presents a major shift of control from teacher to learner (Stapleton, 2004; Tüzün, 2007).

Games are specifically designed for players to experience interactively, in order to construct their own meaning (Stapleton, 2004, p. 2). Students explore these virtual worlds at their own pace, and have a great deal of control over the direction of their learning. Traditionally, these decisions were made by the teacher. This shift in authority, from teacher to learner, where they become co-participants in the learning process echoes Freire's philosophy that teacher and learner "become jointly responsible for a process in which all grow. In this process, arguments based on 'authority' are no longer valid; in order to function, authority must be on the side of freedom, not against it" (Freire, 2000, p. 80). This transfer of control does not mean that the workload of the teacher is reduced, nor that the teacher becomes obsolete (Tüzün, 2007). Instead, the role of the teacher changes from that of instructor to that of facilitator and guide (p. 471). In fact, it can be argued that this change represents a return to the ancient role of the educator; the etymology of the word 'educate' stems from the Latin root *e ducere*, which literally means 'to lead forth' (Oxford English Dictionary Online, 2012).

The rebalancing of authority also requires a change in the way the teacher monitors the learners' progress. While students should be actively encouraged to explore the game world, the teacher must impose some structure, in order to meet predetermined learning outcomes. Monitoring the learners' progress is still an essential part of the teacher's role. There are two main ways in which teachers, who adopt digital game-based learning in adult education, can monitor students' progress, and guide them through the learning experience. In the first instance, teachers can 'float' between students, to visually and verbally monitor their participation, and take any questions related to content, game experience or technical issues (Tüzün, 2007, p. 472). A second way is for teachers to get involved in the game experience as participators. Anders Frank (2007) suggests the inclusion of a defined role for the teacher, within the game design itself (p. 571). A particular advantage of this approach is that the game can provide a set of features, specifically for the teacher. It can provide, for example, access to clear, detailed metrics to illustrate learners' progress. With this information, teachers can more readily identify the learners who need support. This has an added advantage, in that it

can be integrated into a virtual classroom, where students and teachers can work remotely, thus helping to overcome problems of space and distance.

Many theorists hold that post-game discussion is of utmost importance, in order to reinforce the learning constructed in games (BECTA, 2010; BinSubaih et al., 2009; Egenfeldt-Nielsen, 2007; Gros, 2007). BinSubaih (2009) writes that, in order to convert play into valuable knowledge, students must explain the learning to others, as thinking about the best way to convey this knowledge forces them to reflect on, and articulate, the content (p. 22). Freire (2000, p.83) stresses that dialogue is an indispensable part of problem-posing education (p. 83), “dialogue is never an end in itself but a means to develop a better comprehension about the object of knowledge” (p. 18). Gros (2007) suggests that, in a digital game-based learning environment, the most important function of the teacher is to “provide elements of analysis and reflection”, to give weight to the learning encountered in the game (p. 35). The teacher must guide these discussions and ensure that they stay relevant and appropriate. He or she must follow the progress of the students, and balance the in-game learning with other activities (such as discussion), in order to expand the scope of the learning (Egenfeldt-Nielsen, 2007, p. 275).

Another important responsibility of the educator is to assume an active role in the educational game design process. As outlined previously in this chapter, there is a need to strike a balance between pedagogy and engagement (Van Eck, 2006). Game designers and educators must work together to ensure that learning is incorporated seamlessly into game play (Smith & Mann, 2002). In order to create common understanding, both designer and educator will have to learn much about the other’s respective discipline. In order to communicate effectively, teachers will need to have a grasp of game design practices and terminology. This knowledge will also help them in the classroom, when technical difficulties arise. Teachers must also become knowledgeable about the products themselves. They must be able to “identify how a

particular game is relevant to some component on the curriculum, as well as the appropriateness of the content within the game” (Gros, 2007, p. 35).

### **3.5 Conclusion**

In summary, research has shown that games have the potential to develop a range of key skills in today’s cohort of adult learners. Digital Game-Based Learning can be successfully incorporated into formal adult education, provided learning is built into the game design, the design is based on pedagogical principles, and the teaching programme is adapted to facilitate game play. This will present a number of practical difficulties, including scarcity of time and resources, and a shift in attitudes of teachers and learners. It is suggested that the adoption of digital game-based learning places a significant responsibility and an increased workload on adult educators who wish to incorporate educational video games into their practice. They will need to re-examine their approach to teaching, learn to guide learning without controlling it, engage students in analytical and reflective debate, and learn many new technical terms and skills. But it could be argued that all educators, even those who have no interest in digital game-based learning, need to re-examine their approach to teaching in similar terms, in order to educate the new cohort of *digital natives*.

## **CHAPTER 4: LEARNING FROM GAMES**

As demonstrated in the previous chapter, digital game-based learning can be extremely versatile, adaptable to almost any subject matter, and highly effective when applied correctly (Prensky, 2001). A number of drawbacks were identified, among which are the demand on time and money required to develop content-specific, educational games for adult educational settings, and the difficulty of familiarising educators with new technology. There may be, however, a way to apply the principles of game design to adult education, in order to reap the benefits of the motivational aspects of video games, without the high resource demand required for technical development. This chapter will introduce the concept of ‘gamification’; a concept in its infancy, that is currently very much in vogue in corporate and marketing arenas (Antin, 2011; Frey, 2012). It will consider how the principles of gamification can be applied to education and, in order to do so, will seek to establish what it is, in essence, that makes video games engaging, both from a game design perspective and an educational perspective. Finally, it will examine a few suggestions as to how these ideas might be implemented, without the need for a full-blown technological overhaul of our classrooms. Before doing so, however, we must explore the philosophy of “gamification”.

### **4.1 Philosophy of Gamification**

According to Karl Kapp (2012), gamification is the employment of game-based mechanics, aesthetics, and game-thinking to engage, motivate action, promote learning, and solve problems (Kapp, 2012, p. 66). “The intuitive idea is simple and appealing,” writes research scientist, Judd Antin (2011), “games are engaging, so making anything more game-like should make it more engaging too” (p. 11). Currently, gamification is a popular buzz-word in the corporate sector and amongst marketing moguls. One of the most well-known examples can be seen in a recent Starbucks promotion, which

employs the smartphone app *foursquare*, “a location-based check-in service” (Smith-Robbins, 2011). Using global positioning system (GPS) technology, *foursquare* awards points to customers for every time they ‘check-in’ at a different location. Enough ‘check-ins’ at your local Starbucks will earn you a Starbucks badge, entitling you to discounts in that café. The customer who checks in at the store most often, becomes the “mayor” of that particular store, a title that qualifies him or her for nationwide discounts and other rewards (Smith-Robbins, 2011, p. 58).

Most of the commercial uses of gamification focus on the behavioural aspect of video games (Liyakasa, 2012), using points, levels and badges to motivate consumer activity. The application of these inducements is not new to formal education, which has used points, grades, gold stars and other incentives, such as scholarships and awards, for centuries (Kohn, 1993). However, reward systems are only one of the ways in which games engage the player (Kapp, 2012; Portnow et al., 2011). If we can pinpoint what it is that makes games engaging, we may be able to provide the adult educator with new tools to teach from the perspective of engagement and activity (p. 66). In order to do this, we must first look at what the discipline of computer science can teach us about player engagement.

The MDA framework (standing for mechanics, dynamics and aesthetics) is a formal model for understanding video games from the game designer’s perspective (Hunicke, LeBlanc, & Zubek, 2004). Hunicke et al. (2004) formalise the consumption of games by breaking them into three elements, *mechanics*, *dynamics* and *aesthetics*:

“The *mechanics* of a game are the basic components out of which the game is built: the materials, rules, explicit goals, basic moves, and control options available to the players. The *dynamics* of the game are the behaviors that result when applying the game’s mechanics with player input during game play...The *aesthetics* of a game, finally, capture the subjective experience of the player, the emotional response or pleasure that the game is designed to evoke”

(Aleven, Myers, & Ogan, 2010, p. 71).

These three elements can roughly be simplified as 'rules', 'system' and 'fun', respectively (Hunicke et al., 2004, p. 2) and it is this element of 'fun' which we should try to harness for adult education. Studies have shown that an element of fun can have a positive effect on the learning process by "inviting intrinsic motivation, suspending one's social inhibitions, reducing stress, and creating a state of relaxed alertness" (Bisson & Luckner, 1996, p. 108; Cordova & Lepper, 1996). Norman Longworth, former president of the European Lifelong Learning Institute, writes that "learning has to become fun, enjoyable, a pleasurable thing to do - whether it is for work, for leisure, or for life - it has to become a part of our lives in much the same way as shopping or banking or playing games" (Longworth, 1999, p. 4).

From the game designer's point of view, the game mechanics give rise to the dynamics, which in turn, give rise to desired play aesthetics. From the player's point of view, this works in reverse, where the aesthetics set the tone, which is born out of the dynamics, determined by operable mechanics (p. 2). This relationship is illustrated in Figure 4.1. It is the third component, aesthetics (the desirable emotional responses to be elicited from the player), that we wish to focus on; this is how game designers build games with engagement at their core.

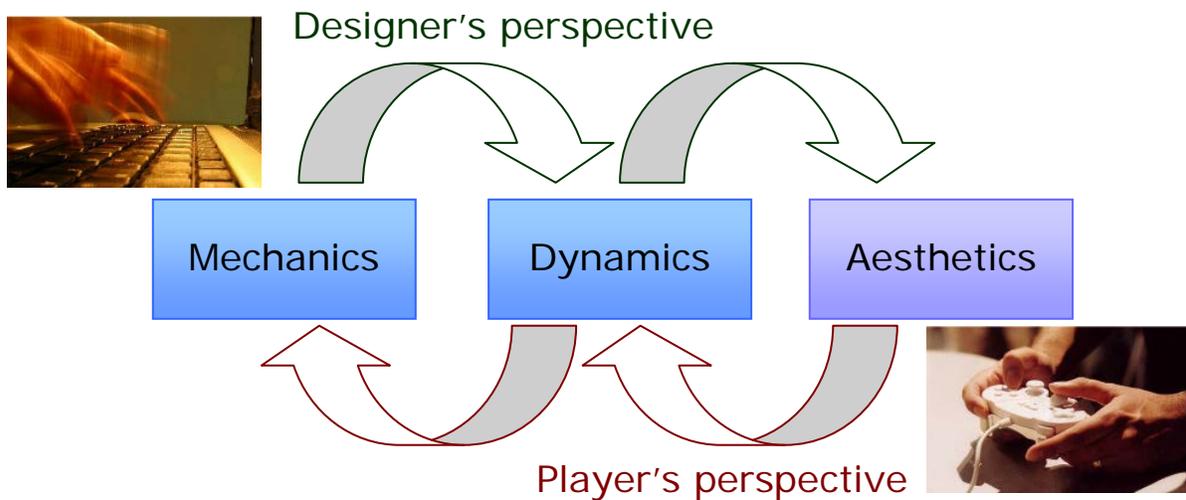


Figure 4.1 – The MDA framework (Adapted from Hunicke et al., 2004, p. 2)

Hunicke et al. list eight play aesthetics found in games, but stress that this list is not exhaustive: *sensation* (sensual-pleasure), *fantasy* (make-believe), *narrative* (drama), *challenge* (obstacle course), *fellowship* (social framework), *discovery* (unchartered territory), *submission* (pastime), and *expression* (self-discovery) (p.2). A video game will typically inspire a number of these aesthetics in varying degrees, depending on the type of game. For example a fast-paced FPS<sup>16</sup>, like *Call of Duty*, might evoke challenge, sensation, competition, and fantasy aesthetics; while a sim game<sup>17</sup> like *Age of Empires*, might evoke discovery, fantasy, expression and narrative aesthetics.

Prensky approached this same question of engagement from an educational perspective and compiled a similar list. There is some overlap here with Hunicke et al.'s aesthetics of play:

Games have *interaction*. That gives us *social groups*.

Games have *goals*. That gives us *motivation*.

Games are a form of *fun*. That gives us *enjoyment and pleasure*.

Games are a form of *play*. That gives us *intense and passionate involvement*.

Games have *rules*. That gives us *structure*.

Games are *interactive*. That gives us *doing*.

Games have *outcomes and feedback*. That gives us *learning*.

Games are *adaptive*. That gives us *flow*.

Games have *win states*. That gives us *ego gratification*

Games have *conflict/competition/challenge/opposition*. That gives us *adrenaline*.

Games have *problem solving*. That sparks our *creativity*.

Games have *representation and story*. That gives us *emotion*.

(Prensky, 2001, p. 106)

---

<sup>16</sup> First-person shooter

<sup>17</sup> Simulation game

Another educational theorist, who has considered engagement, is Karl Kapp (2012). He writes about four game elements that can readily be applied in education; the freedom to fail, the interest curve, story telling and feedback. As can be seen from the above examples, there is no unified theory as to what makes a video game engaging, but many of these play aesthetics correspond neatly with the higher level needs of Abraham Maslow's theory of human motivation (1943, 1954). While the language used is different, the sentiments are the same: *expression* can be read to mean *creativity*, *challenge* to mean *problem solving*, etc. Maslow referred to these as self-actualisational needs and these can be seen "in a person's desire to be all that he or she is capable of becoming" (Merriam & Caffarella, 1999, p. 257). Emotions, such as these (exploration, mystery, problem-solving, confidence, achievement, etc.), can encourage adults to pursue lifelong learning (Longworth, 1999; Smith-Robbins, 2011). What motivates adults to pursue lifelong learning is a contentious issue, but many believe that a 'love of learning' is a powerful motivator (Bisson & Luckner, 1996; DiCarlo, 2009; Longworth, 1999). McCombs (1991) writes that lifelong learning is "facilitated by 'uncovering' natural learning tendencies and enjoyment of learning and by reducing or eliminating negative, insecure thoughts and belief systems" (p. 120). It follows then that if lessons are designed to be engaging, create a sense of fun and induce a state of 'relaxed alertness', those lessons will be more easily learned and better remembered (Bisson & Luckner, 1996; Cordova & Lepper, 1996).

The next section will consider a model to incorporate these elements into the learning process. We will proceed to examine, in greater detail, four aesthetics distilled from the theorists listed above (*narrative, freedom to fail, feedback, collaboration and competition*), and consider how they can be applied in adult education.

## 4.2 Gamifying Adult Education

### *MDA Framework for Adult Education*

A number of practitioners have attempted to apply gamification principles to a learning environment (Smith-Robbins, 2011; Yamabe & Nakajima, 2012). However, this research has uncovered no formal model for the application of play aesthetics in education. There is precedent for applying models derived from computer science in adult education. Computer science and technology has had a real impact on the way in which we talk about adult learning. “We process students and information; we plan learning activities with an eye to inputs, flow, and outputs; we provide feedback to individual learners... Indeed, we program learning experiences and ourselves” (Merriam & Caffarella, 1999, p. 15). For these reasons, let us consider the MDA framework from an adult education and training perspective. If, instead of ‘game designer’ and ‘player’, we substitute ‘educator’ and ‘learner’, how does do the three components of the MDA framework translate to serve adult education?

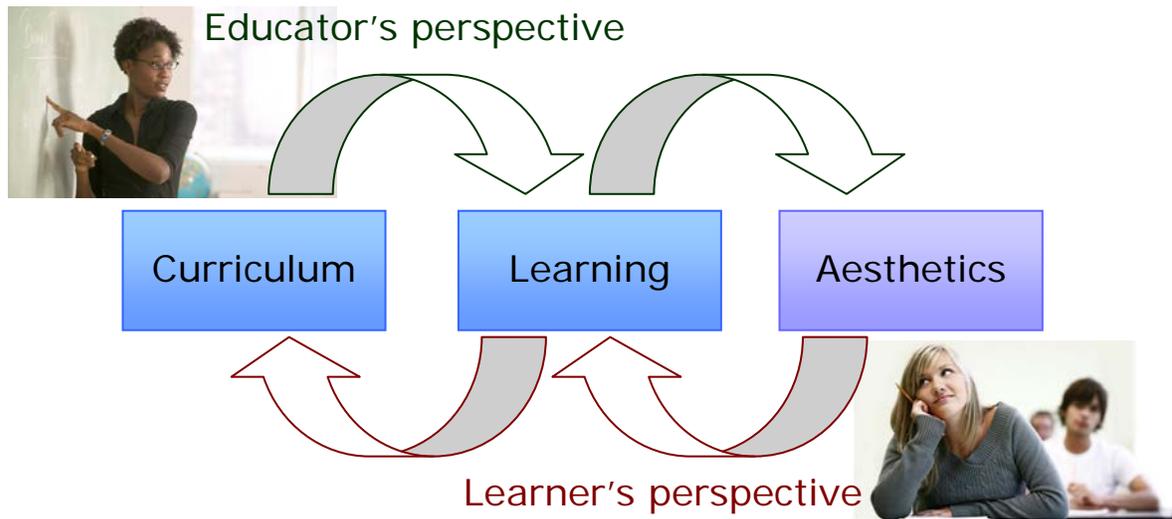


Figure 4.2 – The MDA framework adapted for an adult education setting

For the purposes of this thesis, it is suggested that the *mechanics* equate to *curriculum*: the content, rules, learning objectives, assignments, etc. The *dynamics* are the result of the student interacting with the *curriculum*; in other words, the *learning process* itself. As with the original framework, the *aesthetics* are the ‘methods of engagement’ that can inspire a ‘love of learning’. This relationship is illustrated in Figure 4.2 above. If this framework is placed at the heart of curriculum development, it will ensure that the learning process has engagement at its core. Having put forward a framework for gamifying adult education, let us now consider the four aesthetics of engagement, distilled from the various theories mentioned above: *narrative*, *freedom to fail*, *feedback*, and *collaboration and competition*.

### *Narrative*

Human beings are natural storytellers and are readily drawn into a good story (Jensen, 2012, p. 42). Game designers know this and, in many games, player activity is driven by compelling drama, integrated into game play. A good story, with well-formed characters, can make the player care about the game and give his or her actions meaning. Twenty-three years ago, when my classmates and I first encountered *The Oregon Trail* (discussed in Chapter 1), we were entranced by the story and wanted to succeed, because we did not want our band of settlers to perish. In addition, “games that consider the story of the player’s experience—the ‘player journey’ from novice to master—are deliberately constructed to support real player growth, learning, and self-betterment” (Jensen, 2012, p. 42). Research suggests that people can learn data more effectively, when they are embedded in a story, rather than in bulleted or list form (Kapp, 2012, p. 67).

Adding elements of fantasy and role play to a lesson can, in the same way, help learners to become more involved in content and to explore the practical application of theory. Educators who have adopted exercises from Augusto Boal’s (2008) *Theatre of*

*the Oppressed*, can give testament to the power of role play in fostering learner involvement. Another narrative technique, often employed in video games to promote engagement, is mystery. Human curiosity is a powerful thing, and people love to unravel mysteries (Portnow et al., 2010). This research suggests that alternate reality games (discussed below) can be developed for educational settings, to foster curiosity in the learner about the course content.

Finally, another facet of the narrative aesthetic is the art of pacing. Video games, like film and literature, have found that good pacing is essential to creating engaging experiences. The “interest curve” of a game is the sequence of “events that occur over time to maintain a player’s engagement within a game... to grab and hold the player’s attention” (Kapp, 2012, p. 67). An optimal interest curve begins with a high level of interest to hook the player’s attention, and then settles into a series of peaks and valleys, which gradually builds to a climactic finish. This curve is well illustrated in figure 4.3, which tracks the level of viewer interest in George Lucas’ film, *Star Wars: A New Hope* (Kurtz & Lucas, 1977).

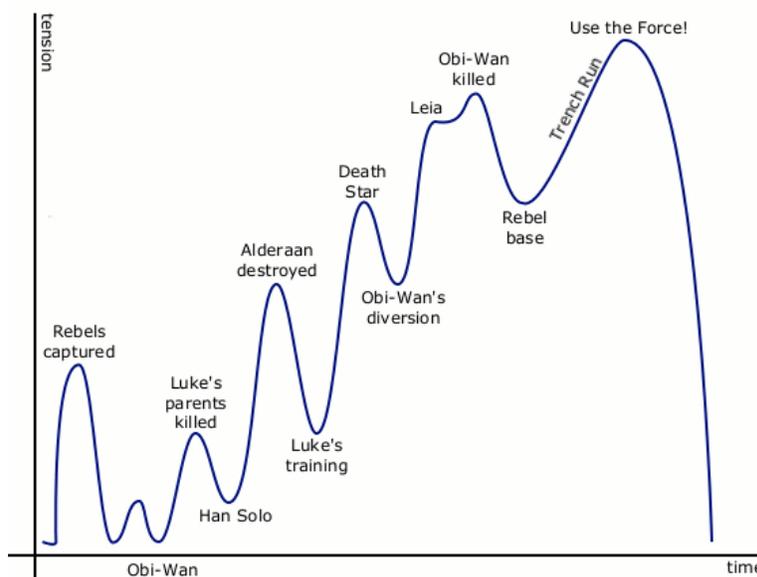


Figure 4.3 – Pacing in *Star Wars: A New Hope* (Wesołowski, 2012)<sup>18</sup>

<sup>18</sup> Source: [http://www.gamasutra.com/view/feature/4032/beyond\\_pacing\\_games\\_arent\\_.php](http://www.gamasutra.com/view/feature/4032/beyond_pacing_games_arent_.php)

Game designers often use this model to pace their games (Wesołowski, 2012). In terms of adult education, initial curiosity could be piqued by presenting an interesting case study, or even a presenting a mystery for the learners to consider. Following the initial engagement, the next step is to settle down to the core content. “If the learning experience is well-crafted, the learner’s interest will then rise again, temporarily peaking at different points” (Kapp, 2012, p. 67). Finally, the lesson should end on a grand finale, to leave a lasting impression on the learner.

### *The Freedom to Fail*

In well designed video games, players are required to operate within, but at the outer edges of their competence (Gee, 2007, p. 223), thus failure is always a possibility. For this reason, good video games lower the consequences of failure (Gee, 2005, p. 35); players have multiple lives and after a failed attempt, players will usually restart at a nearby location, with all their resources intact. In fact, failure in video games can be viewed as a good thing: when tackling a challenge, a player uses initial failures to recognise patterns and find solutions to problems, sometimes failing intentionally, to see what will happen (p. 35). Psychologists describe this desire to persevere in the face of failure as the “flow” mentality (de Luna, 2012, p. 6). By building it in as part of the design, game creators facilitate multiple opportunities to perform a task, until it is mastered, thereby overcoming the “sting of failure”.

“In most instructional environments, failure is not a valid option,” writes Kapp (2012, p. 66). Learners are scored objectively, and opportunities for adaption and re-evaluation are seldom available (de Luna, 2012, p. 5). “If you do not succeed at the first instant, then unfortunately, there will not be a next time, not until the final at the very least. However, by then, your doubt in your abilities may be fully instilled” (p. 5). Moreover, many students will tell of their fear of feeling foolish by asking the wrong question. “The

risk of failure without punishment is engaging. Learners will explore and examine causes and effects if they know it's OK to fail. In many cases, they will learn as much from seeing the consequences of their failure as they will from a correct answer" (Kapp, 2012, p. 66). Kapp suggests that educators should seek to create a comfortable, playful environment, which allows learners the freedom to fail. By exposing them to realistic consequences, which demonstrate the cause and effect of poor decisions, learners will be encouraged to explore content, and take chances with decision making (p. 66 – 67).

### *Feedback*

Game designers are experts in providing feedback to the player. In a well designed video game, players can see their progression through activity. Their scores, health, goals, and how close they are to achieving those goals are evident from a glance at the screen. Achievement, points, and leveling systems are part of this, but the feedback is not limited to these. The interactive nature of the medium allows for "just-in-time" and "on-demand" feedback for the player (Jukes et al., 2010, p. 13). Translated to an adult education setting, an educator should set out clear goals, ensure students wish to achieve these goals, explain how the learning is valuable in a real-world context and provide simple transparent metrics of progression (Smith-Robbins, 2011). This sort of ongoing feedback is reminiscent of Freire's (2000) dialogical approach to critical pedagogy.

### *Collaboration and Competition*

"Games come in two basic flavors", writes Sarah Smith-Robbins, "those in which winning is determined by defeating another player, and those in which winning is determined by beating the game itself" (p. 58-59). As previously discussed in Chapter 3, multiplayer video games develop interpersonal skills of collaboration and teamwork. When players unite, and triumph over an obstacle they could not overcome individually,

it can evoke a powerful sense of accomplishment. Educators should seek to present learners with challenges, give them access to the tools they need to overcome these challenges, and encourage them to cooperate to succeed. The developmental role of group learning is a core concept of adult education (Brown, 2000; Connolly, 2008). Connolly (2008) suggests that the development of relationships, brought about through group collaboration, is an essential process in facilitating learning. “Relationships guard against the abuse of power and also mitigate the entirely human condition of frailty” (p. 88). As for competitiveness, encouraging competition between students is something that needs to be approached very carefully; if done poorly, it can produce animosity among learners. On the other hand, video game designer Nikki Douglass suggests that critics should hesitate before dismissing the competitive nature of most video games as unhealthy (Squire, 2003, p. 7). Graybill et al. (1987) claim that the assertiveness promoted by these games is a socially redeeming quality. In the section that follows, we describe some examples of how these four aesthetics can be applied effectively in adult education.

### **4.3 Gamification in Practice**

#### *Gamifying the Grading System*

James Portnow, Daniel Floyd and Allison Theus are game designers and digital animators, who have had significant influence on video game culture (Fletcher, 2012). In their series of videos, *Extra Credits*, they have suggested a method to gamify the traditional educational grading system (Portnow et al., 2011). “Right now, we are using a grading system that is essentially de-motivational and sets up a reinforcing feedback loop for failure” argue Portnow, et al. (2011). They argue that students approach an assignment thinking they will achieve the highest award, and from there, every mistake they make diminishes that achievement. They suggest that video games can provide a

more motivational model of assessment. “In games, we have learned that progress encourages progress, and the human desire for efficiency is a far stronger motivator than the fear of falling further from one’s goals” (Portnow et al., 2011).

Portnow et al. suggest adopting a grading model influenced by MMORPGs<sup>19</sup> such as *World of Warcraft*. Every student starts with zero experience points (or ‘XP’) and every assignment is worth a certain number of points. This ensures that each assignment and test feels rewarding rather than disheartening, and students never reach the point where they feel they should give up. Lee Sheldon, a professor at Indiana University, implemented a similar grading system in his course ‘Multimedia Game Design’ and found it to be highly effective (McCallum, 2010). Sheldon, an experienced game designer, treats the class itself as a game, and uses language from video game culture to describe classroom activities. “Assignments are quests, groups are guilds, exams are boss fights, and grades are expressed as levels achieved by gaining experience points” (p. 95). When a student gains enough XP, they ‘level up’ (roughly equivalent to grades), earning rewards that can be redeemed in the form of various course activities, including “adjusting the weighting within assignments, additional tutoring, and access to research equipment... This provides rewards that are within the learning objectives of the degree program, but would not be possible to provide for every student” (p. 96).

Portnow et al. (2011) also suggest setting up class-wide achievements to teach lessons within the game system itself and highlight the inherent value of education; not only does this engage the learners but it also teaches them life lessons about cooperation and collaboration. For example, when one student reaches 25,000 XP, all other students receive a bonus 100 XP, or when five students reach 15,000 XP, the whole class receives bonus points. They conclude that

---

<sup>19</sup> Massively multiplayer online role playing games

“...with this sort of reward system you encourage the whole class to be rooting for one another, and you encourage the best students to help out their classmates. You encourage your students to function with *camaraderie* and as a team. The best [students] cannot get the maximum possible score unless they help their peers pull up their grades. And at the same time, the students who are struggling, rather than resenting their classmates who are doing well, are cheering them on.”

(Portnow et al., 2011)

The *Kahn Academy* illustrates another attempt to re-contextualise the grading system from a perspective of progress, this time, with the focus on clear feedback to the learner. Conceived by Salman Khan in 2006, the *Kahn Academy* is a non-profit organisation that provides free-to-access online lessons on a range of subjects, such as mathematics, biology, chemistry, economics, computer science, history, etc (de Luna, 2012). After creating a new account, one is struck by the abundance of game design features. Figure 4.4 shows a screenshot from the website.

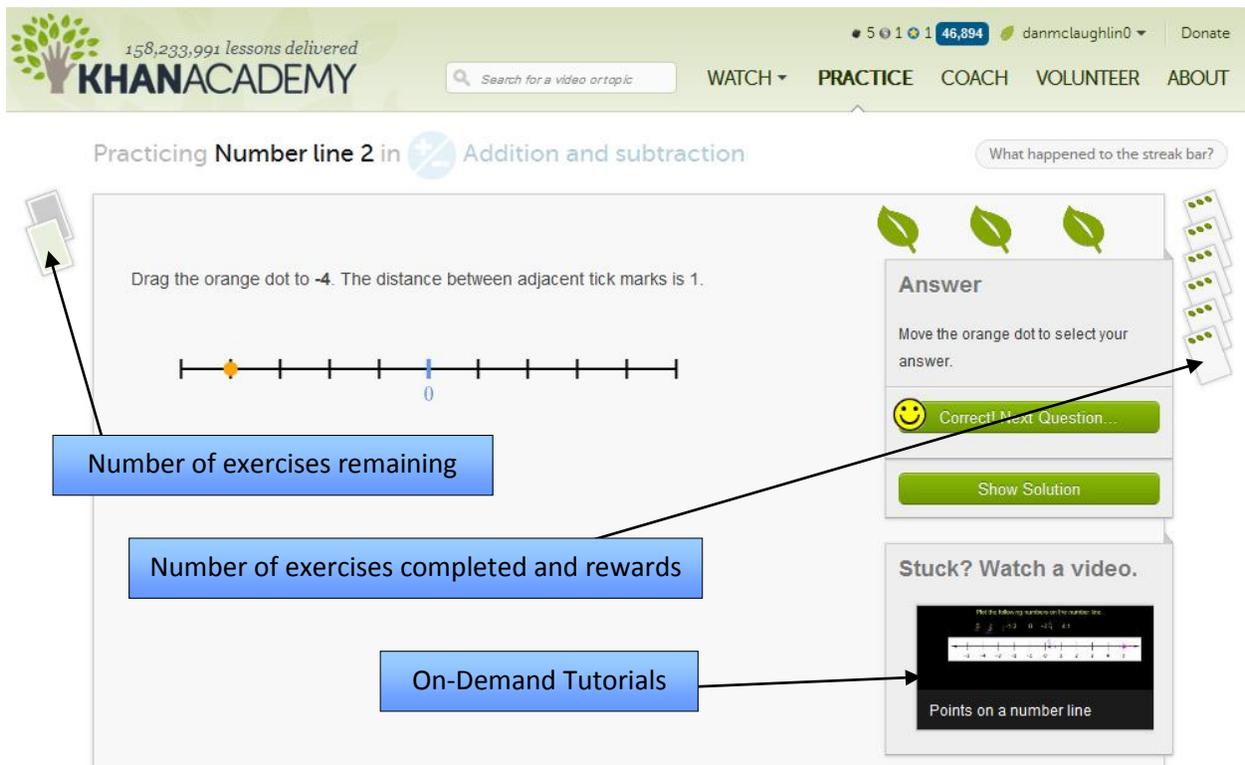


Figure 4.4 Screenshot from the [www.khanacademy.org](http://www.khanacademy.org)

Learners can clearly see their progress as they participate in each activity. The number of leaves on each card represents the achievements awarded for answering each question under certain conditions. Learners who answer all questions correctly are awarded badges; different badges represent increasing merit, motivating the learner to progress and to improve on their results. Players ‘level up’ and gain new ‘skills’ which unlock more advanced lessons. These lessons are presented in the form of a ‘skill tree’ (Figure 4.5), similar to that found in the game *World of Warcraft*.

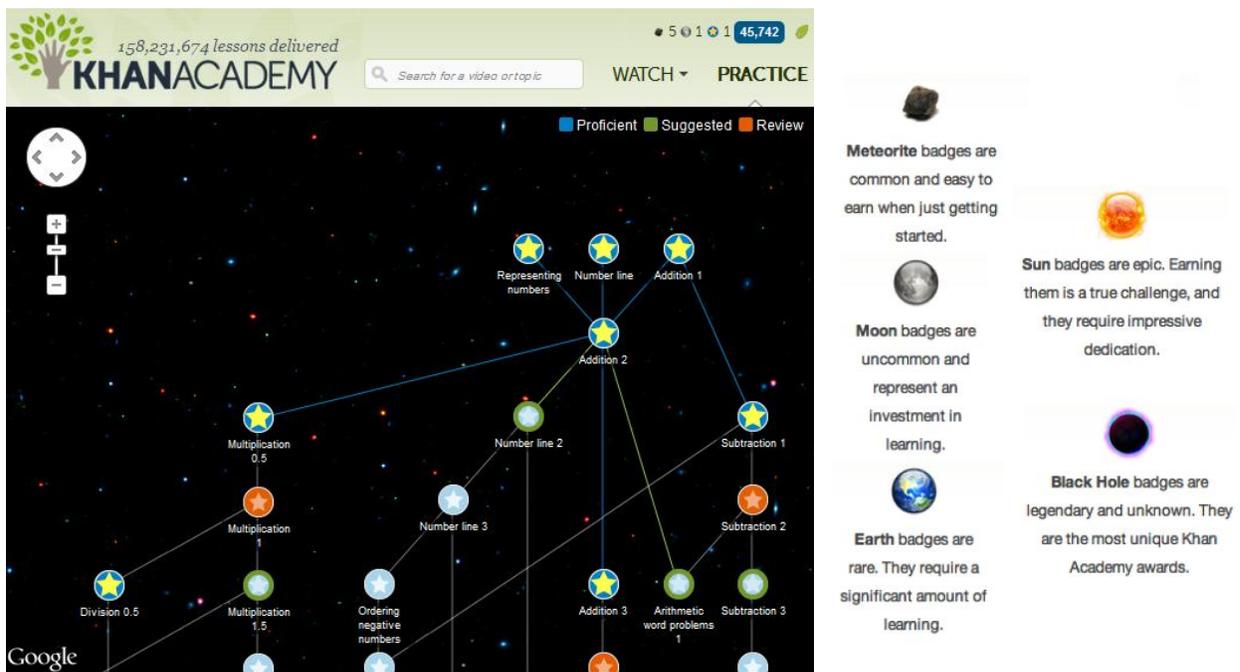


Figure 4.5 – The ‘skill tree’ and badges from [www.khanacademy.org](http://www.khanacademy.org)

To date, the *Khan Academy* has been endorsed by Bill Gates and *Google* among others and has been adopted in many classrooms across America (de Luna, 2012, pp. 28-29). While it can be criticised for an over-reliance on drill-and-practice methods of delivery, it provides excellent metrics of learner progress. At a glance, learners can tell how far they have come and how close they are to completing their short-term and long-term goals.

The advantage to employing the above techniques and resources is that they do not involve any high-tech equipment, or financial investment; they simply involve measuring learner progress and presenting feedback to the learner in a different way.

### *Alternate Reality Games*

The development of a content-specific alternate reality game (ARG) is an effective way to introduce elements of narrative and mystery into learning content, while also encouraging collaboration among learners (Connolly, Stansfield, & Hainey, 2011; Portnow, Floyd, & Theus, 2012). An ARG is a form of “online interactive narrative and puzzle-solving, often involving multiple media and game elements, to tell a story that may be affected by the actions and / or ideas of the players” (Connolly et al., 2011, p. 1391). It can be described as a ‘treasure hunt’, spanning multiple media, where players pool their knowledge together, to beat the game. Almost anything can be used to hold clues in order to progress the game: text messages, websites, emails, radio, television and newspaper advertisements, etc. One of the most appealing aspects of ARGs is that they work on the premise that there is more going on in our mundane, everyday existence than most people are aware of, and the players are the select few of us who realise it (Portnow et al., 2012). The creator of the ARG (referred to as the ‘puppet master’) steers the players in different directions as the story unfolds, by planting clues in various locations. “The puppet master can adopt the role of an adversary to the players in placing obstacles in their path..., or an ally in providing deliberate clues that enable players to find resources to overcoming obstacles” (Connolly et al., 2011, p. 1391).

Once again, the most successful instances of ARGs have been developed by marketing departments to promote films (e.g. a murder mystery to promote Steven Spielberg’s *A.I. Artificial Intelligence*), video games (e.g. *I Love Bees*, the tale of an errant A.I. taking over a bee appreciation website, developed to promote the game *Halo 2* (Bungie,

2004)) and music (e.g. *Year Zero*, a concept piece about a post apocalyptic future, developed specifically for fans of the band *Nine Inch Nails*) (p. 1393). In an adult education context, the designer (or puppet master) of the ARG could make the learning outcomes the keys to unlocking the next section of the game (Portnow et al., 2011). The aim is to inject feelings of mystery and wonder into the learning process. One advantage of developing an ARG for educational environments is that it involves little financial investment; the downside is that it can represent a significant initial time investment on the part of the educator. However, Portnow et al. (2011) suggest that it should not take much more time than it takes to create and grade a few good tests.

These are just some examples of how play aesthetics can be incorporated successfully into curricula, and can benefit adult educational practice. No doubt there are many more, but the examples outlined above illustrate the benefits of considering all aspects of education from a perspective of engagement. Gamification of education, if applied thoughtfully, has been shown to work.

## CONCLUSION

Over forty years ago, in *Deschooling Society*, Ivan Illich (1971) wrote “we need research on the possible use of technology to create institutions which serve personal, creative, and autonomous interaction” (p. 4). Illich warned that educators must be involved in this process, and not leave the development of these technologies solely in the hands of technocrats. With the subsequent exponential growth in the use of technology, that need has become more pressing; consequently, it is crucial that adult educators become involved in the development and application of the burgeoning video game medium. An inquiring and reflexive approach is needed on the part of adult educators, in order to realise that the medium presents strong learning potential, while at the same time recognizing its capacity to be used for destructive or malevolent ends. Video games may evolve in ways that are increasingly addictive, and the immersive power of the medium has obvious potential for misuse: as a tool for propaganda, for exploitation, or as a recruiting agent for questionable ideologies. For these reasons, it is important for adult educators to help learners to develop a critical awareness, which will enable them to build protective firewalls. To do this, adult education practitioners will have to become familiar with the language and culture of video games.

This research has found that video games have significant promise for education. They can support multiple styles of learning and multiple levels of difficulty; provide clear objectives and relevant, timely feedback; promote agency, collaboration, and teamwork skills; pose well-ordered problems of incremental difficulty; foster mastery through challenge and achievement; make repetitive tasks more engaging; create virtual worlds in which the learner can experience learning in context and construct his or her own meaning; and inspire a strong sense of accomplishment in the learner. That is not to say that all games have educational value: indeed, many have the power to mis-educate. Nor does the incorporation of digital game-based learning devalue traditional teaching methods, or the role of the teacher as educator and facilitator. Yet, in some

situations, digital game-based learning can be extremely versatile and highly effective when pedagogical theory is built into the core design.

Digital game-based learning will be expensive and slow to implement. As well as the costs involved, it will require significant debate, research and collaboration between adult education practitioners and game developers. However, there are interim ways in which the motivational power of video games can be harnessed, without significant financial investment. These involve the 'gamification' of education, in order to reap the motivational benefits inherent in video game technology. Admittedly, this presents a daunting task for the adult educator. Changes will be needed in modes of delivery and measures of achievement, as well as a Freirian shift in control from teacher to learner. But if we succeed, the process has the potential to bring enormous benefits to both learner and educator.

## BIBLIOGRAPHY

- Aleven, V., Myers, E., & Ogan, A. (2010). Toward a Framework for the Analysis and Design of Educational Games. Paper presented at the *Digital Game and Intelligent Toy Enhanced Learning (DIGITEL), Third IEEE International Conference*, Human-Computer Interaction Institute, Carnegie Mellon University, Pittsburgh, Philadelphia.
- Anand, V. (2007). A Study of Time Management: The Correlation between Video Game Usage and Academic Performance Markers. *CyberPsychology & Behavior*, 10(4), 552-559.
- Andersen, R., & Kurti, M. (2009). From America's Army to Call of Duty: Doing Battle with the Military Entertainment Complex. *Democratic Communiqué*, 23(1), 45-65.
- Antin, J. (2011). Toy Psychology. *Technology Review*, 114(5), 11.
- Baek, Y. K. (2008). What Hinders Teachers in Using Computer and Video Games in the Classroom? Exploring Factors Inhibiting the Uptake of Computer and Video Games. *CyberPsychology & Behavior*, 11(6), 665-671.
- Beck, J. C., & Wade, M. (2004). *Got Game: How the Gamer Generation is Reshaping Business Forever*. Boston: Harvard Business School Press.
- Bell, J. (2005). *Doing Your Research Project: A Guide for First-Time Researchers in Education, Health and Social Science* (4th ed.). Maiden Head: Open University Press.
- Berger, A. A. (2002). *Video Games: A Popular Culture Phenomenon*. New Jersey: Somerset.
- BinSubaih, A., Maddock, S., & Romano, D. (2009). *Serious Games for the Police: Opportunities and Challenges*. Dubai: Special Reports & Studies Series at the Research & Studies Center. Dubai Police Academy: Dubai.
- Bisson, C., & Luckner, J. (1996). Fun in Learning: The Pedagogical Role of Fun in Adventure Education. *Journal of Experiential Education*, 19(2), 108-112.
- Boal, A. (2008). *Theatre of the Oppressed* (New ed.). London: Pluto Press.
- Bojin, N. (2008). Language Games/Game Languages: Examining Game Design Epistemologies through a 'Wittgensteinian' Lens. *Journal of Computer Game Culture*, 2(1), 55-71.

- British Educational Communications and Technology Agency (BECTA). (2010). *Games in Education: Serious Games; A Futurelab Literature Review*. Retrieved April 26, 2012, from [http://media.futurelab.org.uk/resources/documents/lit\\_reviews/Serious-Games\\_Review.pdf](http://media.futurelab.org.uk/resources/documents/lit_reviews/Serious-Games_Review.pdf)
- Brown, R. (2000). *Group Processes*. Oxford: Blackwell.
- Byron, T. (2008). *Safer Children in a digital world: The Report of the Byron Review*. Nottingham: Department for Children, Schools and Families, and the Department for Culture, Media and Sport.
- Charsky, D. (2010). From Edutainment to Serious Games: A Change in the Use of Game Characteristics. *Games and Culture*, 5(2), 177-192.
- Chuang, T. Y., Su, S. H., & Tsao, Y. P. (2010). Using handheld gaming device to increase multiple intelligences with digital puzzle game. Paper presented at the *18th International Conference on Computers in Education*, Putrajaya, Malaysia.
- Connolly, B. (2008). *Adult Learning in Groups*. Maidenhead; New York: Open University Press.
- Connolly, T. M., Stansfield, M., & Hailey, T. (2011). An Alternate Reality Game for Language Learning: ARGuing for Multilingual Motivation. *Computers & Education*, 57(1), 1389–1415.
- Cordova, D. I., & Lepper, M. R. (1996). Intrinsic Motivation and the Process of Learning: Beneficial Effects of Contextualization, Personalization, and Choice. *Journal of Educational Psychology*, 88(4), 715-730.
- Creswell, J. W. (2003). *Research design: Qualitative, Quantitative, and Mixed Methods Approaches* (2nd ed.). London: Sage Publications Ltd.
- Creswell, J. W. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (3rd ed.). London: Sage Publications Ltd.
- Chatfield T. (2009, September 27). Videogames now outperform Hollywood movies. *The Observer*, (p. 27). Retrieved June 1, 2012, from <http://www.guardian.co.uk/>
- Crocco, F. (2011). Critical Gaming Pedagogy. *Radical Teacher*, 91, 26-41.

- Crotty, M. (1998). *The Foundations of Social Research: Meaning and Perspective in the Research Process*. London: Sage.
- de Luna, C. (2012). Learning as Fun: What Video Games Do that Classrooms Do Not. *Momentum*, 1(1), 1-34.
- Dewey, J. (1938). *Experience and Education*. New York: Collier Books.
- DiCarlo, S. E. (2009). Too Much Content, Not Enough Thinking, and Too Little FUN! *Advances in Physiology Education*, 33(4), 257-264.
- DiMaggio, P., & Hargittai, E. (2011). From the 'Digital Divide' to 'Digital Inequality': Studying Internet Use as Penetration Increases. Princeton University Center for Arts and Cultural Policy Studies, Working Paper Series number 15.
- Dimock, K. V., & Beothel, M. (1999). *Constructing Knowledge with Technology*. Austin, Texas: Southwest Educational Development Laboratory.
- Dorn, D. S. (1989). Simulation Games: One More Tool on the Pedagogical Shelf. *Teaching Sociology*, 17(1), 1-18.
- Durkin, K., & Barber, B. (2002). Not so doomed: computer game play and positive adolescent development. *Applied Developmental Psychology*, 23, 373-392.
- Dye, M. W. G., Green, C. S., & Bavelier, D. (2009). Increasing Speed of Processing with Action Video Games. *Current Directions in Psychological Science*, 18(6), 321-326.
- Edutopia. (1997). Interview with Howard Gardner on Multiple Intelligences [Video]. *Big Thinkers*. Retrieved April 21, 2012, from <http://www.edutopia.org/multiple-intelligences-howard-gardner-video>
- Egenfeldt-Nielsen, S. (2004). Practical Barriers in Using Educational Computer Games. *On the Horizon*, 12(1), 18-21.
- Egenfeldt-Nielsen, S. (2006). Overview of research on the educational use of video games. *Nordic Journal of Digital Literacy* (3), 184-207.
- Egenfeldt-Nielsen, S. (2007). Third Generation Educational Use of Computer Games. *Journal of Educational Multimedia and Hypermedia*, 16(3), 263-281.

- Entertainment Software Association (ESA). (2011). *2011 Sales, Demographic and Usage Data: Essential Facts About the Computer and Video Game Industry*. Retrieved June 1, 2012 from [www.theesa.com/facts/pdfs/ESA\\_EF\\_2011.pdf](http://www.theesa.com/facts/pdfs/ESA_EF_2011.pdf)
- Fletcher, J. (2012). Sexual Harassment in the World of Video Gaming. *BBC World Service Magazine*. Retrieved June 13, 2012, from <http://www.bbc.co.uk/news/magazine-18280000>
- Frank, A. (2007). Balancing Three Different Foci in the Design of Serious Games: Engagement, Training Objective and Context. Paper presented at the *Digital Game Research Association Conference*, Swedish National Defense College, Stockholm.
- Freire, P. (1998). *Pedagogy of Freedom: Ethics, Democracy, and Civic Courage*. Lanham: Rowman & Littlefield Publishers.
- Freire, P. (2000). *Pedagogy of the Oppressed* (30th anniversary ed.). New York: Continuum.
- Frey, T. (2012). 28 Major Trends for 2012 and Beyond: Part 2. *Journal of Environmental Health*, 74(9), 40-43.
- Gardner, H. (1983). *Frames of Mind: The Theory of Multiple Intelligences*. London: Heinemann.
- Gardner, H. (1993). *Frames of Mind* (revised ed.). New York: Basic Books.
- Gardner, H. (2009). *Multiple Intelligences: The First 25 Years* [Video lecture]. Retrieved May 7, 2012, from [http://www.youtube.com/watch?v=tDtZEpf\\_SJ4](http://www.youtube.com/watch?v=tDtZEpf_SJ4)
- Gee, J. P. (2005). Good Video Games and Good Learning. *Phi Kappa Phi Forum*, 85(2), 33-37.
- Gee, J. P. (2007). *What video games have to teach us about learning and literacy* (Revised and updated ed.). Basingstoke: Palgrave Macmillan.
- Gilgun, J. F. (2010). Reflexivity and Qualitative Research. *Current Issues in Qualitative Research*, 1(2), 1-8.
- Giumetti, G., & Markey, P. M. (2007). Violent Video Games and Anger as Predictors of Aggression. *Journal of Research in Personality*, 41(6), 1234-1243.
- Glazer, S. (2006). Video Games: Do They Have Educational Value? *Congressional Quarterly Researcher*, 16(40), 937-960.

- Glenn, A. D. (2002). Thirty years and some of the same issues. *International Social Studies Forum*, 2(2), 179-181.
- Graybill, D., Strawniak, M., Hunter, T., & O'Leary, M. (1987). Effects of Playing Versus Observing Violent Versus Nonviolent Video Games on Children's Aggression. *Psychology: A Quarterly Journal of Human Behavior*, 24(3), 1-8.
- Green, C. S., & Bavelier, D. (2003). Action video game modifies visual selective attention. *Nature*, 423, 534-537.
- Greenfield, P. M. (1984). *Mind and Media: The Effects of Television, Video Games, and Computers*. London: Fontana.
- Greenfield, P. M. (1996). Video Games as Cultural Artefacts. In P. M. Greenfield & R. R. Cocking (Eds.), *Interacting with Video* (pp. 35-46). Norwood, New Jersey: Ablex Publishing.
- Greenfield, P. M., Dewinstanley, P., Kilpatrick, H., & Kaye, D. (1994). Action Video Games and Informal Education: Effects on Strategies for Dividing Visual Attention. *Journal of Applied Developmental Psychology*, 15, 105-123.
- Gros, B. (2007). Digital Games in Education: The Design of Games-Based Learning Environments. *Journal of Research on Technology in Education*, 40(1), 23-38.
- Gunn, M. (2005). An interview with Dr. Henry Jenkins [Podcast]. *Technation*. Retrieved June 1, 2012, from <http://itc.conversationsnetwork.org/shows/detail435.html>
- Hofer, B. K. (2004). Exploring the dimensions of personal epistemology in differing classroom contexts: Student interpretations during the first year of college. *Contemporary Educational Psychology*, 29, 129-163.
- Holisky, A. (2012). World of Warcraft Subscriber Numbers Dip 100,000 to 10.2 Million. *Joystiq*. Retrieved May 27, 2012 from <http://wow.joystiq.com/2012/02/09/world-of-warcraft-subscriber-numbers/>
- Howland, D., Fujimoto, T., Ishiwata, K., & Kamijo, M. (2009). Multiple Intelligences Perspectives from Japan. In J. Q. Chen, S. Moran & H. Gardner (Eds.), *Multiple Intelligences Around the World* (pp. 76-94). New York: Jossey-Bass.

- Hunicke, R., LeBlanc, M., & Zubek, R. (2004). MDA: A Formal Approach to Game Design and Game Research. Paper presented at the *Challenges in Game AI Workshop, 19th National Conference on Artificial Intelligence, AAAI Workshop* (pp. 1-5), San Jose, California.
- Hunt, M. (1993). *The Story of Psychology*. New York: Doubleday.
- Illich, I. (1971). *Deschooling Society*. London: Calder and Boyars.
- Jansz, J., & Martens, L. (2005). Gaming at a LAN Event: The Social Context of Playing Video Games. *New Media & Society*, 7(3), 333-355.
- Jensen, M. (2012). Engaging the Learner Gamification Strives to Keep the User's Interest. *Training and Development*, 66(1), 40-44.
- Jukes, I., McCain, T., & Crockett, L. (2010). *Understanding the Digital Generation; Teaching and Learning in the New Digital Landscape (21st Century Fluency Series)*. Thousand Oaks, California: Corwin Press.
- Kafai, Y. (1996). Software by Kids for Kids. *Communications of the ACM*, 39(4), 38-39.
- Kapp, K. M. (2012). Gamification, and the Quest for Learner Engagement. *Training and Development*, 66(6), 64-68.
- Kearney, P. (2006). Immersive Environments: What Can We Learn From Commercial Computer Games? In M. Pivec (Ed.), *Affective and Emotional Aspects of Human-Computer Interaction* (pp. 38-44). Amsterdam: IOS Press.
- Keating, E., & Sunakawa, C. (2010). Participation Cues: Coordinating Activity and Collaboration in Complex Online Gaming Worlds. *Language in Society*, 39(3), 331-356.
- Klein, P. D. (1997). Multiplying the Problems of Intelligence by Eight: A Critique of Gardner's Theory. *Canadian Journal of Education*, 22(4), 377-394.
- Knowles, S. K. (1970). *The Modern Practice of Adult Education*. New York: Association Press.
- Kohn, A. (1993). *Punished by Rewards: the Trouble with Gold Stars, Incentive Plans, A's, Praise, and Other Bribes*. Boston: Houghton Mifflin

- Kutner, L., & Olson, C. K. (2008). *Grand Theft Childhood: The Surprising Truth about Violent Video Games*. New York: Simon & Schuster.
- Liyakasa, K. (2012). Game On. *CRM Magazine*, 16(5), 28-32.
- Longworth, N. (1999). *Making Lifelong Learning Work: Learning Cities for a Learning Century*. London: Routledge.
- Maslow, A. H. (1943). A Theory of Human Motivation. *Psychological Review*, 50(4), 370-396.
- Maslow, A. H. (1954). *Motivation and Personality*. New York: Harper & Row.
- McCallum, S. (2010). Game Design for Computer Science Education. Paper presented at the *2010 Norsk Informatikkonferanse (NIK)*, Gjøvik University College, Norway.
- McClurg, P. A., & Chaille, C. (1987). Computer games: Environments for developing spatial cognition. *Journal of Educational Computing Research*, 3(1), 95-111.
- McCombs, B. L. (1991). Motivation and Lifelong Learning. *Educational Psychologist*, 26(6), 117-127.
- McLeod, G. (2003). Learning Theory and Instructional Design. *Learning Matters*, 2(3), 35-43.
- Merriam, S. B., & Caffarella, R. S. (1999). *Learning in Adulthood; A Comprehensive Guide* (2nd ed.). San Francisco: Jossey-Bass Publishers.
- Merrill, M. D. (2002). First Principles of Instruction. *Educational Technology Research and Development*, 50(3), 43-59.
- Metcalfe, J., Riedlinger, M., Pisarski, A., & Gardner, J. (2006). *Collaborating Across Sectors; the Relationships Between the Humanities, Arts and Social Sciences and Science, Technology, Engineering and Medicine Sectors*. Canberra, Australia: Department of Education, Science and Training.
- Mezirow, J. (1991). *Transformative Dimensions of Adult Learning*. San Francisco: Jossey-Bass.
- Michael, D., & Chen, S. (2005). *Serious Games: Games that Educate train, and Inform*. Boston: Thomson Course Technology.

- Monke, L. (2009). Video Games: A Critical Analysis. *Encounter: Education for Meaning and Social Justice*, 22(3), 7-20.
- Morgan, H. (1996). An Analysis of Gardner's Theory of Multiple Intelligence. *Roeper Review*, 18, 263-270.
- Murray, M. (2011). Critical Reading [Lecture notes]. NUI Maynooth. Retrieved March 15, from <http://moodle.nuim.ie>
- O'Brien, D., & Scharber, C. (2008). Digital Literacies Go to School: Potholes and Possibilities. *Journal of Adolescent & Adult Literacy*, 52(1), 66-68.
- Oxford English Dictionary Online (2012). (3rd ed.). Retrieved June 4, 2012, from <http://dictionary.oed.com>.
- Pink, D. H. (2005). *A Whole New Mind: Why Right-Brainers Will Rule the World*. New York: Riverhead Books.
- Plato. (2002). *Phaedrus* (R. Waterfield, Trans.). Cambridge: Oxford University Press.
- Portnow, J. (2008). The Power of Tangential Learning. *The Edge Magazine*. Retrieved June 2, 2012, from <http://www.edge-online.com/opinion/power-tangential-learning>
- Portnow, J., Floyd, D., & Theus, A. (2010). The Skinner Box [Video]. *Extra Credits*. Retrieved May 6, 2012, from <http://www.penny-arcade.com/patv/episode/the-skinner-box>
- Portnow, J., Floyd, D., & Theus, A. (2011). Gamifying Education [Video]. *Extra Credits*. Retrieved May 19, 2012, from <http://www.penny-arcade.com/patv/episode/gamifying-education>
- Portnow, J., Floyd, D., & Theus, A. (2012). ARGs Part 1 [Video]. *Extra Credits*. Retrieved May 23, 2012, from <http://penny-arcade.com/patv/episode/args-part-1>
- Prensky, M. (2001). *Digital Game-Based Learning*. New York, NY: McGraw-Hill.
- Prior, L. (2003). *Using documents in social research*. London: Sage.
- Radoff, J. (2011). *Gamification, Behaviorism and Bullshit*. Retrieved May 22, 2012, from <http://radoff.com/blog/2011/08/09/gamification-behaviorism-bullshit/>

- Rainwater, T., Salkind, N., Sawyer, B., & Massy, W. (2003). Virtual U 1.0 Strategy Guide. Retrieved June 5, 2012, from <http://www.virtual-u.org/downloads/vu-strategy-guide.pdf>
- Schultz, D. P., & Schultz, E. S. (2008). *A History of Modern Psychology* (9th ed.). London: Thomson/Wadsworth.
- Scott, J. (1990). *A Matter of Record: Documentary Sources in Social Research*. Cambridge: Polity Press.
- Shaffer, D. W. (2006). *How Computer Games Help Children Learn*. New York: Palgrave MacMillan.
- Shearer, B. (2004). Multiple Intelligences Theory After 20 Years. *Teachers College Record*, 106(1), 2-16.
- Silverman, D. (2005). *Doing Qualitative Research; A Practical Handbook*. (2nd ed.). London: Sage.
- Skinner, B. F. (1953). *Science and Human Behavior*. New York: Macmillan.
- Skinner, B. F. (1974). *About Behaviorism*. New York: Knopf.
- Smith, L., & Mann, M. (2002). 15th Annual National Advisory Committee on Computing Qualifications. Paper presented at the *15th Annual National Advisory Committee on Computing Qualifications Conference*, Otago Polytechnic, Hamilton, New Zealand.
- Smith-Robbins, S. (2011). "This Game Sucks": How to Improve the Gamification of Education. *Educause Review*, 46(1), 58-59.
- Spence, I., & Feng, J. (2010). Video Games and Spatial Cognition. *Review of General Psychology*, 14(2), 92-104.
- Squire, K. D. (2003). Video Games in Education. *International Journal of Intelligent Simulations and Gaming*, 2(1), 49-62.
- Stapleton, A. (2004). Serious Games: Serious Opportunities. Paper presented at the *Australian Game Developers' Conference, Academic Summit*, Melbourne, Australia.

- Steinkuehler, C. (2008). Cognition and literacy in massively multiplayer online games. In D. Leu, J. Coiro, C. Lankshear & K. Knobel (Eds.), *Handbook of Research on New Literacies* (pp. 611-634). Mahwah, New Jersey: Erlbaum.
- Stoll, C. (1999). *High-tech Heretic: Reflections of a Computer Contrarian*. New York: First Anchor Books.
- Subrahmanyam, K., & Greenfield, P. M. (1994). Effect of video game practice on spatial skills in girls and boys. *Journal of Applied Developmental Psychology*, 15(1), 13-32.
- Susi, T., Johannesson, M., & Backlund, P. (2007). Serious Games – An Overview [Technical Report HS-IKI-TR-07-001]. Skövde, Sweden: School of Humanities and Informatics, University of Skövde.
- Thomas, A. (2004). *Research Skills for Management Studies*. London: Sage.
- Thorndike, E. L. (2000). *Animal Intelligence; experimental studies*. New Jersey: Transaction Publishers.
- Trefry, G. (2010). *Casual Game Design: Designing Play for the Gamer in All of Us*. Burlington, Massachusetts: Morgan Kaufmann.
- Turkle, S. (1997). *Life on the Screen: Identity in the Age of the Internet*. New York: Touchstone.
- Tüzün, H. (2007). Blending Video Games with Learning: Issues and Challenges with Classroom Implementations in the Turkish Context. *British Journal of Educational Technology*, 38(3), 465-477.
- Van Eck, R. (2006). Digital Game-Based Learning: It's Not Just the Digital Natives Who Are Restless. *Educause Review*, 41(2), 16-30.
- Wesołowski, J. (2012). Beyond Pacing: Games Aren't Hollywood. *Gamasutra, UBM Techweb*. Retrieved June 10, 2012, from [http://www.gamasutra.com/view/feature/4032/beyond\\_pacing\\_games\\_arent\\_.php](http://www.gamasutra.com/view/feature/4032/beyond_pacing_games_arent_.php)
- Willmott, H. (2011). Qualitative Document Analysis [Lecture notes]. Cardiff Business School. Retrieved from <http://dialspace.dial.pipex.com>
- White, J. (2005). Howard Gardner: The Myth of Multiple Intelligences. *Viewpoint* (Vol. 16). London: University of London.

Yan, X., Diaconis, P., & Van Roy, B. (2004). Solitaire: Man versus Machine (Technical Report No. 2004-30). Retrieved May 20, 2012, from <http://statistics.stanford.edu/~ckirby/techreports/GEN/2004/2004-30.pdf>

Zyda, M., Hiles, J., Mayberry, A., Wardynski, C., Capps, M., Osborn, B., Davis, M. (2003). Entertainment R&D for Defence. *Computer Graphics and Applications (IEEE)*, 23(1), 28-36.

## MEDIA BIBLIOGRAPHY

- 3rd World Farmer Team. (2005). *3rd World Farmer* [Flash game]. Games For Change.  
Retrieved June 10 2012 from <http://www.gamesforchange.org/play/3rd-world-farmer/>
- Activity Research Services (ARS). (2005). *Synwin* [Computer software]. Chula Vista, California: Activity Research Services.
- Blizzard Entertainment. (2004). *World of Warcraft* [PC game]. Irvine, California: Blizzard Entertainment.
- Brøderbund Software. (1985). *Where in the World Is Carmen Sandiego?* [PC game]. Eugene, Oregon: Brøderbund.
- Bungie Studios. (2004). *Halo 2* [Xbox game]. Redmond, Washington, Microsoft Game Studios
- Curtis, B. (Producer), & Spielberg, S. (Director). (2001). *A.I. Artificial Intelligence* [Motion picture]. United States: DreamWorks.
- Davidson & Associates. (1983). *Math Blaster!* [Apple game]. Torrance, California: Davidson & Associates.
- Enlight Software. (2003). *Virtual U* [PC game]. Bolton, Massachusetts: Anker Publishing.
- Firaxis Games. (2001). *Civilization III* [PC game]. Paris: Infogrames.
- Infinity Ward. (2007). *Call of Duty 4: Modern Warfare* [Xbox 360 game]. Santa Monica, California: Activision.
- Kurtz, G. (Producer), & Lucas, G. (Director). (1977). *Star wars: A New Hope* [Motion picture]. United States: 20th Century Fox.
- Maxis. (1989). *SimCity* [PC Game]. Eugene, Oregon: Brøderbund.
- Maxis. (2008). *Spore* [PC game]. Redwood, California: Electronic Arts.
- Microsoft. (1990). *Solitaire* [PC game]. Redmond, Washington: Microsoft.
- Minnesota Educational Computing Consortium (MEEC). (1974). *The Oregon Trail* [Apple game]. Eugene, Oregon: Brøderbund.
- Minnesota Educational Computing Consortium (MEEC). (1986). *Number Munchers* [Apple game]. Minnesota: MECC.
- Mojang. (2011). *Minecraft* [PC game]. Stockholm: Mojang.

Robinett, W., & Grimm, L. (1983). *Rocky's Boots* [Apple game]. San Francisco: The Learning Company.

Rovio Entertainment. (2009). *Angry Birds* [IOS game]. Guildford, United Kingdom: Chillingo.

The Software Toolworks. (1987). *Mavis Beacon Teaches Typing* [Computer software]. The Software Toolworks.

Valve Corporation. (2000). *Counter-Strike* [PC game]. Oakhurst, California: Sierra Studios.

Wardynski, C., & Zyda, M. (2002). *America's Army* [PC game]. U.S. Army.

Westwood Studios. (1995). *Command & Conquer* [PC game]. UK: Virgin Interactive.