Defining A Formal Model of Edutainment That Enhances the Learning of Cyber Security Subjects By Higher Education Students

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A thesis submitted in partial fulfilment of the requirements of the University of Greenwich for the degree of Doctor of Education

February 2016

DECLARATION

"I certify that this work has not been accepted in substance for any degree, and is not currently being submitted for any degree other than that of Doctorate in Education (EdD) being studied at the University of Greenwich. I also declare that this work is the result of my own investigations except where otherwise identified by references and that I have not plagiarised the work of others."

Student's signature:

Supervisor's signature:

ACKNOWLEDGEMENTS

I would like to thank my supervisors Prof. Jill Jameson and Dr. Priti Chopra for their unwavering help and guidance over the years. It is quite clear to me that I would never have got this far without their invaluable comments, time and patience. Thank you both, very much.

ABSTRACT

This thesis was about construction of a model of edutainment (education + entertainment) concerning teaching of cybersecurity in higher education. Cybersecurity has become an important issue for most nations, requiring a search for new methods of teaching. Although many see the way forward as the application of technology to the teaching process, a so-called technology-fix, since learning is essentially a human experience, with teaching a predominantly human to human experience, it is argued that a psychology-of-learning-fix of some kind might be more useful. The resultant model of edutainment created herein was derived from a literature review and analysis of six existing models of edutainment good practice and the resultant model was trialled in two ways:

Firstly, it was used by the researcher in teaching a student cohort and six types of feedback (formal student surveys, informal student surveys, informal student interviews, formal student performance statistics, formal student attendance statistics, lecturer's personal reflections) were collected and used to further improve the model.

Secondly, parts of the model were trialled by fellow lecturers in their own teaching scenarios (taster sessions, new courses) and also presented in three conference presentations (cybersecurity, forensics, STEM). In all cases feedback was obtained on acceptability or otherwise of the model.

Findings in all categories were positive that the model was a contribution to knowledge. Pedagogically speaking, the model demonstrates a synergistic blend of education with fun and play that may enhance students' learning experiences overall. The notion of promoting 'deeper learning', as opposed to shallow learning, has been used to underpin the research reported herein. Overall, the research found that by combining entertainment purposefully with education using psychological principles that are common to both, student outcomes for the higher education taught curriculum in cybersecurity courses were improved.

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1. INTRODUCTION

In the Museum of Childhood at Bethnal Green, London, is a doll's house – it's called the Nuremberg House and is dated 1673. It is not the earliest doll's house still in existence but it is a good model in good condition and a lot is known about it. It is highly detailed with miniature furniture, bedding, drapes, pots and pans and kitchen implements and represents an upper class merchant's home of the period. Doll's houses today are considered toys for children to act out their imaginations creating narratives in which the characters, the dolls, come alive, have fun and play. However, the Nuremberg House was not created for entertainment alone – in fact, it wasn't created for this purpose at all. Doll's houses were then used as aids for teaching girls their expected domestic duties and household management skills. At that time few girls were ever taught to read, so the reading of books on domestic instruction was a limited option, and using doll's houses proved a popular alternative, (Wood 2012: 74). Girls could therefore learn their expected female roles as wife and mother through playing with the doll's house; it was only from the 19th century onwards that the doll's house became predominantly a plaything. And adults? Actually, the little girl's mother would also have used the doll's house to experiment with her own ideas of household decoration, furniture, cutlery, crockery and room layout. This was important at a time when, in wealthier households, it was the role of the wife to take sole care of the house and its running and when, if marriage breakdown occurred, the house would pass to the husband but the contents would pass to the wife. The doll's houses of past years may just stand lifeless in museums today but they represent perhaps one of the earliest well-documented examples of the use of edutainment, education in an entertainment setting. Many types of edutainment exist in the world today along with many things calling themselves edutainment that perhaps aren't really. There are good examples and poor, but, arguably, nowhere does there really exist a clear definitive model of what edutainment should be if it is to be used as

Fig 1.1 The Nuremburg House 1673 (Wood 2012:74s)

a working educational tool for formal education in a technologically driven world. This is what this thesis aims to remedy.

This thesis is entitled:- 'Defining A Formal Model of Edutainment That Enhances the Learning of Cyber Security Subjects By Higher Education Students' and is about the building of a model of edutainment to be used for teaching purposes in higher education (undergraduate and postgraduate levels). Jung and Latchem (2011: 8) suggest that new theories are needed to cope with the changes in learning orientations and the advent of new digital technologies and this thesis is wholly in agreement but, at this early stage, it must be made clear that, although the title concerns the teaching of a technology subject (cyber security) it is not itself about learning technologies. It is not about computer based technologies as such, although it's findings may apply to their use - it is more about developing new learning psychologies than developing new learning technologies. As Jung and Latchem (2011: 10) again point out , citing Kozma (2001), "the quality of learning is influenced more by the instructional design than the technology". However, the title does beg two questions. Firstly, there is the question of what do the words in the title really mean? In other words, what is really meant by 'Edutainment', 'Cyber Security' and 'Higher Education'? and, more importantly, what is meant by 'Defining a Formal Model" and "Enhance Learning" and how can such 'enhancement' be measured? Secondly, why bother at all - what really is the need for such a particular model in such a particular context? Each of these two questions will be dealt with in turn.

1.1 What Is Meant By: Edutainment

For this thesis to progress it needs, at the very least, an operational definition of the term 'edutainment'. Edutainment is clearly a merging of the words 'education' and 'entertainment'. The Merriam-Webster online dictionary Merriam-Webster (2013) says only that it is 'education + entertainment and was first used in 1973' so a more enlightened understanding may be gleaned from treating the words separately. The same dictionary says, of education : 'Learning that takes place in schools or school-like environments (formal education) or in the world at large; the transmission of the values and accumulated knowledge of a society' and of entertainment : 'amusement or diversion' or 'something diverting or engaging'. However, there are, already in use, some working definitions of the word 'edutainment', and although no agreed common definition exists, four varied definitions have been chosen below, each of which introduces some

important concept which may be useful as a working reference during the progression of this thesis.

Firstly, there is that of the LNCS (Lecture Notes In Computer Science) website, a resource used extensively by teachers and lecturers in the computational sciences, which states: "Edutainment,… educational-entertainment or entertainment-education, … designed to educate as well as to provide fun" (LNCS 2009). This explicitly uses the word 'fun', implying elements of humour, laughing, enjoyment; this notion of producing positive feelings, the emotional or affective elements of learning, might be important. Fun is also implied in a definition from the MIT (Massachusetts Institute of Technology) Media Laboratory, a world-renowned centre of learning that has been heavily involved in edutainment research over thirty years, and whose definition "Edutainment? No thanks – I prefer Playful Learning", Resnick (2004), goes even further and introduces the concept of 'play'. The word 'play' is significant, and suggests more than the word 'fun' on its own, for it suggests activity, that the player could be doing something, making or producing something themselves, much like playing with the doll's houses discussed before, rather than being an onlooker in a passive process; this notion of involvement, in itself, could be important. However, it is perhaps Matchett (2009) in the article "Edutainment Fills The Gap" that expands on the notion of 'fun' with:- "To assume individuals have only a utilitarian interest in education, solely studying what delivers a degree, ignores key drivers of … curiosity and creativity". This goes even further by suggesting that edutainment, through fun and play, could unlock motivations that are sometimes overlooked in the normal educational process. In addition, the LNCS (2009) discusses the need for adults to continue their education ad-hoc into the future after formal learning in early life: "Edutainment … is motivated by the increasing demands on individuals for life-long learning and the need to integrate effective learning opportunities". This suggests edutainment may touch upon the 'how to learn' in addition to the 'what to learn' and this must always be considered in any novel educational paradigm. But perhaps the best definition of all, and one which seems to get to the heart of edutainment, is that of McKenzie (2000) who said "EDUTAINMENT: a blend of education and entertainment that synergistically deliver a deeper learning experience." This contains three significant words: 'blend' which suggests common areas of mixing, integration and functionality where education and entertainment may work closely together, 'synergy' which suggests that this mixing together has a greater effect on the educational outcome than if the two operated separately, and by blending and attaining synergy such edutainment could produce a 'deeper' learning experience for the learner as opposed to a 'shallow' learning experience (Laurillard 2012:38; Jung & Latchem 2011:8).

So, there appear from the above definitions to be several themes in the use and common interpretation of the word 'edutainment'. Many of these themes: synergy, play, creativity and curiosity, deeper learning and lifelong learning, will be explored in this thesis. An operational definition of edutainment is needed for guidance and reference and a goal to work towards in this thesis so that it is clear from the start what any final edutainment model is trying to produce. Integrating the definitions found above produces such an operational definition as shown fig. 1.1.

Edutainment is a synergistic blend of education and entertainment that through the use of fun and play, supporting creativity and curiosity, can produce a deeper and lifelong learning experience.

Fig. 1.2 Operational definition of edutainment used in this thesis

1.2 What Is Meant By: Cyber-Security and Higher Education

Cyber security is the area of teaching in which the thesis author specialises. It is around this subject area – the teaching and learning issues and the types of learners – that this thesis will be concerned and the resultant edutainment model will be constructed. Cyber security is the catch-all title for computer and internet security issues and covers such varied topics as shown in Table 1.1 and the skill sets as shown in Table 1.2.

Digital forensics	Scientific uncovering of evidence for civil civil/criminal actions in a court of law
Crime	Modus operandi of common crimes and attacks
Hacktivism	individuals gaining unauthorised access to informational assets and data
Malware distribution	Malicious code : Viruses, Trojans and others
Denial of service attacks	Deliberate shut-downs of websites
Cyber-warfare	Politically motivated attacks on industrial, military, national infrastructure.
Standards and laws	Compliance to recognised models of good-practice security
Table 1.1	**List of topics commonly taught as part of a cyber security course**

Penetration testing	Ethical hacking to test that servers on a network are secure
Firewall setup	To monitor and block undesirable messages coming into a network
Cryptography	The art of making messages unreadable to unauthorised parties.
Steganography	Information hiding
IT auditing	Ensuring compliance to recognised models of good-practice security
Table 1.2	**List of skills developed as part of a cyber security course**

In this context, *higher education* refers to those students who have or are about to be enrolled on a course of study at an institute of higher education i.e one which undertakes studies at undergraduate or postgraduate level (usually a university or equivalent). This definition also includes mature persons with little academic background but with substantial professional qualifications in say computing, police work or IT auditing who may have enrolled on a university short course in a cybersecurity topic. All primary data fact-finding in this thesis will be conducted on people in the above categories.

1.3 What Is Meant By: Model

The word 'model', according to Merriam-Webster (2013) is something that 'can be used for imitation or emulation' – see Fig 1.2 - and this is indeed what an edutainment model is to be used for - as an aid to producing and constructing learning materials. However, such a term must also stand in contrast to similar phrases such as 'good practice', or 'framework' and this is why the word 'formal' has been included – Fig. 1.3.

MODEL
1. structural design <a home on the *model* of an old farmhouse>

2. a usually miniature representation of something; *also*: a pattern of something to be made

3. <u>an example for imitation or emulation</u>

4. a person or thing that serves as a pattern for an artist; *especially*: one who poses for an artist

FORMAL

a: following or according with established form, custom, or rule <lacked *formal* schooling> <a *formal* dinner party> <*formal* attire>
b: done in due or lawful form <a *formal* contract> <received *formal* recognition>

Figure 1.3 Definitions of words 'model' and 'formal' Merriam-Webster (2013)

Formal implies being created in an established, rule-driven way and by some recognised process. Also, the word 'model' should imply something more robust and defensible than just arbitrary selection of guidelines or a framework of collected suggestions. A model needs to be built upon solid foundations of carefully selected criteria, justified by existing but well accepted practice, and to be tried and tested iteratively in a process of gradual refinement. Many definitions of the word 'model' exist . Fig 1.4 shows the Free Dictionary (2013) definition which seems more comprehensive and gives a variety of explanations of which meaning five is similar to Merriam-Webster's. But the most apt appears to be number three which seems well-worded, concise and most appropriate for this undertaking.

1. A small object, usually built to scale, that represents in detail another, often larger object.
2. a. A preliminary work or construction that serves as a plan from which a final product is to be made
   b. Such a work or construction used in testing or perfecting a final product
3. A schematic description of a system, theory, or phenomenon that accounts for its known or inferred properties and may be used for further study of its characteristics: *a model of generative grammar; a model of an atom; an economic model.*
4. A style or design of an item
5. One serving as an example to be imitated or compared

Figure 1.4 Definitions of word 'model' Free Dictionary (2013)

1.4 What Is Meant By: Enhance Learning

1. make greater, as in value, beauty, or effectiveness; augment.
2. provide with improved, advanced, or sophisticated features

Fig 1.5 Definition of word 'Enhance' FreeDictionary (2013)

'Enhance Learning' is perhaps the most important phrase in this thesis title. It gets right to the heart of what this thesis is all about; it is about finding something that will improve the process of learning amongst the higher education students. The FreeDictionary definition given in Fig.1.5 may be used to define 'enhance' in this context as 'to make more effective and provide with improved features'. Clearly, to establish that enhancement has actually taken place after the edutainment model has been trialled, it will be necessary to measure or evaluate effectiveness and improvement derived from an edutainment approach and that this will require the selection of a number of criteria that may be compared. The broad categories of data collection and analysis methods used herein for this purpose, are:

1. Questionnaires, university and researcher based, to students,
2. Interviews with some of the same cohort students,
3. Formal assessment and attendance statistics over 2 years: edutainment v. non-edutainment,
4. Personal statements and reflections from involved and independent lecturers.

1.5 What Is Meant By: 'Defining a Formal'

The research process in this thesis and it's experimental testing approach must be defendable, justifiable and repeatable and must not fail the test of good research process as per Ben Goldacre, author of Bad Science, who says of bad researchers, that: "they have never tested an idea for themselves … and they have never thought carefully about what results mean for the idea they are testing" (Goldacre 2009:1). This thesis does test its resultant model in a classroom trial and does discuss the results of the testing in a critical fashion with other lecturers and researchers. However, any model has itself to be defensible; it is not acceptable arbitrarily to choose what is to go into the model. The processes of creating a robust model, of how to choose what to include within it, and where and how to search for what to include, must themselves be open to inspection and criticism. Thus, the research process must itself be of robust construction. Crotty (2006:5) has suggested a good research process must consist of four elements: epistemology, theoretical perspective, methodology and methods. Briefly, these four elements are outlined in fig. 1.6 in the left hand box and the actual corresponding elements used in this thesis are shown in the right hand box. How these elements were chosen for this thesis is explained further in the Methodology chapter. Similarly Figure 1.7 shows the research phases and stages – again further explained in Methodology chapter.

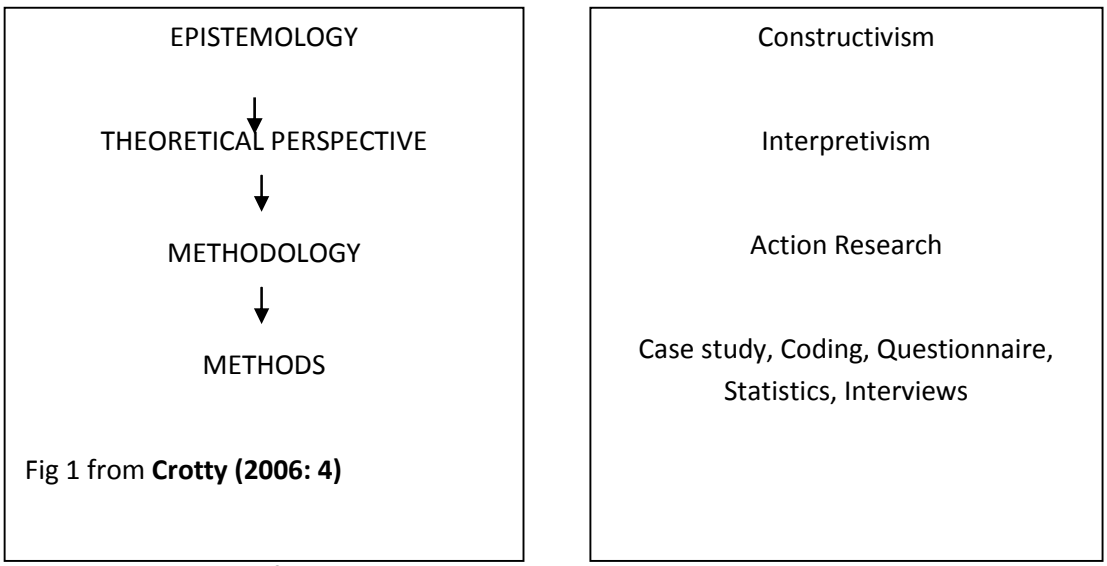


Figure 1.6 Overview of Research Methods used in this thesis

This thesis may therefore be formally summed up in the hypothesis statement that a model of edutainment used for teaching can enhance learning in students of cybersecurity in higher education. Stating more precisely one could say that the null hypothesis might assert that the use of a model of edutainment will either not enhance or will actually hinder the learning of

cybersecurity topics by higher education students whilst the alternative hypothesis might state that the use of a model of edutainment will positively enhance the learning of cybersecurity topics by the same. It is expected that a justifiable, reasoned and recognised approach to the research process will answer the above hypotheses.

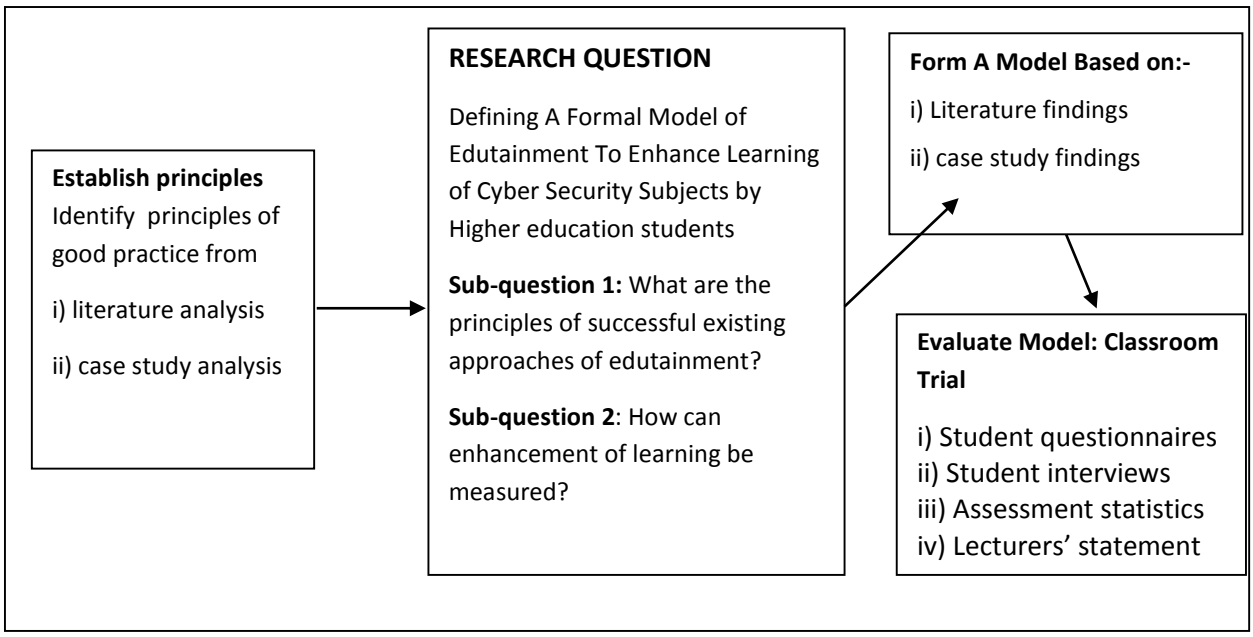


Figure 1.7 Research stages used in this Thesis

1.6 Why the Need For Such a Model?

This thesis is all about edutainment – a blend of education and entertainment – in the teaching of a particular range of skills (cyber security) to a particular set of people (higher education students mainly postgraduate). The word 'edutainment' is in common usage, particularly in marketing materials associated with software games, but, sadly, this marketing copy often suggests more than it delivers in regards to educational content. Additionally, there is much research indicating that a more relaxed, playful approach to learning definitely works well with children (learning by playing Montessori Institute (2014)) but little research on whether such an approach might be useful in the teaching of adults; it is possible, however, that such models used with children may be adapted for use with adults.

As the word 'edutainment' is now in common usage but is poorly defined or explained anywhere it is pertinent that an attempt at creating a viable model for adults be attempted; there are three reasons for such an undertaking in this discipline (cyber security) and with these students (higher education): (i) the need for continual improvement of adult teaching in the classroom, (ii) the

political need for teaching of more cybersecurity practitioners and (iii) the need for new ways of teaching to cater for the diversity of higher education students throughout the lifelong learning process.

1.6.1 Need for Continual Improvement in Teaching

> 'Education is what is left after you have forgotten everything you were taught at school' Albert Einstein.

The above saying, reported in Claxton (2010:88), may sound cynical but one might suppose that Einstein knew something about learning and discovery. He certainly had a poor view of conventional education, a sentiment more currently espoused by Perry & Sherlock (2008:67) talking about TVET (Technical and Vocational Education and Training), who stated that "traditional teaching, using formal instruction to fill supposedly empty vessels with knowledge organised by someone else, is often very ineffective" and subsequently referred to the practice as "pour and snore". Richard Gerver, in his book 'Creating Tomorrow's Schools Today' asked "Why is school not as exciting as Disney World?" before discussing how much children might gain educationally if only it was, (Gerver 2010:21). Consequently, it may be useful for educational practitioners to have a teaching model of edutainment practice that can be imitated or emulated in the classroom – see Fig 1.2 and Fig. 1.4 for definition of 'emulation' and 'model'. Teaching models are not new – several have been proposed over time such as PBL (Problem Based Learning), TBL (Team Based Learning) and others. The PBL model was developed for use in medical schools for training of medical students in simulated patient presentations of illness symptoms (Wood 2012). This approach was preferred to the earlier didactic classroom-based approach of the lecturer giving copious notes about symptoms with no relation to actual presentations by patients. The early approaches adopted in medicine were eventually codified into a PBL 'model' for general use as an educational paradigm by lecturers in other non-medical subjects. In a similar vein, cyber security teaching may also benefit from breaking away from dry, fact-based presentations with too little practical relevance. In addition, cybersecurity topics require good logical and numerical skills, which are often lacking in student applicants, as well as a definite sense of real-world application involving people as well as technology; overall, cybersecurity teaching could benefit from novel, absorbing teaching methods that might capture attention and enthuse a diverse group of learners as well as structuring learning more appropriately to fit the many ways in which people really learn. Consequently, as an output from this thesis, a 'model' of edutainment codifying principles of learning psychology known to enhance learning and which can be used for emulation in the classroom may be just as useful as the PBL model in improving student learning.

1.6.2 The Political Need for Teaching More Cybersecurity Practitioners

This thesis' author is a lecturer in cyber security topics and teaches at postgraduate level in a UK university. Cyber security is also becoming an increasingly popular topic for masters level study, amongst not only young people progressing from general IT undergraduate studies but also amongst older people with some IT experience attempting to retrain in a new area e.g. the short course training of anti-terrorist police officers in cyber security techniques (Chadwick et al 2012). This last group of persons has proved problematic in several ways as students are increasingly attending with no familiarity with academic study, weak logic and numeracy skills, and yet bring substantial experience from other possibly related areas of knowledge. It seems that what is needed are methods of teaching that quickly capture and hold the students' attention whilst explaining as easily as possible some very complicated logical and numerical subjects e.g getting students to act as both criminal and investigator (rather than just investigator) in the creation of coursework scenarios for forensics investigation (Chadwick et al 2012).

Fig. 1.8 UK Cyber Security Strategy

As if to support this personal observation, the UK government in 2011 voiced it's concern over the lack of cyber-security training and awareness in the UK, (Clemente 2011). The UK Cyber Security Strategy was released in November 2011 and earmarked £650m to accomplish four objectives over five years. The UK Cabinet office published the Strategy as a download from its website and the four objectives can be seen in Figure 1.9 **(**UK Cyber Security Strategy 2013:3). As part of the Action Plan for Objective 4, the UK Government outlined several actions they were going to take of which one very significantly was: Encourage, support and develop education at all levels, crucial key skills and R&D. The government had in mind the education of three categories of persons: children (to protect from cyber-bullying, grooming and paedophile activities), building of awareness amongst the population in general (to protect from phishing, fraud and other scams) and the extension of university education in cyber security (to boost awareness and acceptance of cyber security as a professional area). The Cyber Security Challenge was the first government initiative to engage universities and colleges in sending students to

compete in a games contest with the aim of raising awareness of cyber security and encouraging young people to take it up as a career. Industry also became involved with, in 2015, Minecraft, the software games developer, producing the Cysphinx online site for cyber security challenges.This thesis, revolving as it does around developing a model for enhancing learning of cyber-security subjects by university students, has something to contribute to this political initiative.

The UK government has also shown the need to improve the teaching of STEM subjects (Science, Technology, Engineering, Mathematics) in general, (Halsey et al 2007). In early 2016 it is expected that the Wakeham Report will be published. This independent review will look at the provision of STEM degree courses and how their associated accreditation arrangements support graduate employability and should identify whether there are areas which need further investigation. As part of its brief, the review will also focus on gaining an understanding of the skills requirements of employers, how STEM graduates' skills and knowledge relate to labour market demand, and how existing accreditation systems support this (UK Gov 2015).

1.6.3 Need for New Ways of Teaching in the Lifelong Learning Process.

'*Civilisation is a race between education and catastrophe'* H.G. Wells (Gerver 2010: Foreword)

If H.G. Wells thought that was true in the early 20th Century then how much more true is it in the early 21st century? The world today is even more busy, with global communications, complex technologies, sophisticated weaponry and competing ideologies. It is a necessity that education is no longer limited to the first 21 or so years of life. More and more people are having to learn for longer and longer into their adult lives, about topics that impact their working, and sometimes, family lives – cyber security is now one of those issues. With the increasing pace of science and technology, adults are having to learn topics that are completely new to them in both theory and practice, and learn quickly as only limited time can be gleaned from a busy working life (Halsey et al 2007). There is an international drive to increase the uptake of education in all its forms by people beyond their early twenties and the OECD has published a policy briefing to this effect (OECD 2007). So there are political pushes to make lifelong learning a mainstream issue in formal education; a model for the use of edutainment in teaching may prove a useful tool here.

1.7 Conclusion

It is envisaged that this thesis will formulate a basic practical model of edutainment that will go some way to addressing the above issues. It is believed that this work will contribute to the body of knowledge concerning the learning processes in adults and how adult learning may be enhanced. Such a body of knowledge for teachers will increase in importance as the numbers of adult learners increase not just in formal teaching areas (universities, further education colleges) but in the workplace environments themselves. Therefore this thesis, producing a practical model of edutainment, justified by deep research into carefully chosen already existing and successful examples of such, may prove useful to all kinds of educational practitioners.

Whatever the outcome, it is believed that this exercise has value in itself. Although much research has been undertaken into what helps children learn, much less has been done on what helps older learners. This was not a particularly important issue 25 years ago when most formal learning was over by the time the majority of people reached 16 years and even for the tiny minority of educated persons was mostly finished by age 24. But nowadays as people live longer, and the workplace becomes more technologically oriented, and bodies of knowledge (especially in security of IT) grow extensively in the professions, the need for research into adult learning has become more pronounced. The world of education, especially the growing area of adult learning, will always be seeking better ways of teaching and it seems unlikely this drive will ever cease; this thesis is a small part of that drive.

1.8 Chapter By Chapter Roadmap Of This Thesis

Chapter 2.Literature Review
This is based upon a Relevance Tree – see appendix A – that shows the areas of interest explored throughout the literature review. This chapter is divided into four phases:

Phase I: What is Edutainment' meant to explaining what edutainment is and reviewing similar work done elsewhere;
Part II: Can Edutainment Enhance Learning?' discussing what was lacking in current educational practice and how edutainment might be able to fill the gap;
Part III: What problems might arise?' addressing issues that might seriously compromise any the research and its findings.

Part IV: ‘What professional issues might arise’ looking at the stakeholders of teachers, managers, government and professional bodies and their issues surrounding the possible use of an edutainment model.

Chapter 3.Research Methodology

This chapter describes the methodologies used in the research process outlined in fig.1.7 above. The methodology is divided into six stages:

1) Criteria for selection of important principles from the literature review.
2) Criteria for selection of the six case studies for analysis.
3) Coding schema used in analysis of the six case studies
4) Method of combining 1 and 3 above to determine principles useful for edutainment model.
5) Method of implementing classroom trial of the model: design of materials, delivery.
6) Method of evaluating the said model and data tri-angulation from the classroom trial using student interviews, student surveys and assessment statistics.

Chapter 4 . Data Collection and Analysis

This looks at the same six stages as in the Methodology chapter but looking at the collection and analysis and use of the actual data. This meant:

1) Selection of principles from the literature
2) Selection of six case studies from UK, USA and South Africa
3) Analysis of case studies using principles derived from the literature
4) Creation of draft practical edutainment model using principles found in 1) and 3)
5) Lesson plan, assessment, lectures and tutorial examples for trialling with real students
6) Evaluation part 1 : analysis of feedback from student trial of step 5
   Evaluation part 2 : analysis of lecturer peer feedback on using and commenting upon model

Chapter 5 Discussion

Looks at the limitations of the research process and makes recommendations for further research

Chapter 6 Conclusion

Looks at how well the thesis question and sub-questions were answered by the research..

2. LITERATURE REVIEW

Carl Rogers, the renowned American psychologist and educationalist, said in his book '*Freedom to Learn'* published in 1983:

> "I want to talk about learning. But not the lifeless, sterile, futile, quickly forgotten stuff that is crammed in to the mind of the poor helpless individual tied into his [sic]seat by ironclad bonds of conformity! I am talking about LEARNING - the insatiable curiosity that drives the adolescent boy [sic] to absorb everything he can see or hear or read about gasoline engines in order to improve the efficiency and speed of his 'cruiser'. I am talking about the student who says, "I am discovering, drawing in from the outside, and making that which is drawn in a real part of me." I am talking about any learning in which the experience of the learner progresses along this line: "No, no, that's not what I want"; "Wait! This is closer to what I am interested in, what I need"; "Ah, here it is! *" (*Rogers 1983: 18-19) cited in (Smith 2003).

Rogers' main contribution to education was the concept of teacher as facilitator creating the environment for engagement often through making short (sometimes provocative) input. And what he was also able to emphasize was the attitude of the facilitator. There were 'ways of being' with others that fostered exploration and encounter – and these 'ways of being' were more significant than the teaching methods employed (Smith 1997, 2004). It wasn't long before Rogers' ideas were adopted in America and then also in Europe and the rest of the world leading to his eventual nomination for a Nobel Prize in 1987. Rogers was referring mainly to the education of children and his ideas proved successful in practice but this thesis asks - what about adults? His work may provide some basic fundamentals for adult learning as well: the notion of short provocative (not necessarily antagonistic) input, the notion of creating an environment for engagement and the notion that the educator can influence learners just by his/her ways of delivery. In fact, Howard Gardner, the creator of the concept of multiple intelligences, himself said "presenting materials and fostering multiple representations is one component of effective teaching" (Gardner 2009:113). Overall, both Rogers and Gardner seemed to be suggesting that variety in delivery and materials may be useful in learning so that perhaps an edutainment approach, with its pieces of education blended with entertainment, may be useful.

Perhaps the main problem with this thesis was where to start. So perhaps best to start with the title: *Development of An Edutainment Model To Enhance Learning of Cyber Security By Higher Education Students*

A literature review should not be a "furniture sales catalogue" , so said Bell (2002: 92), "in which every literature source merits a one paragraph entry no matter how significant it is". In consequence, it was deemed necessary to skim various promising areas to identify concepts and examples pertaining to edutainment and which might be pertinent as parts of the thesis and the model of edutainment it was attempting to construct. This initial skimming of the literature, with its cursory analysis of 'playing' with data sources, was considered useful in directing the Literature Review itself; according to Yin (2014: 135) "A helpful starting point is to "play" with your data. You are searching for patterns, insights, or concepts that seem promising" and, to this end, a Relevance Tree (appendix A) was drawn up. This was based on a recommendation in Howard and Sharp (2004:84) showing the necessity of identifying and levelling topics of interest to direct the literature review. However, in addition to statements of areas of interest at each level,
questions were also used at each level; questions seemed more useful as they directed the research into new regions, widening the scope of sources and introducing areas of critique and debate.
If this doctoral thesis was to be a contribution to human knowledge then it would need to be in an area minimally-researched or non-researched previously, and have premises which are either axiomatic or are justified by the critique of other researchers findings. To meet these criteria a number of questions arose immediately which the literature needed to answer. Firstly 'Was this work original – or had models of this type, or something similar, been created already?' or as Howard and Sharp (1983:6) put it, it must 'seek through methodical processes to add to one's own body of knowledge and … to that of others, by the discovery of non-trivial facts and insights'. Secondly, 'Would this work be a contribution to human knowledge' or as Rudestam & Newton (1992: 46) put it, would it be both important and timely. Thirdly, 'Was this project feasible – were there any issues that might be problematic?' and lastly, how would this project impact on professional considerations? By pursuing answers to these four questions it was hoped the literature sources would 'discover themselves' and lead to a structured whole. The literature review was therefore structured into the four following parts:

Part I: 'What is Edutainment?' which was expected to answer the question 'is this thesis original?' by explaining what edutainment might be and reviewing similar work done elsewhere;
Part II: Can Edutainment Enhance Learning?' was meant to satisfy the second question concerning making a contribution to human knowledge by explaining something that was lacking in current educational practice and how edutainment might be able to fill the gap;

Part III: Building the Model: What problems might arise?' was to answer the third, the feasibility, question and point out any issues that might seriously compromise any findings.
Part IV: 'What professional issues might arise' was to look at professional considerations concerning a model of edutainment particularly the impact on stakeholders such as government, education funding bodies, teachers, educational games manufacturers and the professional computing bodies.

2.1 PART I : WHAT IS EDUTAINMENT?

> "And what is the use of a book" thought Alice "without pictures or conversations?"
> So says chapter 1 line 1 of 'Alice in Wonderland' by Lewis Carroll (Carroll 2001)

One wonders why Alice said that … or more pertinently, why Lewis Carroll made Alice say that. Was he perhaps trying to suggest that books might be made more interesting, that reading, and the learning that comes from reading, might be more effective if there was a bit more entertainment? Was he perhaps thinking of … 'edutainment, educational entertainment or entertainment-education, … designed to educate as well as to provide fun' as the LNCS(2001) puts it? However, although the keyword 'edutainment' was, and still is, in common use currently, it was problematic to find a common definition of the term. A Google (2014) internet search found 1.25 million references to 'edutainment', 'edutainment process' and 'edutainment models' but most examples were merely marketing copy for selling games software; there was no doubt that if you wanted to sell a shoot-em-up knock-em-down game then parents were much more likely to buy for little Johnny if they thought there were some educational merit to it. But a cursory look at the first 100 sources from Google under each search term found that few were concerned with actual models of edutainment deliberately designed to enhance the learning of something; there was a tendency merely to include a few random facts as 'educational' material. Also, the term 'edutainment' did not arise much in the educational research literature. Evidence of the word in the research literature was sought amongst the 'effects' credited to John Hattie. John Hattie, influential in the meta-analysis of educational statistics, created his list of 'effects', given in full in appendix L, that can be shown to have influenced learning outcomes amongst secondary school children and discussed at length in (TeachersToolBox 2014). Apparently, Hattie (2011) had collated thousands of research

papers to draw up his list of ‘effects’ and their supposed influence in terms of GCSE awards. It was salutary to note that the word ‘edutainment’ did not appear in this list as an individual item although, of course, it may have been hidden under other effects. It can only be assumed therefore that ‘edutainment’ did not appear in many, if any, research paper titles or abstracts that John Hattie investigated and he was credited in having investigated more than 100,000 of them; this, in itself, suggested that edutainment was not a term widely recognised in the educational research community.

The discussion of several definitions of edutainment in the Introduction chapter concluded with a working definition of edutainment as shown in Fig. 1.1: ‘Edutainment is a synergistic blend of education and entertainment that through the use of fun and play, supporting creativity and curiosity, can produce a deeper and lifelong learning experience’ and this was the definition used for reference throughout this literature review. But firstly we need to begin with the word itself. Edutainment is a hybrid word of ‘education’ and ‘entertainment’ but what exactly is meant by entertainment and education in this thesis? According to Oxforddictionaries (2014) ‘entertainment’ was “the action of providing or being provided with amusement or enjoyment”. The words ‘amusement’ and ‘enjoyment’ suggest the engendering of positive emotions associated with play and fun. Even if we question this and say ‘what about horror stories and films - they are considered entertainment but they don’t engender positive emotions?’ However, according to the late Wes Craven, film-maker and producer of ‘Nightmare on Elm Street’ we do derive positive emotions from horror as the audience bring their real fear with them, and there is something about sharing it with other people in the safety of a theatre that is the enjoyable experience (Craven 2015). A similar explanation, for why people enjoyed watching dramatic tragedies and so forth, was stated by the Greek philosopher Aristotle 2,400 years ago in his Poetics. Aristotle considered that the dealing with unpleasant emotions through drama was, in some way, a cathartic experience for the onlooker (Halliwell 1987).

But just how might this ‘amusement’ and ‘enjoyment’ be engendered? It is not difficult to guess that humour (jokes), narrative (story-telling), characterisation (acting, theatre, role-playing), games (riddles, puzzles, problems) and music - and there might be other themes - might be considered fundamental to entertainment in all its guises (Wright 2007:6). Of course, one might also consider sport and dancing as forms of entertainment but these may be ignored for this thesis as they are unlikely to occur in a classroom teaching cyber security. So, what exactly is meant by these five broad entertainment themes and in what ways could they possibly be associated with educational use?

2.1.1 Characterisation:

The most obvious application of characterisation is in acting which may itself be divided into theatre and role-playing and puppetry. Children readily identify with colourful characters and learn behaviour from seeing those characters' actions – hence the use of puppets and cartoon characters in the children's TV programme Sesame Street (Davis 2009:80). In fact the use of muppets (derived from 'marionette' and 'puppet' as per Jane Henson, one of the creators) in Sesame Street was a very powerful edutainment tool and many of the teaching 'skits' concerning words, letters and numeracy were based around muppet characters. In addition, the use of role-play in child education has an extensive history especially in the teaching of social skills (Fisch & Truglio 2001:29). So important was character identity to children that it had to be handled carefully and a particular incident from Sesame Street TV programme shows this clearly. One of the characters, Big Bird, so named because he is a big yellow bird, decides he didn't want to be named after his appearance and wanted a proper name and, throughout a whole programme, Big Bird searched for a new name. However, feedback from the pre-school children's focus-group found that the children were confused about how could someone with one name decide to have another name? – if he was a Big Bird and was changing his name then was he trying to change into something else (Gladwell 2000:116)? Characterisation appeared important in children's entertainment but what about for adults?

For adults, characters are the building blocks of theatre, films, radio, TV serials and written fiction. Characterisation enables the audience member to adopt or empathise with another identity other than their own and this is a most important function. Katie Fforde, author, says in (Writers' and Artists' Yearbook 2013: 305): "Why do people buy my books?... because readers can recognise themselves in my characters and this is the same whatever age you are" . As Gilsdorf (2009:293), in his book 'Fantasy Freaks and Gaming Geeks' puts it "I will always struggle with some dissatisfaction with reality. Simple pursuits – folding laundry, mowing the lawn, watching American Idol [a TV programme] – can seem paralyzingly dull when compared to the exploits of that parallel [me] in a in a faraway land". This fundamental ability of humans (both children and adults) to identify with others' emotions, their roles, their problems and their viewpoints is known to psychologists as the 'theory of mind', and has all kinds of benefits. It enables humans to role-play, to identify with others and to enter alternative imaginary lives, devices powerfully used in

entertainment to capture and maintain attention and provide mental hooks on which the audience could hang their own experiences and memories.

But how important is characterisation to adults in a learning context? Paul Street of the University of Greenwich showed that there is evidence that teaching in higher education requires good acting skills on the part of the lecturer; apparently these engage the students' attention and make the learning process more effective (Street 2006). Nursing tutors at the University of Surrey frequently dress up in masks, false hands, torso and feet in order to simulate patients for student nurses to practice upon; apparently, according to nursing tutor Dr Maria Miklavcich, this reduces 4 hours of teaching to 20 minutes (Burns 2015). Godfrey Baseley, the creator of the Archers, a long-running, highly successful radio programme about country-life in the UK and which sought to teach farmers about new farming techniques, was reported as saying " …the target radio audience would be small farmers [so]... the principal characters would be small farmers so that farmers or their wives could identify easily" (Smethurst 2000:13).

2.1.2 Narrative

Narrative, or story-telling, has always been used in entertainment for children. Lewis Carroll's book Alice In Wonderland (Carroll 2001), contains examples of both long and short narratives. The long narrative flowing through the entire book is one of a little girl falling down a rabbit-hole and having various adventures in a strange world; this long narrative is itself composed of short narratives, highly imaginative and defying common logic, such as repeatedly meeting the character known as the Cheshire Cat whose head appears and disappears, or meeting the Caterpillar sitting upon a toadstool, or herself shrinking and growing. These different types of narrative make for good story-telling that capture children's imaginations and hold their attention (Gardner 2001). The childrens' TV programme Sesame Street also relies on long and short narratives; Big Bird's search for a new name (see Characterisation paragraph above and Gladwell (2000:116)) was a long narrative that occupied the entire programme but was composed of several shorter narratives each dealing with a particular educational issue.

But what of narrative in adult entertainment? There are specific techniques from the entertainment industry itself on how to construct plot (narrative); the Archers radio programme had a policy of always running three stories …one of a week's duration, one of a month's duration and one for a longer period up to three months (Smethurst 2000:116). In this way they calculated they would be

able to maintain the attention of the audience especially with the use of occasional 'cliff-hangers' (Smethurst 2000:9).

In terms of teaching, story-telling for children has always been in vogue and was also in favour for the formal education of adults in higher education (McDrury & Alterio 2003; Moon 2010). John Sweller, in his concept of cognitive load theory (CLT), pointed out "instead of asking students to "study" material we ask them to "imagine" or "mentally rehearse" the material instead … rehearsing by imagining involves processing procedures or concepts in working memory" which Sweller maintained was the most effective way of fixing things in the mind (Clark 2006:326). In fact, this notion of using imagination in learning may be under-rated for, the important thing about story-telling in an educational sense, is that it has often included strong characterisation which has facilitated identification on the part of the students with scenarios and human dilemmas. As an example, an approach that embodied both narrative and role-playing was Problem Based Learning (PBL) which originated in the 1950's as a new method of teaching medical students. The students were presented with patient-based scenarios (story-telling) and asked to act the role of medical practitioners tending to the patient even though they themselves were still students and had never seen a real patient (role-playing).This was very successful with both trainers and students alike and Fry et al (2009: 431) were impressed far enough to say "There is some evidence that PBL students (in medicine) take more of a deep approach to learning, retain knowledge longer and perceive their learning as more relevant". This is an important observation by Fry et al, as their statement contained the phrases 'deep approach to learning', and 'retain knowledge longer' which are highly desirable features and consistent with the definition of edutainment, see Fig. 1.1, being used herein where 'deeper' and 'lifelong' are explicitly referred to.

2.1.3 Humour

Humour, of course, is immediately consistent with the provision and encouragement of the fun aspect of the edutainment definition given in Fig. 1.1. In 2003, the BBC Radio 4 Reith Lectures were given by eminent neurologist Dr Vilayanur Ramachandran. In his first lecture he asked the question 'Why do we laugh?' and went on to say "laughter is a specific and universal trait for us humans. Every society, every civilisation, every culture, has some form of laughter – except the Germans" (Wright 2007:6). There are several significant things about this joke that exemplify humour and its possible use. Like most humour, it contained a sudden change in perspective; it also contained an incongruity of some kind, Gamon & Bragdon (2005: 255), in that one didn't

expect an eminent neurologist to say what he did say about the Germans and that this was definitely unexpected during the Reith lectures which were renowned for being morally upright and politically correct. However, the above example does show the necessity for humour to be treated with caution. Of course, in humour, there were practical issues of delivery that needed to be considered. Apart from ensuring something is funny to as many of the audience as possible (and not offensive to any group), there is also the issue of timing and duration. As Wright (2007) pointed out, any stand-up comic could explain that jokes need a lead up to a decoy scenario, a trigger followed by a pause whilst the audience absorbed the decoy mind-set, then a delivery of an alternative perspective – the subterfuge causing the laughter as the audience realised they had been led into thinking something else. Here is an example from British comedian Bob Monkhouse, who, aged in his 60's, very wealthy and very famous after a spectacular career on television and film, said:

'When I was young I told people I wanted to be a comedian'

<Short pause>

'They laughed'

<Longer pause>

'Well they aren't laughing now.'

Like most humour, this example contains subtle timings and a punch line; the pauses, or the timing of the statements, are part of the joke as the audience needs time to absorb information and build an internal mental model and the punch line exemplified a sudden change in perspective. Also, this joke, like most jokes, was not very long as the audience could quickly lose track of what was happening. In education, such ploys could also be useful; in fact, Siler (1997: chs 8,22) pointed out that some of the attributes of genius were the ability to find alternative perceptions, to see things differently, to break thinking habits and to deliberately seek paradox (all attributes shared by both jokes and education).

So, is humour really useful in education? According to Susan Cowley, pupils at a UK secondary education school considered the best teacher approach was 'firm but fun' (Cowley 2003: 57). The students interviewed by Susan Cowley defined the best teacher as one who "is strict … but makes everything fun. [They] play with words to make the work more interesting" (Cowley 2003: 117). Surely this playing with words, and the fun that young people derived from it, must be considered of benefit as it not only held their attention but also extended their vocabulary. More significantly for this thesis and its context, humour is becoming accepted in higher education and Powell and

Andresen (2006) observed humour in higher education had often been credited with the "the promotion of understanding, holding the attention of students, managing disruptive behaviour, creating a positive attitude to the subject matter, and reducing anxiety" . They discussed the fact that, provided it was not used to excess, humour could be a useful tool but cautioned that it involved skills which needed to be learnt through practice and that staff development programmes needed to provide opportunities for academics to acquire such skills. This latter finding was recognised in the Methodology chapter hereto where arrangements were explicitly made for gaining professional comments on the final edutainment model. Further observation on the work of Powell and Andresen (2006) was that of the five benefits of humour in the classroom that they mentioned, four of them (attention, behaviour, attitude, anxiety) were involved with attentive and affective (emotions, feelings) factors … but more about this later. According to (McGill & Beaty 1995:239; Rose 1985:91) humour was also useful for recall of past experience and knowledge - a feature important for adult learning and the 'firm but fun' approach of excellent teachers valued by secondary school pupils in (Cowley 2003: 57).

Lastly, from a neurological viewpoint, there is some evidence that laughing increased the production of the brain neurotransmitters: dopamine, epinephrine, and norepinephrine, aiding alertness and memory. There is also evidence that humour might enhance learning and memory by countering the adverse impact of stress on the capacity to regenerate neurons in the hippocampus, an important memory centre in the brain (Gamon & Bragdon 2005:253).

2.1.4 Music

Music is immediately consistent with the provision and encouragement of the creativity and play aspects of the edutainment definition given above (Fig.1.1.) and, according to Campbell (2002), the application of music in aiding education, or the 'Mozart effect' as it is commonly known, is well researched. Some teachers consistently make use of music in the classroom and various good practice guides have arisen to make the best use; Vazicek (2011) has a simple set of rules: be consistent (he advises introducing musical elements slowly into the classroom), experiment but do not overuse, most important is to have a purpose (he says music in a classroom without a purpose is counterproductive) and ensure any music is school appropriate (with lyrics suitable for the age group). In addition, it has been widely reported that listening to classical music (hence Mozart effect) can indeed calm students and heighten concentration especially before examinations and this is well-known as a relaxation technique for exam preparation (NHS Choices 2014). Colin

Rose, in his book ‘Accelerated Learning’, mentions the work of Stephen Cooter on brain-wave patterns, and that of Lisa Summer who came up with an explanation involving integration of the two hemispheres of the brain, to find a physical explanation of the power of music to alter mood and aid concentration (Rose 1985:97–110). Some of the benefits of background music in the classroom were that it could improve attention, increase concentration and relieve tension. According to Brewer (2014) at Johns Hopkins University USA there were two effects of music on the brain, the so-called ‘concerts’ invented by Lozanov an early pioneer of music in learning environments. These ‘concerts’ created very different but equally effective learning environments. The Active Concert activates the learning process mentally, physically and/or emotionally while the Passive Concert iss geared to place the student in a relaxed alpha brain wave state and stabilize the student's mental, physical and emotional rhythms to increase information absorption. Both teaching methods resulted in high memory retention and according to Brewer (2014), used together, the two concerts provided a powerful learning experience. But, there is some dispute about how effective the music issue really was; Gamon & Bragdon (2005: 78, 261) cited evidence to show the ‘Mozart effect’ was much more limited than at first sight and only worked in spatial-temporal reasoning and only then for a short period (the original American research was performed on the paper-folding task of the Stanford-Binet test where it did enhance learning – however, it failed to have any effect on other tasks). These findings were reinforced by the work in 1985 of Steven Smith at Texas A&M University who did work with students remembering word lists in three groups listening to either Jazz, Mozart or silence. It was found that ‘having something going on in the study environment, like music, is better than nothing’ but that was as far as the research could conclude about the use of music (Carey 2014:51). It therefore follows that more research needs to be done to prove that music directly benefits students in all learning tasks although it cannot be ignored that just relaxing people so they concentrate better or by blotting out other more distractive sounds could also be useful in educational settings.

However, in a wider context, outside of the formal learning environments in developed countries, music is widely used as a carrier for educational messages usually to populations of low-literacy and those affected by social deprivation. Examples of this are the ‘Fight Malaria’ song by the group Tanzania House of Talent broadcast in Tanzania 2014 and broadcast on UK television on (Al Jazeera 2015) to tell people that the fight against malaria continues and to warn populations to obtain medical care quickly after the appearance of symptoms especially in children. Also, not to forget, ‘Ebola in Town’ a popular dance song from Samuel Morgan and Edwin Tweh in Monrovia, Liberia, one of the countries badly hit by the virus. Morgan and Tweh had written songs before

about social issues such as absent fathers and sanitation failings and 'Ebola in Town', the words of which are to be found in appendix N, spread a message of how to protect from the disease (NPR 2015). These references to use of music in social education are mentioned here because the use of musical edutainment in developing countries is widespread and very effective but often under-recognised in more developed countries. For this reason one of the case studies herein, Soul City, was deliberately selected to reflect this rich vein of practice.

2.1.5 Games

Fig. 2.1 The Turtle

Games and the different forms of games, such as puzzles, riddles, brain-teasers, and all those problem-type scenarios which pose an intellectual challenge to the participant, are immediately consistent with the provision and encouragement of the play, curiosity and creativity aspects of the edutainment definition given in Fig.1.1. Learning-Theories.com, an educational website, states that the use of educational games in the classroom has three positive effects: it encourages collaboration between players of the game, it encourages empathy and new perspective generation and lastly, it promotes system thinking or the ability to see how things influence and relate to one another within a larger entity (system). A game used in classroom settings that incorporates these three principles, and which is aligned with the American Next Generation Science Standards, is 'EcoChains: Arctic Crisis'. This is a two to four player card game about a rapidly warming Arctic ecosystem. Players build food webs using attractively illustrated cards featuring Arctic cod, walrus, polar bear, seals and more with the aim of protecting Arctic species from the impacts of climate change and see how they can devastate food chains; the player who keeps the most animals alive wins the game (EcoChains Kickstarter 2015). Another game, specifically for adults learning cyber security penetration testing techniques ('good' or 'white-hat' hacking) is (Control-Alt-Hack 2012). This is a card game in which 3 to 6 players are required to employ their hacker skills and social engineering skills to attack power grids and robots. This game has been used in cyber security tutorials at the University of Greenwich where students report (anecdotally, as no scientific survey has yet been conducted) that they enjoy the game as it forces them to think and bring together the more formally taught technical skills of the courses themselves.

Game-playing begins at an early age – simply put, a game poses a challenge to solve some kind of problem. Morrow (2008) mentions that there was a frequent ‘skit’ in the Sesame Street children’s TV programme, a programme to aid the basic education of pre-school children, in which four objects were presented in a 2*2 matrix. Three of the objects supposedly had something in common and the preschool child viewers were ‘challenged’ to find the odd one out. On one broadcast of this frequent game, Mr Hooper, the grocer, placed boxes of detergent and food in the 2*2 matrix and asked Big Bird ‘which is different from the others?’ Big Bird had trouble with this and Mr Hooper explained that the custard mix box was a different size box from the others – it was smaller**.** However, Big Bird replied that there was another explanation: the detergent box was the only one that did not contain food. Games such as this are highly educational for children for they not only pose a challenge but show that more than one solution is possible. Games for children were also a particular interest of Seymour Papert of the MIT Media Lab. Papert was concerned with improving the teaching of mathematics and computing skills and believed in using non-didactic, student-centred and entertaining methods of instruction. He believed in the notion of ‘play’, and the enjoyment of play, as a learning enhancer particularly in the teaching of logic-related subjects such as mathematics and computer programming (STEM-type subjects); in fact, he was the first person to use the word ‘edutainment’ in a structured, strictly academic context. As a practical demonstration of his belief, he created an electronic wheeled vehicle, the Turtle, controlled by a programming language Logo, for use by programming learners (adults as well as children) – see fig.2.1. In his book ‘Hard Fun’ Papert reported a teacher hearing a child saying of his computer work: "It's fun. It's hard. It's Logo" and Papert went on to say “I have no doubt that this kid called the work ‘fun’ because it was hard rather than in spite of being hard” (Papert 2002). These early ideas of Papert, especially his interest in the kinetic aspects of manipulating physical objects, which are so attractive to children, have since been developed by others as technology has improved. Examples of this are the 3D objects learning games of Imaginality (2015) or the methods of using small robots to teach programming to children as reported in (SkyNews 2015). BBC News (2012c) also reported the recent trend in UK primary schools of teaching computer programming in Coding Clubs and particularly in some primary schools the teaching with edu-bots, robots designed for educational purposes.

Fig. 2.2 The Aldebaran Teaching Robot

A typical edu-bot is the Aldebaran, shown in Fig.2.2, a robot about 40cms tall that can move, dance, speak and pick up objects and can be programmed by a child on a laptop using a WiFi link and the language Python. This robot and several others have been trialled in Warwickshire schools in the UK as part of their 'We believe that creativity and education should go hand in hand' policy (Warwickshire County Council 2015). The really useful thing about edu-bots is that, from a teacher's point-of-view they incorporate all four strands of STEM (Science, Technology, Engineering, Maths) and from a child's point-of-view are highly visual (look cute), kinetic (they walk and dance), nicely noisy (they speak and sing) and can be interacted with (they are controllable). Also, and this is conjectural but needs to be said, they can be seen as characters in their own right … and characterisation in objects is very important for children as mentioned before with the characters in Sesame Street. The importance of Papert's work is not that it used technology, but that it used technology to deliberately incorporate games, building projects and fun into the learning psychology of the classroom. It was the intellectual stimulation of the games that was of importance and, in education, games may take many names: riddles, puzzles, brainteasers or just problems that needed solving.

Children and adults love learning through games but there are practical issue involved with game-playing. The game must be not too hard and not too easy – it needs to be a challenge in itself so it must be carefully designed at the right intellectual level and pace of operation for the learner. So a hard game can be called 'fun' simply because it is sufficiently challenging enough to dare the gamer to tackle it and in so doing to offer an ultimate satisfaction of eventually mastering the game. The psychology of setting up a game-playing scenario needs careful consideration. Here is a puzzle, a form of game, from the author Lewis Carroll, a master of edutainment and whose book 'Alice's Adventures In Wonderland', Carroll (2001), is one of the case studies herein. Carroll often included mathematical or logical conundrums in many of the letters he wrote to his child friends in order to encourage their learning. This puzzle, explained in Wilson (2009:108), is to 14 year old Wilton Rix:

Honoured sir,

Understanding you to be a distinguished algebraist (i.e distinguished from other algebraists by different face, different height etc), I beg to submit to you a difficulty which distresses me much.

If x and y are each equal to "1", it is plain that $2 * (x^2 - y^2) = 0$

And also that $5 * (x - y) = 0$

Hence, $2 * (x^2 - y^2) = 5 * (x - y)$

Bearing in mind that $(x^2 - y^2) = (x - y)(x + y)$ *divide each side of this equation by* $(x - y)$

Then $2 * (x + y) = 5$

*But (x + y) = (1 + 1), i.e. 2 So that 2 * 2 = 5*

I have not slept more than 8 hours a night and have not been able to eat more than 3 meals a day. I trust you will pity me and will kindly explain the difficulty to Your obliged, Lewis Carroll

This is a simple game showing a process of logic (obviously faulted in some way) that concludes that 2 * 2 = 5. See how Carroll draws his 'victim' into the game with 'distinguished algebraist' to catch his vanity and 'I have not slept' and 'I trust you will pity me' suggesting that Carroll himself was beaten by the problem but that he, Wilton Rix, might solve it. So Carroll was psychologically setting up the 'victim' with a challenge. The statement 'I have not slept more than 8 hours and have not been able to eat more than 3 meals a day' is an obvious joke as he is stating quite normal things and is itself an example of humorous word-play. These tricks were meant to inspire the young Rix to tackle the problem and gain enjoyment and much learning by so doing (and it is only a pity that no correspondence survives to tell us how it all went).

The use of games can therefore have a beneficial effect upon learning. Fry et al(2009: 35) mentions that the "assessment system should be one that encourages conceptual understanding as opposed to rote-learning…through the increased use of problem-solving, case studies and the like, where knowledge has to be used rather than just learnt" . Game-playing in all its facets uses puzzles, riddles, conundrums, brain-teasers, all of which can be made challenging, and which, when solved, can lead to the emotional satisfaction, the feel-good factor, that is so important for student self-confidence and which aids the move towards deeper learning. This was well supported by Papert et al (2004:262) who mentioned "learners do not mind, and benefit most from, activities that are 'hard' as long as they connect deeply with their interests and passions". Today, this delight in the use of games for learning has found a new home in the software games industry particularly for the so-called 'serious games' which contrive to educate as well as entertain. The term 'serious games' has been defined by Le Compte et al (2015:204) as 'a mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy and strategic communication objectives' and the military and public services, particularly, have become very interested in this. Such games, for example CyberCIEGE and SimBLEND, and variants upon these, are so promising as a future application of edutainment as defined by this thesis that they are explored at some length later in this literature review under section 2.4.7 in Professional Issues where the software industry itself is perceived as a stakeholder in the development of a detailed model of edutainment.

But where was the concrete research evidence for the psychological effects of game-playing on learning? The most important findings were from experimental psychology under the term 'Generation Effect' (Hirshman & Bjork 1988:1; St. James et al 1992:149) which intimate that there

is robust research evidence that information is better remembered if it is generated from one's own mind rather than simply read. There is no doubt that being interactive with information, rather than passively accepting it, is itself a form of scaffolding that aids the construction of memory. On this experimental evidence, games, through their inter-activeness, clearly have a role in fixing learning in the mind. This does not necessarily mean complicated time-consuming group-driven competitive events but also quick individual-based simple games such as riddles, conundrums, simple problems, brain-teasers and so forth. There is also much evidence that playing games and the deep attention that game-players seem to develop, and termed 'flow', is a form of 'deferred gratification' as defined by Walter Mischel, the experimental psychologist who first coined the term 'deferred gratification' from his research on the 'marshmallow tests' with small children (BBC Forum 2014). But more about 'flow' later.

In synopsis, five themes of entertainment have been identified which may be useful in the edutainment model under creation. We have seen that each theme is currently in use in education and that each has particular issues regarding practical delivery. However, each theme must be used with some forethought and planning in an edutainment scenario because in addition to content and context there are also issues such as timing, very important in humour as telling a joke requires putting some details first and other details last in order to deliver a punch-line, the forming of amusing mental images as mental hooks and cliff-hanging techniques between episodes of story-telling.

2.1.6 What do we mean by Education: Pedagogy, Andragogy and Heutagogy?

The other half of the hybrid word 'edutainment' is education. Most people would say that education was all about learning to think; however some interpret this as learning 'what to think' and others 'how to think'. De Bono (1976:33) defined thinking as 'the deliberate exploration of experience for a purpose' and he expanded upon the 'purpose' as meaning 'understanding, decision-making, planning, problem-solving, judgement, action' amongst other things, so one might say that education was always more than just 'what to think'. However, it is not the intention of this thesis to explore education in all its depths – this would warrant another doctoral thesis in itself. Suffice to say, that as this work is about the education of adults in higher education then discussion of pedagogy, andragogy and also heutagogy is essential.

Pedagogy, the usual term used to describe teaching of any kind, literally meant 'leading children' and was a term generally used to define the didactic, teacher-led, very formal methods of teaching found in most schools incorporating rote-learning, replication of the teacher's notes and thoughts

and sometimes, in its worst excesses, the discouragement of individual thinking.. Andragogy, in contrast, was a term coined by Michael Knowles to refer to the art/science of teaching adults. Knowles maintained that adults learned best when they : 1) moved from dependency to self-directedness; 2) drew upon their reservoir of experience for learning; 3) were ready to learn when they assumed new roles; and 4) wanted to solve problems and apply new knowledge immediately (Knowles 1980: 43). This concept of andragogy is important within this thesis as it concerns itself with higher education and consequently with the teaching of adults most of whom would wish to learn about topics of particular interest to themselves (statement 1 above), had much prior knowledge work-based as well as life-based (statement 2 above) and be looking for teaching that related to work-based scenarios and problems (statement 3 above). Statements 3) and 4) were especially pertinent as knowledge for work is often termed generally in the literature as 'situated learning' highly important for adults of working age (Pritchard 2009:26). Adults, too, were known to exhibit 'metacognition' referring to the learner's ability to be aware of their own learning processes which underpinned more self-directed learning (statement 1 above) (Pritchard 2009:26). Overall, the work of Knowles (1950:6) was important in reorienting adult educators from 'educating people' to 'helping them learn' and was closely associated with the notion of 'scaffolding' by (Vygotsky 1962). The concepts of Knowles and Vygotsky will arise again in this thesis as they are directly relevant to use of edutainment in the context of teaching cyber security to adult students at university.

Allied to andragogy, and not to be neglected when discussing education of adults, was the concept of heutagogy. This term basically referred to 'self-directed learning' and the growing circumstances of adult learners having to take responsibility for their own learning (statement 1 above in Knowles' list). It points to a future in which information is readily and easily accessible and where change is so rapid that traditional methods of training and education are totally inadequate such that discipline based knowledge is inappropriate to prepare for modern living and workplaces. It suggests that learning is increasingly aligned with what we do, that modern organisational structures require flexible learning practices; and there is a need for immediacy of learning. Heutagogy attempts to address some of the deficiencies of the more formal pedagogical and andragogical methods (Hase & Kenyon 2001). One of the important aspects of this approach is that heutagogy suggests that knowing how to learn must become be a fundamental skill given the pace of innovation and the changing structure of education and learning opportunities. This is important as the notions of lifelong-learning and self-reflective practice are becoming more recognised in modern society (Canning 2010).

However, this thesis maintains that the three terms pedagogy, andragogy and heutagogy are not necessarily exclusive – they are possibly better appreciated as overlapping sets such that a mode of teaching may very well involve all three methods to accommodate variable content and variety in delivery to learners of any age. Examples might be that although children may be taught predominantly pedagogically (with the teacher at the front of the class stating categorically what is to be learnt, and what is true, and what the answers to questions are), there may also be instances where even children need an andragogic approach and perhaps also a heutagogic approach. Guy Claxton in his book 'What's the point of School?' even coins the term 'epistemic apprenticeship' by which he implies that the normal teacher-facing pedagogy in secondary schools must give way to teaching that is more andragogic in nature based around work-oriented practices found in the adult world such as learning by watching, learning by making mistakes, learning by sorting through information not neatly packaged/presented/structured and learning how to learn (Claxton 2010:20,54). Claxton even went so far as to quote Winston Churchill who said "The only time my education was interrupted was when I was at school". Of course, it was well-known that Churchill disliked the blatant pedagogy of his own school days and wanted for something different. The contemporary literature, also, indicates that not much has changed since Churchill's day; Gerver (2010:21) quotes a secondary school leaver as blogging 'I have finished education and i [sic]feel lost in the world of work i [sic]don't have 1 [sic] main idea that i [sic] want to go on and pursue in my life' which does seem to imply that a bit of andragogy might have been a preparation for life after pedagogy. Similarly, not all adult teaching is necessarily solely andragogic or heutagogic as pedagogy may also have its part to play; the professional computing bodies such as ISC[(2)] and ISACA talk of 'bodies of knowledge' that practitioners are required to commit to memory for their CISSP and CISA professional examinations. As a matter of interest, the doctoral programme followed by this thesis' author effectively demonstrated this mixing of '-gogies'; the taught courses had pedagogic episodes from a tutor usually followed by andragogic periods of discussion amongst the teaching professionals in the student body whilst the resultant thesis part (this thesis hereto) was mainly heutagogic in nature.

2.1.7 Synergy between education and entertainment

The working definition of edutainment derived during the Introduction chapter and shown in Fig.1.1 stated that '*Edutainment was a synergistic blend of education and entertainment …'*. This definition emphasised that blend and synergy were important as together they implied close integration and the sharing of some common functionality. However, it is possible to have synergy

without blending: commercial TV in the UK has entertainment programmes sponsored by a product endorser who pays for the entertainment and presents his own product information during the commercial break – here the entertainment and the 'teaching' are separate. In contrast, in the USA there is additionally, a more blended form of TV marketing whereby the product itself is presented as an integral part of the programme – here the programme draws the audience and the audience is captured for the integral advertising. It is only in the second instance that a blending of the contents of the programme with the advertising message actually occurs. However both instances are instances of synergy, as in both cases the programme makers (paid by the product endorser) and the product endorser (receives large audience from the entertainment) receive mutual benefit. Needless to say it is the blended approach that tends to be more effective as the 'message' appears within the entertainment itself and avoids the risk of losing the audience during the commercial break. Although one may not agree with the ethics of such a marketing ploy one must accept that they are effective. On this basis 'synergistic blend' in the edutainment definition seems an appropriate term but begs the question of how might education and entertainment be blended to obtain synergy – where is their mutual overlap of practice?

A quick glance at entertainment reveals the obvious psychological imperatives of capturing audience attention and manipulating audience emotions usually to highly positive happy emotions associated with fun and play. It does not require much insight to realise that an entertainer who did not capture and keep the attention of his audience and then do something for them emotionally, would not survive long. This is what entertainment is all about – it is all about dealing with two psychological domains: the attentive domain and the affective domain. But the obvious question here is - doesn't education also operate in the same two domains? Surely education requires the teacher to capture and retain the attention of an audience of students for without their attention it is axiomatic that there would be no learning at all. And surely, if students are happy with their learning environment, the way they are taught and the materials presented to them, then they would be more likely to learn something? Entertainment and education certainly both operate in these two areas of psychology – the attentive and the affective - and this will be dealt with in more depth later in this literature review.

But even more compelling, and here the literature jumps out at the researcher, both entertainment and education employ very similar practical psychological effects. These practical effects may shed some light on how the two functions may 'synergise' together as the definition of Fig.1.1 suggests. McInerney & McInerney (1994) and St.James et al (1992), in their exploration of the psychology of learning touch upon several psychological effects. These effects are known as

Primacy, Recency, Frequency, the Zeigarnick (Interruption) effect, the Von Restorff (Isolation) effect, the Generation (Participation) effect, Cognitive Loading (managing short term memory) and Eidetic (Imagery) effects.

To demonstrate these psychological effects let us take an example from pure public entertainment. In the UK in the 1950's there was a programme on Sunday TV called 'Sunday Night at the London Palladium'. Each week a member of the public, who had won through a series of tasks against other members of the public, had the chance to watch a conveyor belt of household items pass by in one minute. The task was to remember and recall as many items as possible and those remembered would be won as prizes. This simple game contained many of the psychological effects that might explain how entertainment and education might work closely together. In this game, the contestant would invariably remember the first and last items (Primacy and Recency effects) on the conveyor, items that stood out (Von Restorff effect), identical items that were repeated and occurred more than once (Frequency effect), particularly colourful items (Eidetic effect) and items that related to each other but appeared at different times in the list such as an iron and an ironing board (Zeigarnick effect). In addition, the whole event was exciting and attention grabbing, it was a game that everyone could play along with especially the theatre and TV viewer audiences – so, overall, it was an excellent example of the Generation (Participation) effect. Even the concept of Cognitive Loading had an application here, as there were too many items exposed for too short a period and at too fast a pace for the short term memory to deal with easily unless particular memory strategies had been adopted. But let's just pause for a moment – surely some of these effects are also considerations in educational practice? Isn't education also involved in remembering things and making relationships between things? Yes it is. In fact, conventional educational psychology really does put emphasis on many, if not all, of the same memory and learning techniques that occur frequently in entertainment. Each of these psychological 'effects' is dealt with separately below.

2..1.7.1 Primacy and Recency

The Primacy Effect says that the first things taught in a learning session are usually easily remembered (McInerney & McInerney 1994:207). (Stapleton 2001:68) cites Ausubel's suggestion that 'advance organisers' be used in teaching i.e. a set of ideas, devised by the teacher, and given to learners before the material is actually introduced and which provide an easily remembered cognitive structure onto which the new learning could be attached. Similarly, the

Recency Effect, which states that the last things taught in a learning session are usually easily remembered (McInerney & McInerney 1994:207) is also well known in the educational literature. Primacy and Recency effects are well-known to the experimental psychology community where they are technically known as 'Free Recall and the Serial Position Effect' (St.James et al 1992:121). Edutainment could well use these effects by having an entertaining event at the start of a lesson, to capture and hold attention, and one at the end of a lesson, so that excitement for the next session could be created.

2.1.7.2 Frequency Effects

This maintains that repeating already taught facts/principles is useful for memory retention as it reinforces newly laid long-term memories especially if the timing between the repeated instances is well-controlled (McInerney & McInerney 1994: 205). The repetition effect also arises in entertainment especially in long narratives. Take for example the 'Three Bears' children's story in which the little girl hero, Goldilocks, tries out beds and breakfasts belonging to each of a family of bears: baby, mother and father, and decides which items she prefers for herself. The child listener is drawn into the story because s/he looks forward to hearing about and comparing the three bed/breakfast episodes. Although education is more than just remembering facts there is no doubt that memorising facts and examples is a very useful technique. In a work situation, management are often impressed by an employee who appears to have facts and figures on the tip of their tongue. Edutainment might well use this frequency effect by giving at least one repetition of already taught material, material taught in a conventional academic sense, but then presenting the same material in a totally different way. Not only will this reinforce the original material by repetition but , as edutainment will give a different perspective, it will also benefit by the Von Restorff Isolation Effect.

2.1.7.3 Von Restorff (Isolation) effect,

As explained by Rose (1985:37) and Hunt (1995) the more similar events (or facts) are then the more likely they are to be forgotten whereas scenarios and events that have strong visual or emotional association are more easily remembered (Rose 1991: 53). Most adults find it difficult to remember events that happened last week but, if you over a certain age, you will probably have heard at least one person say 'I bet you remember where you were the day President Kennedy

died' or perhaps, if you are younger, 'Where were you on 9/11 when the Twin Towers World Trade Center collapsed?' Von Restorff stated that this effect may be used to make particular events stand out against other less distinguished, run-of-the-mill, events. In the educational literature this is supported by researcher Ausubel who recommended that all education should contain what he called 'Discriminability' (Stapleton 2001:68). By this, Ausubel meant that information which is similar to that already known is less likely to be remembered (and he calls this 'derivative subsumption') than information which is very dissimilar (and he calls this 'correlative subsumption'). The implied meaning from this is that a teacher should contrast the differences between new learning and pre-existing learning in order to promote retention. Perhaps edutainment could make good use of this effect by repeating information in very contrasting ways.

2.1.7.4 Zeigarnick (Interruption) Effect

Simply put, this maintains that interruptions to a flow of events concentrate the attention and facilitate remembrance of the flow at the point of interruption (Rose 1991; 42). Briefly, Zeigarnick's original research found that waiters who were deliberately interrupted during their work shifts always continued to remember their unfinished orders (and forgot their finished orders). Zeigarnick's subsequent experiments and theory showed that 'unfinished business' tended to stick in the mind (Carey 2014:136). Entertainment makes widespread use of this effect. The (Springer(a) 2014) website, in its introduction to Zeigarnick, states 'What can waiters, the TV series 'Lost' and the novelist Charles Dickens teach us about procrastination? Charles Dickens' novels were all originally serialised and TV and radio serials all contained strong elements of 'cliff-hanging' – plotted events that end each broadcast with an unresolved issue that hangs in the audience's mind and encourages them to revisit events with the next episode. The Archers radio programme had its producer, Godfrey Baseley, saying 'End every scene with a situation that needs further explanation. End every night on an upward questioning inflection' (Smethurst 2000:107). This psychology may also be of use in education where, say, a closing statement or question in one lecture may whet the students' appetite for the next lecture – a sort of educational cliff-hanger.

2.1.7.5 Eidetic Imagery Effect

The Eidetic Imagery Effect states that unusual mental pictures easily fix in the memory and enable events to pass easily from short-term to long-term memory (Rose 1991: 48; McGill & Beaty

1995:195). As if to illustrate this, Winston (2003:122) in his discussion of the neuro-chemical basis for human memory, poses 'Think of a blue elephant. And now you've done that, here is a second exercise. Don't think about a green elephant'. Of course the image of a blue elephant in the mind is very distinctive and will stick for some time; so too, and possibly to an even greater extent, that of the green elephant especially as one must think of the very thing one is asked not to think about which adds an emotional element of stress and strengthens the memory even more. But it is experimental psychology that gives perhaps the most concrete support to the use of eidetic imagery within the research areas of 'Sentence-Picture Comparisons', 'Mnemonics and Pegwords' and 'Symbolic Distance Effect' – (St.James et al 1992:131, 109) . In education, eidetic imagery is well known for helping students to memorise things; Tony Buzan, of mind-map fame, uses such imagery Buzan (2005) and Rose (1985:72) makes the point that the more the 'mental hooks' and the more pictorial the 'hooks' on which to hang new knowledge the better the retrieval.

2.1.7.6 Cognitive Loading Effects

The entertainment elements of humour, narratives and games are always carefully constructed so as to not have too much information presented too quickly without time for absorption. Timing in humour is paramount as any stand-up comic will confess, and the pacing of a story is of most concern to any author. As demonstrated above, in the Palladium scenario, cognitive loading played a big part in the game. But cognitive loading, or especially cognitive over-loading, arises a great deal in education. John Sweller, of the university of NSW, Australia, acknowledged the work of George Miller in 1956 who first mentioned that short term working memory could only hold 7 +/- 2 information items at any one time and that putting more items into memory meant one of those already remembered would be forgotten. Sweller expanded upon Miller's work to create his own theory. Sweller's Cognitive Load Theory (CLT) has been influential in education in challenging teachers to break up information into easily digested learning-bites, a process sometimes called 'chunking' or 'segmenting'. Getting 'chunking' right is extremely important in education; teaching events can either enlighten or confuse students if chunking is not done appropriately (Clark et al 2010:5). It might, therefore, be useful for edutainment events to be used to briefly separate 'chunks' of new learning.

2.1.7.7 The Laurel and Hardy Joke

To reinforce this notion of psychological effects and their use in entertainment let us look at another example. There is a joke told in (Laurel&Hardy 2016), of a well known film actor duo Stan Laurel and Oliver Hardy who were very famous, probably second only to Charlie Chaplin, in their home country of the USA as well as the UK and who appeared in many comic films in the 1920's and 1930's..

Hardy: 'Didn't you once tell me you had an uncle?'
Laurel: 'Sure, I've got an uncle'
<short pause>
Hardy: 'Is he living?'
Laurel: 'No, he fell through a trapdoor and broke his neck'
<short pause>
Hardy: 'Was he building a house or something?'
Laurel: 'No, they were hanging him'

From the' Laurel and Hardy Murder Case' (1930)

Fig. 2.3 The Laurel and Hardy joke

Now …let's analyse this. It definitely has humour and a short narrative (story-telling). It has strong aspects of characterisation – the duo were renowned for playing off against each other with Oliver Hardy (the big one wearing a bucket on his head in the picture) playing the know-all bossy person whilst Stan Laurel (the thin one) played his stooge, the simple, put-upon character. It was the juxtaposition of these two characters that formed the backbone of all their films. The psychology of this joke shows various attributes already mentioned in this thesis. The importance of timing is shown in that it contains short pauses which divide up the narrative into small self-explanatory blocks. One of the character-traits of Laurel (the thin one) was that he would say something but not offer further explanation thus Zeigarnick pauses in which the listener longs for more detail. It also contains the Von Restorff effect when a sudden surprising statement 'he fell through a trapdoor and broke his neck' leaving the audience to start wondering what is to follow. Additionally, there is possibly some Eidetic imagery here in that this was dialogue from a film in which the hapless two were also doing some decorating in a cluttered environment and so a work-based accident could easily be imagined especially to the two disaster-prone characters. These timings, Von Restorff and Zeigarnick effects immediately capture audience attention and capturing attention is essential for comedians, or any entertainers for that matter. The joke element raises a laugh and in so doing puts the audience into a highly positive

emotional mood making them more receptive to following jokes. Of course, Laurel and Hardy were not trying to teach anything to their audience, it was pure entertainment. The psychologies used in the above are quite common to all forms of entertainment and are used specifically for two essential entertainment outcomes: (i) the capturing and keeping of attention – essential for entertainers of all kinds as the loss of audience attention spells inevitable failure , (ii) the deliberate changing of audience mood to one more receptive and, usually, emotionally highly positive (although entertainment such as horror films/stories create negative emotions such as fear and fright they are still entertainment because the frightening scenario is unreal and the audience is only vicariously involved). However, these two facets of entertainment are also extremely useful in education. Retaining students' attention is essential as without it no learning can occur. And raising student's mood to one more emotionally positive is much more likely to increase their motivation and participation in classroom events.

So, to sum up, this use of Primacy, Recency, Frequency, Von Restorff, Zeigarnick, Eidetic, Cognitive Loading and Generation effects for capturing attention and changing mood may very well be how 'synergy' between education and entertainment can be obtained and used in edutainment episodes in formal learning environments.

2.1.8 Are there existing models of Edutainment?

To identify existing edutainment models in the real world, a number of possible case studies were considered:

The Royal Institution Christmas lectures by the British television broadcaster BBC;
The 'Horrible Science' series of books by Nick Arnold and Tony De Saulles;
Typical English pub quizzes by typical English pub landlords;
The Teletubbies children's programme by British television broadcaster ITV;
The 'Hitch-hikers Guide to the Galaxy' book by author Douglas Adams;
'Alice's Adventures in Wonderland', a book by author Lewis Carroll;
The Sesame Street TV series by the Children's Television Workshop in the USA;
The Archers radio programme by the British radio broadcaster BBC;
Soul City website an initiative of the South African HIV/AIDS health awareness programme;
Johnny Ball's 'Mathematical Puzzles'.

Although all these examples took the label 'edutainment', or education + entertainment, and they all had some entertainment, they did not all exhibit 'synergy' between education and entertainment. Consequently, the above twelve examples were scrutinised for evidence of such 'synergy' and their good provenance towards deliberately providing 'enhanced learning'. English pub quizzes have a well-designed format (teams, questions, points for correct answers, prizes for successful teams) and a process of being put together (books of questions can be purchased or questions received from the audience, teams appointed, rules of answer acceptance, a points recording system, and quizzes on different topics on different nights (Taylor 2009). However, overall, pub quizzes are deliberately designed to entertain, albeit possibly to entertain educated people by showing off what how much they know, and certainly not designed to 'enhance learning' in any way. An English pub quiz was therefore not an acceptable candidate for a serious edutainment model and could not be considered as a case study for the purposes of this thesis. Similarly, the Hitchhikers Guide to the Galaxy by Douglas Adams was excellent story-telling with entertaining mental hooks and emotional associations to make the story more easily remembered; however, there was little evidence that the book was meant as anything but entertainment and was not a deliberate attempt to enhance learning except, perhaps, from reminding people that 7 multiplied by 6 is 42. The Teletubbies, a programme for 2-3 year-olds with characters who have adventures but don't actually speak clearly, has had a varied press. According to the Chicago Herald Tribune journalist (Zorn 1998) this programme was 'bizarre, inane, maddeningly repetitive, unsophisticated, banal and cloying' and that was one of the nicer comments in the press. The main criticisms were that that there was too little educational matter and too little teaching of social skills and language; for this reason Teletubbies was not considered as a case study.

Johnny Ball's mathematical puzzles was a series of brain-teasers each with its own scenario. Sadly, the book lacked a continuing narrative, there was some attempt at humour but not a lot, the puzzles were stand-alone so educational themes were hard to discern and the scenarios, too, were somewhat simplistic - so, overall, the educational element was too diffuse to be considered edutainment for this thesis.

The above examples were considered very weak as edutainment examples that would meet the definition of edutainment derived in the Introduction in Fig.1.1 and were discounted as case studies for analysis. Eventually, and see Methodology chapter for more detail on this, six of the examples given were selected as case studies for further investigation (see appendices C to H) and an overview of each of these is given below.

2..1.8.1 Horrible Science

The forty plus 'Horrible Science' books, for ages 10 to14 years, with titles such as Killer Energy and Painful Poison were good examples of the edutainment genre (Arnold & De Saulles 2009a , 2009b). They contained practical exercises for children to try out at home, as well as graphic vignettes of experiments (especially ones that had gone wrong!!), dreadful deeds, criminal and un-savoury characters and all within a connecting narrative explaining some aspect of science at a level suitable for the child reader. Each book had a *100% Horrible* warning on the cover and gory pictures that oddly appealed to the older child – of course, they did capture the attention of the child and capturing attention is a desirable feature in any learning environment. This combination of games, narrative and humour worked well in capturing children's attention and growing their interest in science. According to the website (Horrible Science 2014) the creators had won many awards for this model of popularising science including the ZSL Thomson Reuters Award, Junior Aventis Science Book Prize 2004 and the Rhône-Poulenc Junior Science Book Prize 1997. This example was acceptable as a case study for this thesis as it was intentionally designed to enhance learning and it had a definite product (artefact) template of how edutainment should be applied in practice within its books. The only weakness was that little information was available on how the Horrible Science books were put together and the process by which their brand of edutainment was planned. Nonetheless the process format, whatever it was, was repeated in similar series Horrible Histories and Horrible Geographies so this was clearly a winning formula. Further information on this case study is to be found in appendix D.

2.1.8.2 Royal Institution Christmas Lectures

The Royal Institution Christmas Lectures was a series of lectures for 10-14 year olds, broadcast at Christmas time each year, by an acknowledged professional researcher. Three such years were looked at as part of this thesis being the lectures given by research biologist Prof. Alison Woollard of Cambridge University (RICL 2012), research chemist Dr Peter Wothers of Queen Mary College (RICL 2013) and engineering professor Danielle George of Manchester University (RICL 2014).These lectures were fast-paced, full of facts and contained experiments, demonstrations and games in which the young audience and their accompanying teachers were encouraged to participate often alongside a celebrity character from show-business or sport. This series of annual lectures was deliberately designed as

a form of edutainment; it had a definite product design (the programmes from year to year followed much the same design format) and clearly had the same process of production. For further information see appendix E.

2.1.8.3 The Archers

The Archers, brainchild of Godfrey Basely, programming assistant on BBC Midlands radio in the 1950's, was to combine the attributes of an adventure thriller with the need to teach British farmers how to modernise their practices at a time when the UK was short of food (Smethurst 2000:12). It used speech for narrative, music for atmosphere and strong characters to impart the farming information with authority (Smethurst 2000; Whitburn 1997; Toye 2009). It also had a well-defined programme structure. However, it's limitation was of it only being in the aural media and not addressing formal education in any way and certainly not that of cyber security. However, in every other way, this was an excellent model of edutainment for adults which was widely considered to provide the first example of modern broadcast edutainment. It had excellent provenance as being deliberately designed to put over an educational message for adults, with a programme production process by which programme products were created to a template; this made it an ideal candidate as a basic model for use in this thesis. Further information on this case study is to be found in appendix H.

2.1.8.4 Sesame Street

The press release for the Sesame Street TV programme called the show an 'experiment primarily designed to establish whether entertainment techniques that preschool children are known to enjoy on television can be put to meaningful educational purpose" (Morrow 2008:113). It taught literacy, numeracy and social skills using powerful characters (puppets and human celebrities) with use of graphics, cartoons, human actors, music and dancing in a series of vignettes within an integrating narrative that held together the entire programme. Sesame Street had a well-defined template for what each TV programme should contain, a well thought out structured process for producing programmes, and a research programme linked with university academics. The abiding rationale of Joan Ganz Cooney, creator of the initial idea behind the children's programme in the 1960's was that it "combined stylish popular elements of televisual art with an educational gadget of goals and testing", the whole approach being masterminded by television producers, writers of marketing copy, educational psychologists and educators (Morrow 2006:1). According to the four

literature sources used for analysis herein: Morrow (2006), Davis (2009), Fisch & Truglio (2001) and Gladwell (2001), Sesame Street was an excellent model of edutainment incorporating salient features such as summative and formative feedback Morrow (2006:68), children's focus groups Fisch & Truglio (2001:16) and distraction techniques for measuring attention hold and span (Fisch & Truglio 2001:15). It was a precursor of many children's edutainment programmes to follow and defined an exemplary model for others especially when children were followed up in later years to see how they had progressed educationally. The Recontact Study Summary found the adolescents who often watched SS as pre-schoolers, compared with those who rarely watched the program, had higher grades in English, mathematics, and science; spent more time reading books outside of school; perceived themselves as more competent at school, placed higher value on achievement in mathematics and science and expressed lower levels of aggressive attitudes (Fisch & Truglio 2001:140). Many of these relations between SS viewing and teen behaviour were stronger and more consistent for boys than girls. There was little relation between SS viewing and creativity but there was no evidence for a negative effect. All the above patterns occurred when groups were statistically equated for parents' level of education, birth order, site, and sex.

Sesame Street therefore offered an excellent model for this thesis study with only one highly significant draw-back; from the viewpoint of this thesis, Sesame Street was expressly designed for teaching pre-school children and raised the question of whether it's tried-and-tested televisual concepts, so successful with children, would lend themselves to the teaching of adults. This latter issue is dealt with at length in the literature review phase III. Further information on this case study is to be found in appendix F.

2.1.8.5 Soul City

The Soul City case study, on the other hand, was different from all the previously mentioned examples as it was based in a non-developed country, South Africa. It was a TV programme that dealt specifically with adults who had low-literacy skills – and the edutainment was used as a carrier of an educational message about social and health issues to do with HIV/AIDS control as well as many other social messages (Soul City 2014).

However, Soul City was considered an important literature source as it was successful (very popular in S.Africa), academically researched – see Singhal et al (2002) - and contained a well-defined process model; it therefore had something to contribute towards a generic model of

edutainment. More importantly, it was also the only model that was not a product of a western (highly industrialised) country and was designed specifically for a population that did not have high levels of education and literacy. Although superficially appearing to have little in common with the other case studies, it did represent perhaps the most widely used application of edutainment in the entire world - the education of adults with low levels of literacy in order to educate them on important health and social issues that affected their lives; it, therefore, could not be left out. Soul City contained strong narratives and characters and also games but not logic games as in the 'Alice' books – these were social games, decision-making scenarios involving inter-personal and intra-personal relationships. Further information on this case study is to be found in appendix G.

2.1.8.6 Alice in Wonderland

The 'Alice in Wonderland' book by Lewis Carroll was initially considered a poor candidate for consideration in this thesis but as the literature research continued it was found to have increasing merit. Carroll, who was really the Oxford University mathematician Charles Dodgson seemed obsessed with creating scenarios containing mathematical and logical conundrums (the correct term is 'syllogisms') for the reader to think through. This is exemplified in three texts written about the Alice books: (Wilson 2009), (Gardner 2001) and (Bayley 2010). Wilson and Bayley, both mathematicians, gave insight into the mathematical and logical puzzles and conundrums evident (or sometimes hidden) in the actual Alice text. Gardner, in his book 'The Annotated Alice', Gardner (2001), takes a much more hermeneutic approach, explaining the text in its Victorian academic and public contexts. Gardner's book was very influential within this thesis in helping to understand the Alice text.

Although an Oxford lecturer, Dodgson also worked in a local school with poor children, and, through his letters, it appeared he had a great interest in encouraging children to learn, especially maths and logic. He varied his lessons with stories and puzzles, and he may have been the first to use recreational topics as a vehicle for conveying more serious mathematical ideas (Wilson 2009:63). According to Gardner (2001) Carroll also had an interest in using word-play something mentioned before in this literature review by Susan Cowley as being particularly attractive to young learners in modern schools (Cowley 2003: 117). From 1880 to 1884 Carroll wrote for the a periodical *The Monthly Packet* ; each issue featured a story that concealed some ingenious

mathematical problems (Wilson 2009:151). A study of his three longest children's narratives 'Alice in Wonderland', 'Alice Through the Looking- Glass' and 'Sylvie & Bruno' showed his increasing commitment to edutainment of some kind throughout much of his life and to several audiences: children, adults and professional mathematicians. This became clear when in 1884 he wrote to his friend Mary Brown of his forthcoming *Symbolic Logic* which was to be in three parts with Part 1 being suitable for children aged 12-14 (Wilson 2009:185). Carroll's 'Alice' books were good examples of narrative, humour, strong characters and logical games and so, as an early but lasting example of edutainment, they deserved a mention in this thesis. Further information on this case study is to be found in appendix C.

2.1.9 Overview of Part I

In this part I of the Literature Review it has been shown that entertainment might be said to have a number of themes: Humour, Acting, Narrative, Games and Music. In addition, six examples of edutainment were chosen for later analysis – see Methodology chapter for more detail on selection criteria. However, overall, the literature search could not uncover any evidence of an existing edutainment model that was built purposefully for higher education learners learning cyber security subjects. The examples mentioned above all had something to offer towards the creation of a model that fulfilled the requirements of this thesis but there were some issues that needed to be clarified and these are dealt with in the following Parts II, III and IV. In the following Part II, it is now necessary to ask whether, in consideration of prior literature, the thesis topic would be a contribution to human knowledge – in other words, what benefits could an edutainment model actually give to higher education students – what exactly is missing from current education literature and which indicates that an edutainment approach might actually have the effect of enhancing its outcomes?

2.2 PART II: CAN EDUTAINMENT ENHANCE LEARNING?

> 'In those days [early 1980's], …most of the books about teaching rarely mentioned learning and most texts about learning rarely mentioned teaching'. Jarvis (2009: 22).

To attempt to answer if edutainment could enhance adult learning in a higher education setting it was necessary to ask whether adults were already learning to their maximum potential or not. If not, then if adults were not learning to their fullest potential then what was stopping them? And could these 'stops' be removed or lessened?

2.2.1 Adult Learning Models

To effectively understand this area, the literature was reviewed for models of the adult learning process so that areas of possible under-achievement or weaknesses of students and learning arrangements could be identified. Several such models were found in the literature and assessed for their usefulness to this research including models by Kolb, Bloom, Gagne, Gardner and Prosser and Trigwell.

2.2.1.1 Kolb and the Learning Cycle

David Kolb said that 'Learning is the process whereby knowledge is created through the transformation of experience' (Kolb 1984:38). And his Learning Cycle as described in Rogers (2002: 110), and shown in Fig. 2.4, is probably one of the most cited in educational research giving, as it does, some insight into the supposed cognitive processes of learning. However, although a useful model of how adults might learn, it seemed overly complicated and it's practical application seemed limited – a viewpoint supported by Jarvis (2009:22) who recognised it as being flawed because it "omitted the social and the interaction". So, it was not clear where edutainment, obviously interactive and with a strong social interaction between teacher and student, might be useful. Even the adaptations to Kolb's model through Pedler's Action Learning work - McGill & Beaty (1995), Pedler (2014) - did not fit the

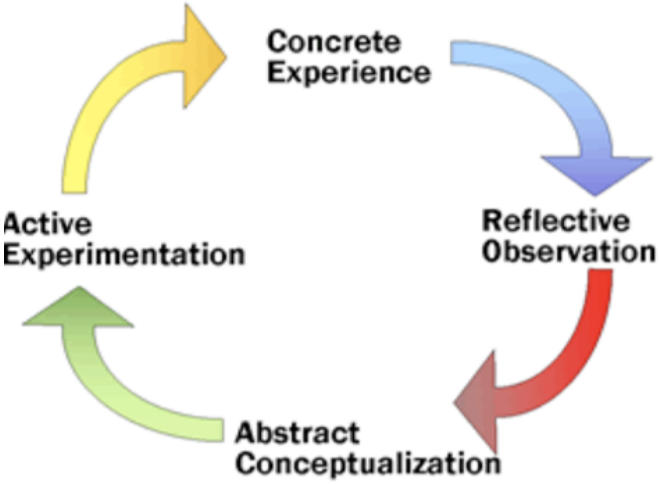


Fig. 2.4 Kolb's Learning Cycle

requirement; Action Learning was primarily concerned with group work in industry settings where the sharing of work experiences was paramount and it was difficult in this model to see where the weaknesses in learning might be or how learning could be enhanced using edutainment techniques.

2.2.1.2 Bloom's Taxonomy

Bloom's Taxonomy was also considered (see appendix J). This model was already widely used in Higher Education and so would have been easily understood by most lecturing staff. However, it was definitely a model of cognitive levels which, although useful for classifying learning activities, would be limited as a process model for observing the effect of a teaching method and the psychological principles involved in a process of learning. Bloom's Taxonomy was therefore considered too static and too much within the cognitive domain to give a sound platform on which to base a model of edutainment.

2.2.1.3 Gardner's 7 Intelligences

Another option, described in McInerney & McInerney (1994: 108), was Gardner's 7 Intelligences which held out the possibility that problems in learning were due to the student being of a different kind of 'intelligence' to what the learning materials were addressing. There was also the promising concept that edutainment could work because it might cause the learner to switch from one 'intelligence' to another and thereby wake-up, pay more attention or become more attuned to the learning process generally. The notion that a learner might be encouraged to use more than one 'intelligence' seemed attractive especially as it led to consideration of neurological issues concerning left-brain and right-brain capabilities. According to Dryden & Vos (2001:125) the left side of the brain dealt with words, logic, numbers, sequences (the so-called academic parts of learning) whereas the right side emphasised rhyme, rhythm, music, pictures and imagination (the so-called creative activities). Hence, the possibility of a sudden switch from one side of the brain to the other induced by an edutainment episode, which might thereby heighten attention and catch the learner's imagination, seemed attractive and would have been a complete neurological explanation of why edutainment worked. This was also backed up by Minsky (2003) who made the assertion that "when we change what we call our emotional states we're switching between different ways to think". Initially, this seemed a possible learning model around which to research the literature but although it had something to offer it was not satisfactory as the scientific evidence

for these multiple intelligences seemed fragmented. A better choice of learning model was Gagne's 9 Instructional Phases (see appendix I) because the phases represented a process model that showed the stages each learner had to pass through to learn anything at all and these seemed to be directly related to some of the learning psychologies behind edutainment. However, there was a lack of a built-in concept of what kind of learning could be attained, and where things might go wrong.

Although several models had been rejected by this stage it was becoming more evident what was truly being sought. This was a model of learning that would accommodate a concept of students having problems in the learning environment that edutainment might be able to alleviate, having a learning goal that was not being attained (for some reason) and that edutainment might help to attain. At first it was decided to resort to a very simple model of student enters learning environment (ignorant), student progresses through learning environment (learning) to finally, student exits learning environment (knowledgeable). Fortunately a model similar to this but with more detail and with theoretical underpinning was found in the literature.

2.2.1.4 Prosser and Trigwell Presage-Process-Product Model

The most useful model of adult learning was found in the simple timeline process model of Presage-Process-Product of Prosser and Trigwell (Prosser & Trigwell 2001: 7). Fig. 2.5 shows the outlines of their model (hereafter known as the PPP model) which covered the lifeline of a typical learning curriculum session showing how problems might arise from the very beginning (with a mismatch between student characteristics and the learning environment), a progression through the learning experience (with success tempered by the student perspective of what was going on) finally to reach the desired outcome of deep learning (as opposed to surface learning) and being assessed using assessments that presumably attempted to measure the extent of deep learning in the learning outcomes. The concept of deep learning, the ultimate goal of the Prosser & Trigwell model, was an attractive one as it represented the ideal for any educational process or as Diana Laurillard of the Institute for Education, explained in detail "Deep learning is well-defined as the focus on understanding, aiming for meaningful learning, using critical thinking, relating and structuring ideas, reflective/elaborative processing, constructing knowledge, and use of evidence. Deep is to be contrasted with the less desirable 'surface' learning of . reproducing, the superficial intake of knowledge, memorizing without understanding,, repeating analyses already carried out, unthinking acceptance of ideas, syllabus-bound fragmented knowledge and the student being

extrinsically motivated by external regulation" (Laurillard 2012:38) . A similar viewpoint was expressed by Jung & Latchem (2011:8) who argued that the demands of the 21st century and the need for lifelong learning called for the development of higher-order learning skills (deep learning). This concept of deep learning also arose in the working definition of edutainment derived in Fig.1.1 in the Introduction chapter: "Edutainment is a synergistic blend of education and entertainment that through the use of fun and play, supporting creativity and curiosity, can produce a deeper and lifelong learning experience." Consequently, the PPP model as presented by Prosser & Trigwell was considered a very apt and usable model of adult learning on which to base this thesis and, as the work progressed, it was also found to be useful as a tool in analysing the case studies and structuring the classroom-based activities.

The PPP model showed where edutainment might play a role. It had already been established from the literature that edutainment, with its strong entertainment component, might play a role in inducing positive emotions and thereby allaying negative ones. It seemed possible, therefore, that dealing with the negative emotional effects of student problems and creating positive upbeat learning environments might aid the formation of deep learning. Additionally, Prosser & Trigwell (2001:7) affirmed that one of the most powerful influences on the lack of performance of adult learners was the effect of their previous experience; not only did students enter the learning environment with individual proclivities towards their learning, such as preferred learning style and family and personal circumstances, but any dissonance caused by a mismatch between their learning proclivities and the learning environment was a possible factor in limiting their maximisation of learning potential. This, more than anything else, determined the type of understanding, deep or surface, with which the student was likely to end up. Some researchers, such as Ausubel et al (1978:163) cited in Prosser & Trigwell (2001:7) have even intimated that if they had to reduce all of educational psychology to just one principle, it would be that the most important factor influencing learning was the learner's previous experience of being taught.

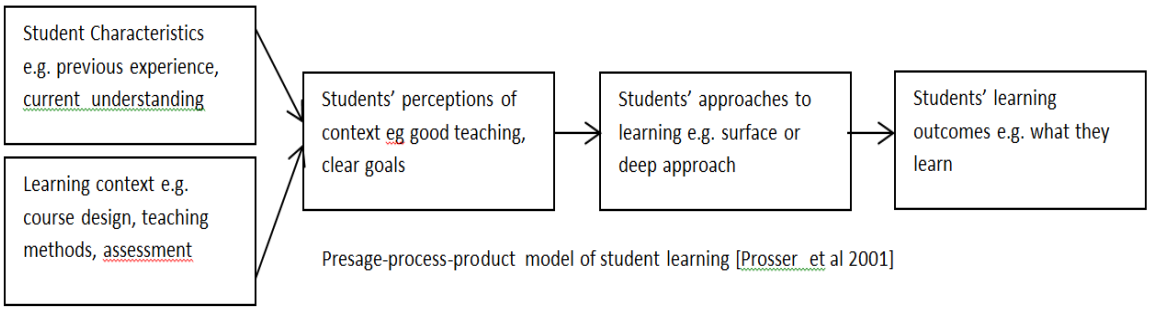


Fig. 2.5 Presage-Process-Product Model of Learning

2.2.2 PPP Model: What do we mean by Student Characteristics?

> 'As all good teachers know, every student comes with a 'learning past' that is an important part of his/her future learning' (Kegan 2009:45).

Student characteristics (a component of the Presage stage of the PPP model), that might cause mismatch with their learning context (the other component of the Presage stage) were identified from the literature. They were, firstly, the growing trend towards lifelong learning as per Gibbons et al (1994:74) and UCAS (2014) with older, more mature, students entering university some of whom had been away from formal education for some years or even decades. For these people the nature and expectations of education were likely to have changed resulting in a steep and possibly stressful learning curve. Secondly, there was the expansion of adult learning throughout the world with universities having to cope with student entrants from different countries and cultures – (Laurillard 2012: 26), (UKCISA 2014). For some of these people the mode of instruction in English may have been problematic particularly any specialised jargon. Thirdly, as Laurillard (2012:26) pointed out there was the increasing trend towards students presenting with a multitude of different educational qualifications, some assessed through formal examinations or more coursework based, or some even with professional qualifications based upon multiple-choice tests and work-based learning. Higher education, although accepting of all these, was still expecting students to be able to cope with the highly focussed one-size-fits-all approach that characterises the limited contact hours and extensive self-study of the highly academic, learning environment. Fourthly, as Laurillard (2012: 26) pointed out, students' aspirations and expectations were heavily biased towards good job prospects in a highly competitive jobs market, a finding borne out in a study of new undergraduate entrants by Magee et al (1998) who asked them to complete a questionnaire which indicated a 92% preference for 'The qualification at the end of this course

would enable me to get a good job'. It may have been that the rather academic, abstract nature of some university courses could cause discomfort to those seeking more practical tuition. All of the above points may be summed up by Irons (2007:3) who said that the current HE teaching environment was "… set in a context of almost continuous change with increasing student numbers, students with widely ranging abilities and students from different cultures with different educational expectations". And lastly, and not to be overlooked, all students come with their own personal and family problems that may interfere with their emotional well-being and consequent ability to study.

All the above may induce feelings of stress in the individual student. Stress can, of itself, in small amounts, push a learner to work harder by heightening senses and reaction times. But, according to NHS Choices (2014), too much stress may induce feelings of worthlessness, undermine self-confidence, lead to depression, loss of appetite, loss of concentration and lethargy; Pritchard (2009:98) even suggests that some researchers have suggested that "80 per cent of learning difficulties are related to stress". And there is no doubt that in some cases it can lead to very challenging behaviour in the form of rudeness towards teaching staff, noise, and deliberate disruption of the classroom setting (Jones & Philp 2011). The literature shows that students can arrive with issues, some practical, some emotional, that may become problematic when they come up against the learning environment - not necessarily so, but they may do. It is easy to say that student characteristics are merely peccadillos that each student must sort out for themselves even though the learning environment may take some responsibility by providing personal tutors, counsellors and access to medical services (NHS Choices 2014). Particularly saddening was the case of MIT (Massachusetts Institute of Technology) which was reported by Rocheleau (2014) to have one of the highest suicide rates amongst students in the entire USA but nobody seemed to know why. It could be said that the learning organisation does have a moral duty of care to accommodate students coming to learning events (lectures, tutorials, self-study and so forth) with emotional trauma that may interfere with concentration and ability to learn. It is possible that edutainment, with its entertainment methods including humour, story-telling and games, may be useful in changing the emotional mood within a learning event to one more positive and therefore more conducive to easier, quicker and deeper learning.

2.2.2.1 PPP Model : What do we mean by Learning Context?

It is well known that people entering university for the first time occasionally suffer an educational culture clash. They find the studying regime so different from that experienced at secondary school or previous college that they have difficulty in adapting. Likewise, overseas students, coming to a British university for the first time, may also suffer something similar. There were two possible explanations for culture clash such as this. Howard Gardner's 7 Intelligences, reported in McInerney and McInerney (1994: 108), and Gardner (2009:107), hinted that different people learn in different ways and there was always the possibility of a gross mismatch with the academic and highly logical thinking of the university learning environment. Howard Gardner, himself, said "students do not arrive in school as blank slates, nor as individuals who can be aligned uni-dimensionally along a single axis of intellectual accomplishment" (Gardner 2009:106). However, it was reasonable to assume that most students had personally chosen to be university educated and had proved themselves in their entry qualifications so the effect of the different kinds of intelligences must have been minimal except in the very worst aptitude mismatches. More importantly, and another explanation for dissonance, was that an overseas student's previous studies were within a more didactic, pedagogic paradigm whilst the UK learning context they were entering was very likely to have more emphasis on the andragogic paradigm (for more on andragogy and Michael Knowles' work please refer to 2.1.5). Hiemstra and Sisco (2013) asserted that the constrictions of the didactic and teacher-led pedagogical approach had often produced tension, resentment, and resistance in adults although the inverse may also have been true in that tension, resentment and resistance may have occurred when andragogy was suddenly forced upon the university entrant whose prior experience had been solely pedagogical. Either way, this may be the cause of emotional distress, anxiety, and self-doubt that could again interfere with the learning process of the affected individuals. In fact, Rogers (2002:75) sums up this previous experience factor by categorically stating that one of the biggest challenges facing teachers of adults is the stress on the student of unlearning their previous experience and having to deal with the "emotional investment in existing patterns of experience and knowledge".

2.2.2.2 PPP Model : What is meant by 'Dissonance'?

Overall, any dissonance between student characteristics and learning context seemed likely to cause emotional stress for the individual learner. The drive towards 'deep learning' when prior education was characterised by 'surface learning', was likely to produce anxiety and the move towards 'andragogy' rather than 'pedagogy' could cause emotional stress. And all students come with their own emotional and cognitive peccadilloes that may clash with the learning environment. All of this comes on top of the normal stresses of learning at higher education level which, by definition, must require an intellectually challenging and complex curriculum – which of itself would need a great deal of learner support or 'scaffolding' as Vygotsky (1962) would say (Stapleton 2001:69). There are therefore many reasons why there is a gap between what the student might intellectually be capable of and what they might actually achieve in practice. This 'gap' was partially referred to by Vygotsky with the term 'Zone of Proximal Development' or ZPD. Stapleton (2001:69) showed that the ZPD was the gap between where the student was and where the student, helped to stretch to their maximum potential ability by a 'more capable other', was able to arrive. There was therefore a need for enhancing learning to combat this ZPD gap; edutainment might very well contribute to such a thing.

2.2.3 Question: How Could Edutainment Enhance Learning?

From the above, the role of edutainment may therefore be seen as encompassing the entertainment goals of capturing the audience attention and giving a positive emotional fillip by reducing the negative emotions that enter the learning environment and promoting the positive emotions and curiosity that capture student attention and draw them more completely into the learning environment. These attributes of attention capture and positive emotions seem highly desirable especially if the edutainment can also directly support the actual content learning as well. This thesis therefore posits three domains of operation where edutainment may benefit the learning environment: attentive, affective and cognitive.

(i) attentive: improving attention spans of learners to the maximum possible
(ii) affective: encouraging the creation of a positive emotional learning environment to reduce emotional dissonance as per the PPP model,
(iii) cognitive: providing 'scaffolding' for the curriculum content learning itself to lessen the ZPD.

2.2.3.1 Attentive Domain: Improving Attention-spans

The first domain that edutainment must operate within is that of the attentive, the capturing and keeping of attention. The inventor of the practice of 'lateral thinking', Edward de Bono, said that "Skill in thinking has much to do with perception and with attention-directing" DeBono (1976:51) and this is very supportive of the notion expressed earlier that attention is important in learning. John Sweller also affirmed the importance of attention in his cognitive load theory where he said "you should use methods to focus attention and to avoid split-attention….use methods that direct cognitive resources towards relevant content in the teaching materials" (Clark et al 2010:77). Sweller also had much to add here in his concept of "segmenting, sequencing and learner pacing to impose content gradually" (Clark et al 2010:161) which not only had the benefit of periodically renewing attention capture but of non-exhausting the attentional capacities of the audience so that attention did not fade too quickly. This is important as, although some work has been done on how to capture attention in learning environments not much research has been done on retaining attention or preventing attention-fade. Perhaps the most well-documented research into attention and attention-capture were the experiments conducted by the Children's Television Workshop in producing their Sesame Street programmes (appendix F). Sesame Street, as part of its formative feedback process (feedback to guide the actual TV programme production process itself between programmes) used what it termed a 'distractor technique'. This composed of the use of two televisions – one showing a proposed Sesame Street episode, the other another programme. The technique recorded children's viewing activity every 7.5 secs. This gave data points in time and showed where Sesame Street was more interesting than the control programme (Fisch & Truglio 2001:15; Morrow 2008:67). An interesting by-product of this practical research was how it sometimes contradicted the then widely held beliefs of Jean Piaget, the renowned child learning psychologist of the 1950's and 60's; the latter's teaching had suggested that pre-school children could not follow extended narratives but Sesame Street's practical research approach showed that this was possible, a finding later strongly endorsed by Jerome Bruner, a psychologist at New York University (Gladwell 2000:118).

Attention-span or the ability to concentrate may very well be affected by the emotional effects of dissonance, discussed previously, resulting in stress causing listlessness, students chatting amongst themselves, day-dreaming, talking on mobile-phones, yawning and other manifestations. This kind of attention is to be differentiated from that in the Krathwohl's Receiving level which refers to student's emotional willingness to pay attention to the learning episode in full; this kind

of attention lack, or dis-attention, refers to students' unwillingness or inability to pay attention even to parts of the learning episode and whose attention may be fragmentary. Stapleton (2001:103) cited the Yerkes-Dodson Law which showed that for every task students undertake – reading, writing, taking exams – there is a level of arousal at which performance will be at its optimum. If arousal, defined as alertness and attentiveness, is minimal then performance is minimal but as arousal climbs so does performance – until, if it climbs too high, then panic may set in and performance quickly declines.

However, the literature on attention spans of university students is mixed and the jury is still out on how to measure attention-spans in young people, whether there are different modes of paying-attention, and whether there really is an issue of declining attention spans. Pritchard (2009:102) mentions the lack of concrete research on attention-spans at all levels of learning but does describe two heuristics he says are in common use (although he admits there is no concrete evidence in support) to assess attention span in minutes: firstly, that it is the learner's age plus 2 minutes and secondly, that it is the learner's age minus one minute which puts the average undergraduate attention at 19 – 22 minutes and postgraduate at 22 - 25 minutes. This is possibly a useful rule-of-thumb which may be made use of in the final edutainment model. However, more importantly, and of concern for the future, is the issue frequently reported in the media and supported by such academic sources as Wilson & Korn (2007), who maintain that teenagers today have declining attention spans because of the abundance of instant technologies they use and which are inducing them to have an average attention span hardly over 10 minutes . On top of this, there is also the supposed rising incidence of Adult-ADHD (Attention Deficit Hyperactivity Disorder) or ADD (Attention Deficit Disorder) in the population in general for which there seem to be few explanations – (NHS Choices 2014). Stapleton (2001:122) points out that ADHD is much more common in boys than girls and its overall prevalence is nearly 7%; however if we take the 7% as being properly diagnosed individuals then there is probably a similar number of also afflicted, but less affected and undiagnosed individuals making the total occurrence of ADHD in the classroom possibly as high as 15%. However, day-dreaming, which may be momentarily disruptive if attention is lost to another topic, may be highly beneficial in learning if used to create visualisation-based memory for remembering facts (Rose 1991:75-85; Buzan 2005). The main problem with day-dreaming used for learning is how to control it so it doesn't dominate the student's attention completely and the student falls into reverie. The problem appears to be that all actual statistics on attention spans are compromised by the mechanics of how to actually measure it. A common sense approach might indicate that if student attention does waver during a learning episode then learning

may very well suffer, if only on the *reductio ad absurdam* case that if the student is asleep or comatose with nil attention then they cannot learn anything! But, at the other extreme and very importantly, the literature recognises the situation where a learner's attention is so engrossed in the subject matter that they become oblivious to their surroundings and any distractions. Such a mental state is called 'flow' and may be defined as the state in which we are so involved in something that nothing else matters; in the experimental psychology literature this notion of 'flow' combines effects known as 'Selective Attention and Response Competition' - St. James et al (1992:53) and 'Attentional Interference' – St. James et al (1992:65). 'Flow' is a term currently used widely to describe the total involvement of (usually) children in various tasks from which they derive enormous enjoyment and in which Csikszentmihalyi (1990:1), cited in Robinson & Aronica (2009:92), said: "a sense of time and emotional problems seem to disappear and there is a feeling of transcendence" a state of being that athletes call 'being in the zone'. Csikszentmihalyi is an ardent advocate of the Positive Psychology movement set up by Martin Seligman at Pennsylvania University USA. Csikszentmihalyi investigated the concept of flow by interviewing thousands of people and found that those able to experience it reported: clarity of goals, complete concentration, transformation of time and an experience of flow-inducing tasks as very rewarding (Boniwell 2008:25). Allied to this is the psychological effect known as the Generation effect discussed in Hirshman & Bjork (1988:1) and St. James et al (1992:149) which suggests that when learners are solving problems they are more prone to 'flow' and to learning far more effectively than just passively receiving learning from a teacher. Researchers such as Kirremuir & McFarlane (2004:9) are extremely interested in promoting flow and the Generation psychological effect with the use of serious software-based games that may be used for educational purposes for children. The US Navy also uses cyber security simulation games such as CyberCIEGE for training purposes (Greitzer et al 2007:3,5). The notion of 'flow' has even been linked experimentally with the psychological notion of 'deferred gratification'. Professor Walter Mischel, from Columbia University USA, in the 1960's, conducted a number of experiments with 3-4 years old children, in which he sat them alone in a featureless room with a plate containing one marshmallow and told them that they could eat the marshmallow anytime whilst the investigator was out of the room but if they could resist the temptation until the investigator returned then they would be given two marshmallows to eat (BBC 2011). As expected - some resisted temptation and some succumbed. The curious thing was that, fifteen years later, on following up all the children, it was found that those who had resisted temptation had also performed much better in their studies and were more evenly balanced psychologically, socially and in life-skills generally, than the non-resistors. This

‘marshmallow test’ phenomenon has since been linked with ‘flow’ by Mitu Khandaker-Kokoris at the University of Plymouth in the UK, who maintains that the deep concentration exhibited by software game-players is a form of deferred gratification – the game apparently providing a future ‘reward’ to which all intermediary rewards and interruptions must be deferred – (BBC Forum 2014). One might wonder that if games, and not necessarily software games, were more widely used in teaching at all ages then perhaps such attention capture and flow might potentially become more widespread and an improvement, not only in academic skills but also in life-skills, might automatically occur.

But what about the evidence from neuroscience? According to Robert Winston, medical pioneer and broadcaster writing in Winston (2003:97), neurologists claim that attention is composed of the four processes: arousal, orientation, reward and novelty detection, and executive organisation – each of which is associated with different regions of the brain. Arousal, which starts with the initial catching of an external stimulus by the senses triggers the fight-or-flight response in the amygdala and passes signals to the hypothalamus which momentarily suppresses the body’s hormonal system while the frontal lobes of the brain work out what is happening. In orientation, the posterior parietal cortex, basal ganglia and the lateral pulvina focus attention exclusively onto the stimulus. In reward and novelty detection the mesolimbic pathway tags the stimulus with an emotional value – such as fear, pleasure, disgust etc. Lastly, executive organisation, and the anterior cingulate gyrus (ACG) sustains attention in the new direction blocking out irrelevant information. An experiment at Harvard university showed the power of such attention capture; a group of subjects were asked to watch a film of basket-ball players and were asked to count the number of passes made by the team in white tops. During the 60 second showing, a man dressed in dark gorilla suit walked amongst the players for 9 seconds. When questioned afterward on what was seen, only half the viewers had noticed the gorilla at all – (Winston 2003:95). It seems that the deliberate inducement of flow by setting the viewers a definite task (counting the passes) and their desire to do well in that task had concentrated their attention to the point of missing something quite bizarre.

The encouragement of ‘flow’ may therefore be extremely important for educational practice; edutainment, with it’s strong emphasis on attention capture and retention, may be the very tool to encourage it in a learning environment.

2.2.3.2 Affective Domain: Creating an Emotionally Positive Learning Environment

The second domain that edutainment must operate within is that of the affective or emotional. But where is the evidence that a student's negative emotions may interfere with their ability to learn well? Goleman (1996: 83-84) cites Hunsley (1987) saying that anxious students are more prone to compromise in academic performance of all kinds no matter how that academic performance is measured. Simply put, it appears the mental resources expended on worrying detract from those available for processing other information. Negative and disruptive emotions that are brought into or arise because of the learning environment impede learning and Mezirow, the creator of 'transformative learning' actually said that "the process of transformation is often a difficult, highly emotional passage" (Mezirow 2009:95). Various websites exist to give stress management advice to school children preparing for examinations including advice such as that the playing of classical music can help learning , that visualizations and imagery are proven stress management techniques along with warnings such as the fact that stress can actually impair ability to learn and remember facts – (Scott 2014).

Support for the affective domain comes, too, from the Positive Psychology Center set up by Martin Seligman at the University of Pennsylvania USA. Simply, Seligman suggested that true psychological well-being came from his PERMA approach: Positive emotions, Engagement in activities, Relationships (happy relationships with others), Meaning (in life) and Achievement (through success in life tasks and goals). Although the PERMA approach was put forward as the means to producing the goal of permanent positive lifelong well-being as an end in itself, this thesis takes the view that producing a temporary positive well-being in the learning environment may be a means to the goal of deeper learning. Boniwell (2008:31), a member of the positive psychology movement, suggested that positive emotions could make people more creative, better at divergent thinking and could also stimulate them to play with new ideas, and be more systematic and attentive. And, according to Barbara Fredrickson, another researcher within the positive psychology movement, cited in Boniwell (2008:8), positive emotions could enhance problem-focussed coping and reappraisal and could help people infuse otherwise negative events with positive meaning. However, Fredrickson made an even more pertinent claim – she claimed that positive emotions would undo negative emotions and that a deliberate exposure to positive emotions at times when negative emotions were dominant could serve to undo the effects of the negative emotions. This last finding was extremely important for this thesis as it implied that a

learning environment deliberately producing positive emotions could overlay any negative emotions brought into that environment by the individual students.

With regards to creating positive emotions, edutainment and its entertainment theme of 'game-playing' had a role: difficult concepts in the curriculum could be presented in a multitude of ways using game-playing such as puzzles, riddles, conundrums, brain-teasers, all of which could be made challenging, and which, when solved, led to the emotional satisfaction, the feel-good factor, that is so good for student self-confidence. Self-confidence would also aid the drive towards deep learning, away from surface learning of facts, to be applied in a deeper understanding of how such facts can be used in practice. This is well supported by Papert et al (2004:262) who mentions 'learners do not mind, and benefit most from, activities that are 'hard' as long as they connect deeply with their interests and passions'.

Curiously, the literature seems not to recognise the emotional side of learning in higher education; in two randomly chosen books, all to do with adult education, (Gibbs 1995) (Rogers 2002), none had the word 'emotion' or any variant of 'emotion' in its index pages. However, a look into the literature surrounding Affective Learning did produce some useful insights. Papert et al (2004) point out "too much emotion is bad for rational thinking, … so too is too little emotion – when basic mechanisms of emotion are missing in the brain then intelligent functioning is hindered". So it seems that some, presumably positive, emotions are actually conducive to better learning. Krathwohl's Taxonomy of five levels of emotional/affective response, Krathwohl (2015), shown by the student in learning sessions addresses the affective domain head-on and there is some indication that edutainment may have a role with the two of his lowest levels; Receiving and Responding. **Receiving** refers to the student's emotional willingness to attend to particular phenomena of stimuli (classroom activities, textbooks etc.). Learning outcomes in this area range from the simple awareness that a thing exists to selective attention on the part of the learner. Receiving represents the lowest level of learning outcomes in the affective domain and Krathwohl indicates that this level requires a deliberate and intrinsic emotional willingness to pay attention on the part of the student (this is different from the extrinsic gaining of attention when the student may not even be willing – see later under Improving Attention Spans). **Responding** refers to active emotional participation on the part of the student at this level; he or she not only attends to a particular phenomenon but also reacts to it in some way. Learning outcomes in this area may emphasize acquiescence and satisfaction in reading assigned material, even voluntarily doing so, and further reading for pleasure or enjoyment. So the affective domain, if addressed positively, may have specific learning outcomes.

2.2.3.3 Cognitive Domain: Providing Scaffolding for the Learning Process

The third domain that edutainment might operate within is that of the cognitive. To operate here it must provide some support to the thinking and learning processes of the learners so that they are better able to internalise the curriculum content that they are required to learn. John Sweller, in his cognitive load theory (CLT) says 'another strategy …to preserve limited mental resources is to reduce working memory load by providing external memory supports.' (Clark et al 2010:140). Sweller's notion of helping the learner to learn is well summed up in the 'scaffolding' concept. The 'scaffolding' notion, which was developed from the work of Vygotsky, is well known and is simply summed up by Fry et al (2009: 21) and Stapleton (2001:69) in that new learning needs to integrate with already learned material, and will require definite help to achieve this usually as input from others, and the easier this process is made then the better. An example of 'scaffolding' is the common one where a mother sits with her child and reads a story. Initially, the mother points at words and sounds them out whilst the story is in progress, and then later, encourages the child to identify words themselves and sound these out as mother reads, culminating eventually with the mother encouraging the child to read sentences by themselves; over time the mother withdraws from the reading situation altogether so the child is reading by itself. This social support from the mother is called 'scaffolding'. In the adult world, too, this social support during learning is well exemplified in the notion of 'learning brokers'; Hamilton and Hillier, in their book on the development of adult literacy, discussed the roles of ordinary people with some reading and writing ability who helped those whose literacy was very poor and termed them 'useful brokers … who can mediate between the local, everyday, informal world and the world of official institutional literacies' (Hamilton & Hillier 2006;52).

So edutainment, with its use of humour, story-telling, games and so forth, and their integration with the synergistic outcomes of the psychological effects mentioned earlier in 2.1.6, could easily be seen as a form of 'learning broker' mediating between the official reasoned academic curriculum and the more easily understood everyday informal world of soft practicalities. Vygotsky (1962:87) also stated that 'formal' (systematic discipline knowledge as found in the formal classroom) and 'informal' learning (ad-hoc learning by other means) were not to be treated separately but were interdependent and 'must influence each other's evolution'. This latter aspect is interesting because it suggests that there should be close integration between edutainment used as scaffolding and the content being taught which, in fact, reasserts the need for synergy as identified earlier in the working definition of edutainment derived in the Introduction in Fig. 1.1.

Edutainment may have a number of ways of providing scaffolding. In addition to improving attention and the emotional ambience of the learning environment, which may be considered a form of scaffolding in their own right, the use of the entertainment aspects of edutainment may go some way to meeting the Vygotsky requirement that scaffolding should be a "framework within which learners are able to learn effectively for themselves" as Stapleton (2001:69) put it. In edutainment, such frameworks could be the use of humour that provides changes in perception that are so necessary for all learning (Siler 1997: chaps 8,22), games that certainly provide scaffolding for challenging experimentation with self-learning (Papert et al 2004:262), characterisation that may very well provide a vicarious form of the social support mentioned by Vygotsky above (Fisch & Truglio 2001:29) and narrative which provides an enduring structure over time and on which learning may be fastened (Smethurst 2000:116). The entertainment themes and their associated psychological effects within edutainment may therefore also be looked upon as scaffolding tools for cognitive learning.

2.2.4 Overview of Part II

In conclusion to Part II, the literature does seem to show that adult learning is not perfect and that there are limitations to current practice that might be improved upon. It may therefore be possible to enhance learning through the use of edutainment and that, in operation, edutainment might operate in the three domains as posited herein: (i) attentive i.e. improvement of attention 'flow' which might promote deep learning, (ii) affective: to uplift the emotional ambience of the learning environment to promote motivation and interest towards 'deep learning' and minimise dissonance as per the PPP model , and (iii) cognitive: providing scaffolding for content learning to help minimise the ZPD. If it was found that edutainment really could benefit these three operational domains (attentive, affective, cognitive) in practice then this thesis would certainly be a contribution to human knowledge.

2.3 PART III : BUILDING THE MODEL: WHAT PROBLEMS MIGHT RISE?

This is the penultimate of the four main questions for the literature review. This part – see appendix A Relevance Tree - is concerned with the fact that although this thesis may be original, as shown in part I, and a contribution to human knowledge, as shown in part II, it still remains as to whether it is feasible – can the edutainment model realistically be built? -or will it involve a process that is too complex, too lengthy, or problematic with issues that are either insurmountable or difficult to reconcile in the time frame available. Three salient issues regarding feasibility were identified : (i) could this research fit within commonly recognised underlying research paradigms? (ii) was it really appropriate for adults to 'play' and have 'fun' whilst learning? and (iii) could edutainment models designed for child learning, as in some of the case studies for this thesis, really be adapted for use with adults – surely child learning is different from adult learning, isn't it?

2.3.1 Question 1: What Research Paradigms Might Be Used Here?

> 'Particular research methods represent (though often tacitly) differing views on how the world is constructed and how it operates' (Clough & Nutbrown 2010: 29).

An epistemology is a way of understanding and explaining how we know what we know or as McNiff (2014:29) puts it 'Epistemologies (how we think) influence practices (how we act), and practices influence the development of new cultures of practice'. Crotty (2006:5) identified two epistemologies which may be appropriate here: Objectivism (and the Positivist paradigm), Subjectivism (and the Constructivist paradigm).

2.3.1.1 Objectivism (Positivism)

Objectivism is essentially the concept that truth and meaning reside in objects independently of any consciousness. This is basically the epistemology of physical science research where it is expected that the physical processes of the universe run on rules that exist independently of any human actor or observer. According to the Britannica encyclopedia website Britannica (2015) the basic affirmations of positivism are that all knowledge regarding matters of fact is based on the "positive" data of experience and that beyond the realm of fact is that of pure logic and pure mathematics. This leads towards the use of the scientific method, the mathematical, logical and

experimental techniques employed in the natural sciences which involve the construction and testing of scientific hypotheses.

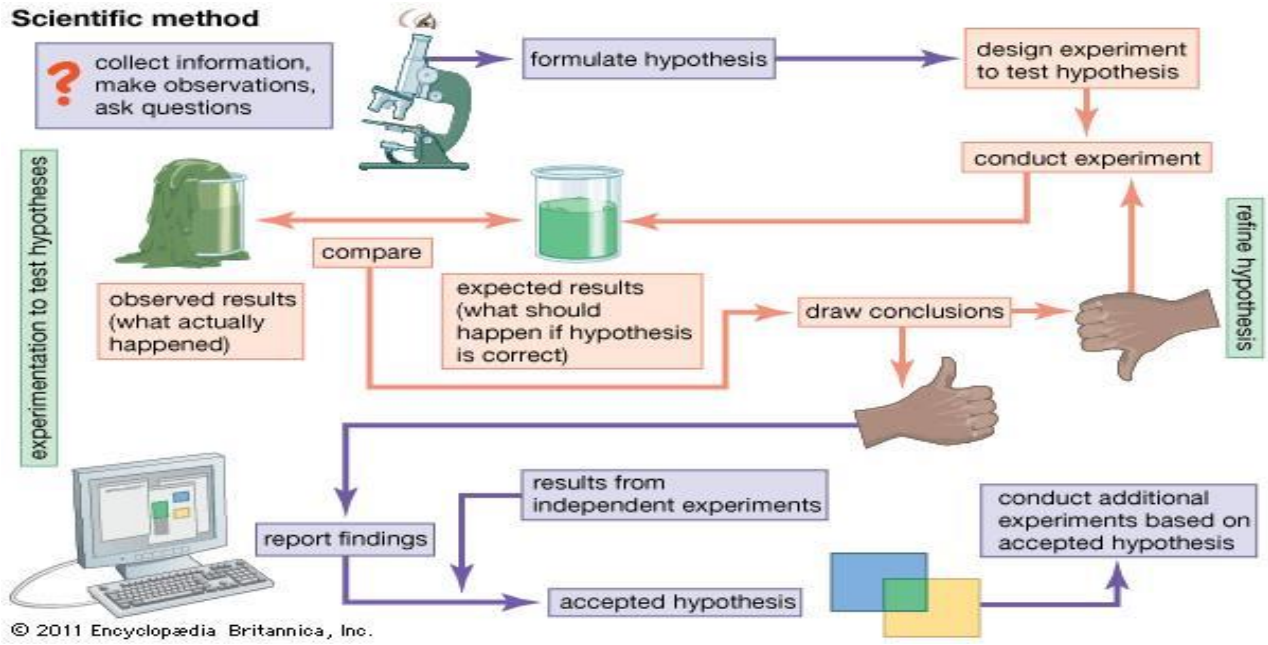


Fig. 2.6 The Scientific Method - Reproduced from (Britannnica website 2015)

There is no doubt that positivism has been phenomenally successful in the study of the natural sciences with its emphasis on objects and assumed fixed rules running the universe but, when applied to the thinking habits of humans, it posed a number of problems when it came to experimentation. This thesis did use a classroom based experiment in which edutainment based materials were trialled with students and their feedback sought. However, one must question whether this 'experiment' really met the criteria of acceptance for positivism; all factors that might account for student acceptance or rejection of edutainment, or even the foundation of their opinions, could not be controlled or reliably measured and the same trial conducted elsewhere by another researcher may well have yielded different results. Consequently, positivism, as an underlying methodology for this educational type of research involving students could not be ascribed to. However, positivism, as the underlying epistemology for the subject 'cyber security', was, and is, very much the case – cyber security was, and remains, very much a STEM (Science, Technology, Engineering, Maths) subject.

2.3.1.2 Subjectivism (Constructivism)

Subjectivism, on the other hand, is, simply put, the view that ethical statements and behaviour reflected the sentiments, personal preferences and feelings of individuals rather than objective facts and that there are as many distinct views of right and wrong as there are individuals in the

world. Subjectivism arose in this thesis in the analytic interpretation of the feedback data from the student interviews following the class-based experimental phase when the principles of edutainment were tested for real; the conscious and subconscious values of the researcher had to be identified at this point (as far as practically possible) for there was an element of interpretation of the students' comments. These were dealt with by the researcher (same person as the lecturer) giving his own personal statement (to be found in appendix S) of what he thought had been happening during the trialling of the edutainment-based materials in the classroom.

In this thesis, perhaps the most important epistemology adhered to was that of Constructivism. Crotty (2006:42) defined this as the view that 'all knowledge, and therefore all meaning, 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' . Meaning, in this view, is not discovered but constructed, and different people (and groups of people) may construct meaning in different ways even in relation to the same phenomenon. Formal learning in a university with interaction between lecturer and student through lectures, tutorials and learning materials is essentially a 'human practice'. There is definitely 'interaction between human beings' as lecturers inform, enlighten, guide, assess and give feedback to students often in face-to-face situations (though it is recognised that this is an ideal, as some lecturers may also confuse, obfuscate, mislead, wrongly assess and bore students with inappropriate feedback). Education, is therefore an 'essentially social context' and will remain so until, if ever, computers and artificial intelligence are so far advanced that not only would students not be able to tell they were being taught by non-human agents but they would welcome it (which seems an awfully long way away at present !!). However, it is the verbs – 'constructed', 'developed' and 'transmitted' – which imply that the students' knowledge is built up, moulded, moved around to form a comprehensible (to the learner) structure within the learner's head. Constructivism is an excellent paradigm for explaining the function of edutainment; not only is it a form of scaffolding as Vygotsky (1962) might have called it but it also incorporates the very notion of multiple representations of reality which could lead to critical thinking (Pritchard 2009:32). However, constructivism is well accepted to work directly on the psychology of the learner through their attention and emotions to effect a learning experience – a viewpoint also supported by Mezirow (2009:94) whose theory of 'transformative learning' suggests that deep (transformative) learning may be produced by cumulative, progressive sequences of insights resulting in changes of point of view leading to transformations in thinking habits. Therefore, constructivism has much to offer

in underpinning this research into edutainment which was primarily concerned with how students could improve their ability to obtain, accept and inwardly order their learning.

In addition, to exploring epistemologies, it was necessary to review the literature on practical methodologies for undertaking research.

2.3.1.3 Grounded Theory

At first, the methodology for this thesis was considered to be grounded theory. This seemed a reasonable choice as the Glaser and Strauss (1967) concept that theory could be derived from the data contained not just an overall approach but a set of procedures to be followed for developing theory from data analysis (Punch 2009:182). These procedures seemed an ideal research plan with their specification of what was to be done at each stage and their notion of taking memos of significant data and ideas as analysis progressed. However, it became apparent that such in-depth analysis as open coding, axial coding and selective coding were to a level not required. For this thesis, it was quickly determined from the literature review what themes should be looked for in the case studies and what features overall might be included in a final model of edutainment. It was not necessary to explore reams of data to uncover the underlying themes, the themes were straightforward to uncover and the data was used only to provide examples and test the validity of the themes. The most important deciding factor on this was that Hamilton & Hillier (2006) did research on adult literacy using the grounded theory methodology and their adoption of it appeared very different from what was required hereto. As part of their approach to determining the changing policies and practices of adult literacy in the UK they collected a myriad different and diverse sources of data, on different media, structured differently, originally produced for different reasons and consisted of 'transcripts of interviews background notes, boxes of archive material and records of project meetings'. Their approach to data analysis was iterative moving constantly between theory and data and eventually identifying three areas of categorisation which formed the chapters and the analysis of their book: actors, themes and lenses. For the actors they identified three key groups: learners , practitioners and policy-makers. For the themes they identified five areas of analysis; Spaces and Places, Curriculum, Assessment & Accreditation, Publicity & Recruitment, and Making Changes. And for the five 'lenses' with which to view actors and themes: Time, Discourses, Agency, Tensions and Deliberative Space. The grounded theory approach suited their needs admirably as they had no idea from the outset what they were looking for, who was involved, what any themes might be nor even how to go about analysing the mountains of

data that they had accumulated (Hamilton & Hillier 2006: 26). However, this was not the case in the thesis hereto; the themes of entertainment had already been identified in the literature review and analysing the data (the case studies) was simply a task of identifying how the themes were used in practice. There were far fewer unknowns and much more structure to the data embedded in the case studies; the analysis, too, was to be much more straightforward – identifying the entertainment themes used in the case studies, observing how they were used and then creating examples for use with students and obtaining their feedback. Hamilton & Hillier also dealt with an enormous variety of data which the grounded theory approach seems particularly suited for. This was supported by Mezirow (2009:90) who, in doing his initial research on his theory of 'transformative learning' also adopted Grounded Theory for his data-sets of 12 diverse college programmes, descriptions of a further 24 programmes and a mail enquiry of some 314 respondents. Again, Mezirow's data sources, like Hillier and Hamilton's, seemed vast in comparison with the data sources in this thesis. The size and amount of work within this thesis were clearly not to be as great as that of Hamilton & Hillier and that of Mezirow. Cohen et al (2005:23), citing Glaser and Strauss (1967), also seemed to rule out grounded theory for this thesis by pointing out that it required that theory should be emergent (from the data) and should not precede research – this, of course, was not absolutely true of this thesis as much theory of edutainment was to precede the student-based trial research and much of the data collected was gathered together to support the theory. It was therefore decided that grounded theory was too complex an approach for this thesis.

2.3.1.4 Hermeneutics

There was also some consideration of the need for a hermeneutics approach as the case studies were to be primarily text-based. According to Stanford University (2005) the term *hermeneutics* covered both the first order art and the second order theory of understanding and interpretation of linguistic and non-linguistic expressions. It would necessitate looking deeply into the literature sources and especially the case studies to uncover the personal reasons why the various writers had said what they had said, or whether the historical or political context had coloured their viewpoints or, indeed, whether words and phrases used in the writings had meant particular things at a particular time in a particular context. Such an approach implied a much deeper analysis than was necessary for this thesis. The methodology applied in this thesis entailed that each case study was to be searched and coded for occurrences of the different themes of entertainment mentioned above: Humour, Narrative, Characterisation, Music and Games. Coding was the essential

analytical tool to be employed. The cross-case analytical case study approach of Yin (2014: 164), discussed at greater length in chapter 3 Methodology, was therefore much simpler ; the case studies were simply analysed using pre-chosen coding items. Therefore, hermeneutics, as a practical application during the thesis methodology and analysis, was dismissed. However, the thesis does make use of literature sources which had themselves been analysed hermeneutically by their authors and other researchers. One example used in this thesis was that of 'The Annotated Alice' which gives the original text of Lewis Carroll's 'Alice in Wonderland' but with margin notes and footnotes referencing and describing the origin of various items in the text, their meaning in their historical context as well as bibliographic oddities (Gardner 2001) . Similarly Wilson (2009) gives a hermeneutics dissection of 'Alice' but from a purely mathematical perspective. However, no actual hermeneutic analysis was performed on the texts by this thesis author.

2.3.1.5 Action Research

Meyer (2000) maintained that action research's strength lay in its focus on generating solutions to practical problems and its ability to empower practitioners, by getting them to engage with research and the subsequent development or implementation activities. Meyer stated that practitioners could choose to research their own practice or an outside researcher could be engaged to help to identify any problems, seek and implement practical solutions, and systematically monitor and reflect on the process and outcomes of change. In many ways this sounded an excellent fit for this thesis being, as it was, predominantly teaching-practice based, researched by a practitioner himself, looking for solutions to practical issues and wishing to build a structure(edutainment model) of practice that could be further refined through practice and observation indefinitely with other practitioners and students. The steps of Action Research are defined in diagram Fig. 2.7.

Fig. 2.7 Action Research stages

2.3.2 Question 2: Is It Appropriate For Adults To Play During Learning?

In the Introduction chapter, in Fig.1.1, a synopsis of several definitions of edutainment concluded with a working definition of edutainment for this thesis of "Edutainment is a synergistic blend of

education and entertainment that through the use of fun and play, supporting creativity and curiosity, can produce a deeper and lifelong learning experience". The 'fun and play' aspects were well supported in LNCS (2009) and Resnick (2004). Although it is now widely accepted that 'play' has a role in teaching children (although this wasn't always the case) it was necessary to discover if play and fun could be extended to adult learning. As this thesis intended to make use of some case studies based upon child learning (Sesame Street, Horrible Science) it was deemed important to address just how alike were children and adults in their thinking? According to Piaget there were four main stages of cognitive development in children: sensorimotor (birth to 2 years), preoperational (2 – 7 years), concrete operational (7 – 12 years) and formal operational (12 – 15 years) – (McInerney and McInerney 1994: 79). It was during the formal operational stage that children became very similar to adults in their ability to solve logical problems. So what was the history of edutainment approaches in Piaget's age ranges for his four stages of cognitive development?

Piaget's earliest stage of learning evolution was the late sensorimotor and early pre-operational phase (age range birth to 7 years) relating to which he maintained that 'play' was consistent with learning. For pre-school children it was probably the only way they could learn. Maria Montessori, an early 20th century researcher, through her concept of 'learning through play', maintained that the teacher's role in any school was not to be a didactic leader from the front of the room but a facilitator of learning opportunities. She maintained that each child could move through learning materials on their own instinctively 'absorbing' at their own pace without feeling they were being taught at all (Montessori Institute 2014). She found that, with proper resources, children could learn to read by age of four and then quickly progress to other subjects such as mathematics. Her methods and thinking have been acknowledged throughout the world and influence much of what passes for children's learning materials today. A later attempt at edutainment design for pre-school learning was through the 1960's experiment of the CTW (Children's Television Workshop) in the USA, namely Sesame Street. This brought the first deliberately designed edutainment approach to the production of children's learning using television. Morrow (2006: 7) reported that this was to meet the needs of the time in raising standards of pre-school learning amongst especially immigrant households and those of low income in the USA.

For somewhat older children, 7 -12 years or Piaget's concrete operational phase, Seymour Papert, educational innovator and mathematician, and collaborator for many years with Jean Piaget at the University of Geneva, and involved with setting up the MIT Media Lab, did much work on child learning. In the 1960's, he came to the conclusion that child learning, especially in maths and

computing, could only be accomplished with an element of play. He invented Logo a computing language for children which could be used to control a small wheeled vehicle, the Turtle which children could manoeuvre along the ground, at varying speeds and directions. Programming the Turtle taught children basic computing skills and mathematical constructs. This foray into teaching children using practical and visual methods was an early attempt at deliberately designed edutainment.

Even older children, 12-16 years in Piaget's formal operational phase, have benefitted from edutainment in their formal learning. Amongst commentators on contemporary UK secondary schools the notion of fun is very much recognised. Cowley (2003: 57) says that the best (secondary school) teacher approach is 'firm but fun' and this is supported by the student cohorts interviewed by her who themselves defined the best teacher as one who 'is strict' but 'makes everything fun'. Cowley (2003: 117) says that by 'fun' the students meant the teacher might play with words or tell stories or introduce topics with games of some kind – many, in fact, of the themes of entertainment mentioned at the beginning of this literature review.

However, although it may be shown that fun and play have a role in children's learning through all of Piaget's phases of development, we must also ask 'Can it also benefit the learning of adults in the post-Piagetian formal operational phase?' The concept of adults playing whilst learning is highly controversial. It is widely accepted that it occurs in sport, entertainment and the media industries or as Gilsdorf (2009:293) quipped 'Maybe it's more important when you're an adult to stop a little bit and have fun, than when you're a kid'. But is the playing and having fun by adults whilst learning accepted so readily in academia? Chadwick (2012) conducted a straw poll of academics in his own university department and found that although most acknowledged it might have a role in teaching there were problems regarding what was meant by play, how to organise it and how to keep classroom discipline when the formal lecturer–student boundary was made somewhat hazy. A minority of academics found the notion of play as absolute anathema to them and inappropriate in the 'serious' world of learning. They maintained that, not only would it not enhance learning, but would detract from it. However, see phase 4 of the Literature Review for more on the Professional Context of this thesis.

Overall, a question arose here as to what benefits play could bestow upon adults that a non-play approach to learning could not deliver. This was well explored in Kane (2004) who believed that in adult lives the concept of 'play' was under-examined - and when it was examined, was often dismissed as 'trivial'. He had a concept of "adaptive potentiation" - the capacity to energetically test and experiment with various survival and flourishing strategies. To quote Kane (2004:64) "the

core function of play …is to give us …chance to exert our virtual mastery over a skill or scenario, so that we are better prepared for the actual engagements of survival" . Kane argued forcefully that 'play' in everyday life was as much a cognitive strategy for learning in adults as it is in children. Huizinga (1938) is also amongst those who have explored the profound significance of play for human and cultural development.

But has 'play' been tried seriously in other professions other than education? Yes – in medicine. Dr. Patch Adams was the subject of a film 'Patch Adams' made in 1998 starring the late American actor Robin Williams. Adams is both a medical doctor and a circus clown (yes – a clown) and also a social activist who has devoted 30 years trying to change America's health care system. Adams (2014) believes that laughter, joy and creativity are an integral part of the healing process and , to this end , in working

with physical health and mental health professionals, he explores the relationship between humour and therapy. His approach to medicine and humour also has support amongst cardiology specialists where there is a belief that laughter may reduce emotional and physical stress and so reduce the likelihood of a heart attack (University of Maryland Medical Center 2014). Still in the USA, the Cancer Treatment Centers of America have adopted 'laughter therapy' as an acceptable therapy for their cancer patients –see appendix B. In the UK, too, the Bluetones music group are writing songs to perform on the mental illness wards in ten NHS hospitals in the belief that music can help develop concentration and social connection thus aiding patients' recovery. The Bluetones have received a £15000 Arts Council grant for this purpose and it is expected that the NHS will be rolling out this initiative country-wide (Mulkerrins 2015). Similarly, in the UK, the Theodora Children's Charity provides clowns to visit children's wards in NHS hospitals (Theodora 2015). Surely it is not impossible that the emotional and physical benefits of laughter may also heighten attention and prime short term memory to receive information – and all in all make a learner more receptive to his learning environment?

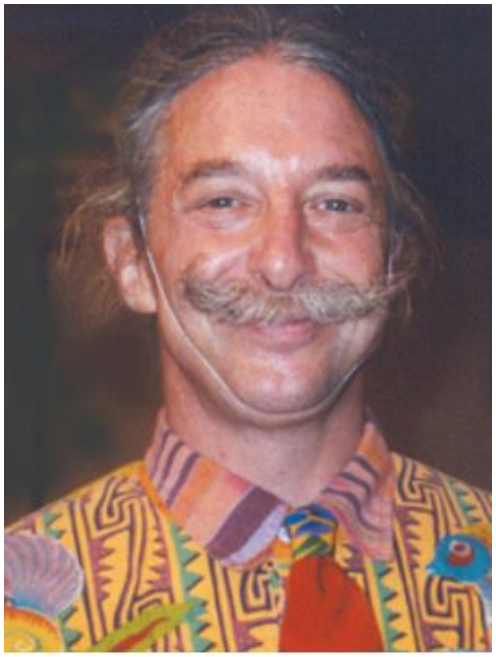


Fig. 2.8 Dr. Patch Adams

2.3.3 Question 3: Can Models Designed For Children Be Adapted For Adults?

Peter Jarvis, educational researcher into adult learning and chief editor of the International Journal of Lifelong Education, has bluntly stated that "Traditionally, adult educators have claimed that children learn differently from adults, but the processes of learning from novel situations is the same throughout the whole life, although children have more new experiences than adults do and this is why there appears to be some difference in the learning processes of adults and children" (Jarvis 2009:27). However, Rogers (2003:130) in his chapter 'The Uniqueness of Adult Learning' attempted to pin down why some thought adult learning was different from that of child learning. Rogers cited many researchers some of whom had found differences in approach, with most of them involving the role of experience in the learning process, but came to the conclusion that 'this does not necessarily mean that the processes of adult learning are any different from those of children, only that the mixture of processes may be different' (Rogers 2003: 132). This is also a position supported by Chadwick (2011a) in his comparison of the learning model behind Sesame Street with that of typical adult learning. However, the work done by Brookfield (2000:89-101) showed that adult learning was significantly different in two respects: firstly, the 'consciousness of learning' meant that an adult could become aware of their own learning style and could consciously learn how to learn and secondly, the 'ability to hold both the contextualised and the decontextualized in harness' meant that specific actions could make a nonsense of general rules and theories and that rules could be broken when the situation demanded. Children could not do these things because they had not gained enough or varied experience. 'Consciousness of learning' or meta-cognition as Pritchard (2009:27) calls it is a self-awareness issue that really starts developing only post-puberty during adolescence and leads slowly to 'contextualisation' as one of pure experience of how the world really works in it's shades of grey as opposed to the black/white dichotomies of childhood. Rogers (2003: 138) also makes a salient point about power – children have little say in the student-teacher relationship whereas adults have more of a peer relationship with the teacher especially in higher education. But Michael Knowles had already tried to differentiate between child learning and adult learning in his 'pedagogy v. andragogy' in Knowles (1980:43) and which culminated in his four criteria: 1) adults want to move from dependency to self-directedness but surely children do attempt to do this as well? Even where, as Vygotsky pointed out, children need scaffolding to aid their learning, they do often go away and learn by themselves; 2) adults draw upon their reservoir of experience for learning – but clearly children obviously do have experiences/memories they can call on although adults definitely have more; 3)

adults are ready to learn when they assume new roles – but surely children also do this – anybody who has ever had children knows that they are always role-playing, dressing-up, playing fantasy games and assuming different roles, they may even have imaginary friends!. but … this is entirely voluntary – perhaps the difference with adults is that adults have to assume different social and economic roles by necessity and 4) adults want to solve problems and apply new knowledge immediately – according to Piaget and his four stages of cognitive development children are capable of solving problems, to a greater or lesser extent depending upon their age, but, however, one wonders if the children consciously wish to apply new knowledge – they might apply it but do they consciously strive to apply it? To what extent is it that children know that they don't know? Adults often enter formal education to learn what they know they don't know, but also with the expectation to learn what they don't know they don't know (with due apologies to Donald Rumsfeld).

John Hattie, very influential in the meta-analysis of educational statistics, has created his list of 'effects' (Hattie 2011) – see appendix L for list of 'Effects' from (TeachersToolBox 2014). As mentioned previously, Hattie reviewed thousands of research papers on secondary education ranking those educational 'effects' or those functions that appeared most often or which appeared to most improve learning. PBL (Problem-Based Learning) comes very low on Hattie's list so presumably is not considered important or has little effect on children's education. However, PBL is used a great deal in the teaching of medicine and engineering to adults and has been shown to be useful in teaching cyber security subjects such as digital forensics at university level (Chadwick et al 2007); in fact, it is quite fundamental to the analytical skills these adult students need to develop. So, perhaps, again, there are some differences between children and adults in the way they learn.

Perhaps the most informative area of work that shone light on this question was the area of adult literacy. During the 1960's in the UK, the concept that some adults might require help with basic literacy and numeracy skills was very new. The Army was really the first institution to wake up to the need and, by 1973, had put into practice their Preliminary Education Centres for bringing recruits up to their minimum 'working literacy' requirement. They did this with readers and worksheets created with examples of Army functions and Army settings. The 1975 BBC 'On The Move' programme was perhaps the first that most people knew of this hidden problem generally - prior to this adult literacy as a recognised field of educational practice did not exist (Hamilton & Hillier 2006:2). From the mid-70's onward the new area of education developed , at first haphazardly, and then as a matter of government policy. However, (Hamilton & Hiller 2006:3)

showed that for adults an O-level English literature or maths class was not a suitable environment for learning the basics. And, in special arrangements for adult learners, where they existed, it was found that 70% of all teaching in 1972 used children's books and 80% used material for remedial 'backward readers' also written for children (Hamilton & Hillier 2006:118). It was quickly learned that a 'challenge was to find a methodology that worked with people who had not succeeded as children' so the adult literacy movement slowly moved away from using children's books to one's specially developed for adults – something the Army had been doing for some time. Eventually materials began to appear teaching the same reading/writing skills as were taught to children but at different speeds and within different contexts. Also, over time, it became clear that adults 'needed to use words in their everyday lives and not learn de-contextualised lists of spellings' (Hamilton & Hillier 2006:117) and have a curriculum that was 'rooted in people's daily experiences' (Hamilton & Hillier 2006:110) and, in the 1980's, publisher Avanti began to specialise in such materials. In time, the same thinking was applied as technologies changed – the best software is produced for children and so needed to be redesigned or adapted with examples and presentation suitable for adults (Hamilton & Hillier 2006:119). What this showed was that, in the world of adult literacy teaching, it was generally considered that adults may learn much the same skills and in much the same way as children but definitely required teaching materials that related to an adult perspective; the differences between adult's and children's learning were, therefore, not cognitive - they were contextual. By inference, models of edutainment built for children could possibly be adapted for use with adults if the context (the narratives and examples) was amended.

2.3.4 Overview of Part III

Part III of this Literature Review has shown that the thesis appears to have a robust philosophical basis – that learners react with their learning environment and construct their own meaning of what is being taught and that edutainment may have a role in this process. The initial problem of whether play was appropriate for adults seems capable of being dealt with. Importantly, there is little support for any notion that models of child-based edutainment cannot be adapted or extrapolated for use with adults. This latter finding is useful as child-based models such as Sesame Street have much to give in terms of making edutainment work in a practical sense. Overall, therefore, it appears that there are few issues to prevent the feasibility and credibility of this thesis work.

2.4 PART IV PROFESSIONAL ISSUES

> 'It's time for inventing new forms of learning. It's time for addressing the entire learning environment in new ways' (Seymour Papert 2002).

Papert's statement, however much a call to arms, will not be so easy to accomplish and inventing new forms of learning and addressing the entire learning environment will cause a lot of disruption to a lot of people in different ways .There is no doubt that a working model of edutainment will impact on all professionals concerned in the higher education arena. Looking at this from the widest possible angle there are five possible professional stakeholders (excluding the students who are not considered professionals in the same sense and whose interests are dealt with elsewhere in this thesis) whose interests are to be taken into account: (i) the lecturers who will have to teach edutainment, (ii) university management who may have an interest in any teaching methods that may impact on scholastic statistics (either negatively or positively) , (iii) the educational funding bodies (mostly local and national government bodies in the UK), (iv) the industry-based professional bodies (in the case of cyber security these would be the BCS (British Computer Society), ISC^2 (International Information Systems Security Certification Consortium) and ISACA (Information Systems Audit & Control Association) and (v) the personnel of the serious software games industry (software that uses gaming as a method of educating and training.) Each of these five stakeholder groups is a professional something in some way who might have an interest in edutainment as a teaching approach.

2.4.1 Lecturers : Gaining Teacher Support for Edutainment in the classroom

'[Students] need help with how to approach the learning of something that is the product of someone else's thinking, and teachers do not naturally provide an environment that affords learning of this kind' (Laurillard 2012:82). Diana Laurillard makes a bold statement above for if 'teachers do not naturally provide an environment that affords learning of this kind' then they will need some help to do so. This is further reinforced by Ramsden (2003:5) who stated the aim of the HE teacher is to '…make student learning possible' with the implication that teachers must do more than just deliver topic knowledge, they must deliver it in a fashion in which students can easily absorb it and then do something with it. If edutainment is to be adopted as a teaching aid to lecturers, the same will need to develop skills they may not have had fully developed previously. Using fun and play to support creativity and curiosity may be something new for some lecturers

and take them out of their comfort zone. This thesis researcher, D Chadwick, recalls a talk given to fellow EdD students on the use of humour in the classroom in which he reported his own student survey that showed students liked the use of humour. To Chadwick's surprise, the audience, all lecturers in HE, responded quite negatively; 'the HE classroom is no place for jokes', 'learning is a serious business' and 'it may work for you but not for others' were some of the comments (Chadwick 2012). This feedback was not scientifically recorded and is represented here as purely anecdotal material, but it did show obvious resistance. This, in itself, was surprising, as humour was slowly becoming recognised as of therapeutic use generally – see appendix B for internet material from the Cancer Care Center in the USA promoting the use of 'laughter therapy' which at last presupposes it may have other uses especially in teaching. However, this negative perception on the part of staff to humour and other forms of entertainment in the classroom may be summed up by Jung & Latchem (20011:16) who noted that "teachers are only interested in educational change that is congruent with their current practices … and label advocacies they regard as abstruse as 'merely' theoretical". And McNiff (2014:60) supports this view with the statement that "many people use the same mental frames throughout their lives …possibly because they are comfortable holding a particular perspective they believe is correct". Powell & Andresen (2006), too, acknowledge that staff may express resistance but say 'presentation of humorous material will involve skills which can be learnt through practice … staff development programmes will need to provide opportunities for academics to acquire such skills'. But one wonders if training in edutainment techniques generally will be enough. Perhaps better would be to encourage staff to buy-in to the whole approach and to develop their own 'flavour' of the edutainment model itself. In this way staff would be more likely to take ownership of the edutainment process and the success or otherwise of its resultant products. Teachers perhaps need to be made aware of the Vygotskian notion of ZPD (Zone of Proximal Development) which is the gap between where the student is and where the student, helped to stretch to his/her maximum potential ability, is able to arrive. Vygotsky himself implied that filling the ZPD might require more than just the normal teaching activity of the classroom – it may require other more risky social, or emotional measures on the part of the teacher – in fact, it may very well require that the teacher himself risk entering their own professional ZPD! Vygotsky (1962:87) lends some support to this as he argues that 'formal' (systematic discipline knowledge as found in the formal classroom) and 'informal' learning (ad-hoc learning by other means such as edutainment) were not to be treated separately but were interdependent and 'must influence each other's evolution'. This suggests that any edutainment

model resulting from this thesis must enable teachers to place their own stamp upon it in order to be get more involved.

But how can teachers be enabled to place their own stamp upon it? A possible answer is that any model of edutainment must give the teacher a 'voice' in the process; it must have a built-in mechanism for encouraging the lecturer to create and research his own use of edutainment. Any model must therefore be more than a mere set of rules to be blindly followed. An edutainment model, to be truly successful, should be able to energise teaching staff to take ownership of the edutainment process and its products. To this end, such a model might benefit from (i) the teachers ability to create edutainment products to fit the content of what is being taught, an approach termed Discipline-specific Pedagogic Knowledge or DPK by Berthiaume (2009) and (ii) the teachers ability to conduct research on their own edutainment trials as practitioners (rather than waiting for academic researchers to undertake this) - an approach termed Pedagogy as Design Science (PDS) and advocated by (Laurillard 2012). These two concepts, DPK and PDS, are further explored below.

2.4.1.1 Lecturer Support: Discipline-specific Pedagogic Knowledge (DPK)

Most lecturers already understand, knowingly or unknowingly, that their choice of teaching methods should fit the subject and the students being taught. DPK was a notion originally devised by Shulman in his original paper on PCK (Pedagogic Content Knowledge). Shulman basically stated that teachers had to confront issues of both content and pedagogy and blend them into an understanding of how aspects of subject matter were to be organized, adapted, and represented for instruction or as Shulman (1986:9) himself put it "the ways of representing and formulating the subject that make it comprehensible to others". If we accept Shulman's notion then the statement the definition proposed in the Introduction Fig.1.1, that edutainment was 'a blend of education and entertainment that synergistically deliver a deeper learning experience" becomes more proscribed. Shulman's model of PCK, Shulman (1986), outlined the ways content, pedagogy and knowledge of learners could be blended into an understanding of how particular topics might be taught, represented and adapted to learner's characteristics, interests and abilities, preconceptions & learning. Shulman's PCK was a good model that has been built upon over the years and Berthiaume (2009) elaborated upon Schulman's simple model to produce a generic model of DPK for university teaching. As shown in appendix M this model has three components: knowledge base for teaching, disciplinary specificity, and lecturers personal epistemology; these three interact

to form a model of generic DPK for university teaching - see Fig 2.9. However, this thesis maintains that neither Shulman's simple model nor Berthiuame's more complex model adequately deals with students as a separate entity – both these models are lecturer-content-pedagogy oriented and the attributes of students, although noted in Shulman's model, are buried in the finer text – see appendix M for detail of Berthiaume's model. This thesis maintains that the student is such an integral part of the edutainment approach that it must be considered a separate entity within the DPK model. The student and his/her attributes cannot be ignored - if one is teaching, say, cryptography (as part of cyber security) then one would select the appropriate pedagogy to make the most of the content to be taught but this in itself would be tempered by the nature of the cohort of students – undergraduates would be taught differently from postgraduates who would be taught differently from mid-career police-officers investigating cyber-crime; mathematically- oriented students would be taught differently from those less gifted, those with a history of employment would be treated differently from those whose experience was purely academic. A model of DPK that fails to include the student as a separate entity must be lacking in something; if education is considered the 'transfer of knowledge from teacher to student' as per Ausubel's expositiory model of teaching described in Stapleton (2001:67), then there must be a transferee as well as a transferor; if education is considered 'a facilitation of learning', as per Bruner's discovery learning model also found in Stapleton (2001:65) , then, in addition to the facilitator, there must a facilitatee. Therefore, it might be more appropriate, if a DPK representation based upon Berthiaume's model were to be used as a component of the final edutainment model, that it should include students more specifically.

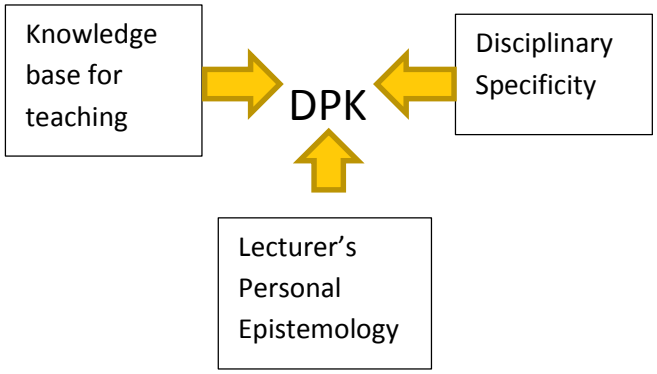


Fig. 2.9: Berthiaume's DPK Model for University Teaching (Berthiaume 2009)

2.4..1.2 Lecturer Support: Pedagogy As Design Science

"Teaching has to make use of what is known about learning and teaching from research, but must develop heuristics, skills, and practitioner knowledge to create effective learning designs …" - so

said (Laurillard 2012:78). It appears that Diana Laurillard was saying that educational research should not be left to professional researchers alone because educational practitioners (the actual teachers and lecturers who have classroom experience and student contact) also have a body of practical knowledge that is relevant to improving educational practice. She went on to imply that much of this practical knowledge, from the coal face so to speak, is not being researched, developed and distributed amongst the profession because the practitioners themselves are not sufficiently involved in the research. Bransford et al (2003:242) cited in Laurillard (2012:78) suggested that all teachers should do research as part of their own professional development and stated "Teachers are learners and the principles of learning and transfer for student learners [also] apply to teachers". Lo et al (2004:193) cited in Laurillard (2012:78) went so far as to suggest that, having defined a set of educational objectives, teaching practice should be designed using feedback from previous teaching and research findings and taught according to this plan; teachers should then evaluate the extent to which students meet objectives and document and disseminate the design lessons learned to other practitioners; these functions should be a part of normal teaching practice. However, it must be acknowledged that there are practical difficulties with this; as Irons (2007:ix) puts it "New teachers can be asked to consider their own approach to teaching in relation to the wider literature, research findings and theory of teaching and learning" but then he immediately continues with "However, … a much more pressing need may be to design and deliver an effective teaching session for tomorrow". The practicalities of such formative feedback for teachers as they progress through a particular discipline-based course, cannot be overlooked but, equally, the usefulness of such formative feedback as a resource for the teacher cannot be ignored. Further support for formative feedback can be gleaned from one of the case studies hereto, the children's television programme Sesame Street (appendix F), which includes, in its own practitioner model, strong concepts of both formative and summative feedback. Formative feedback was the built-in process, between broadcasts of TV programmes, of obtaining feedback from focus-groups of children for evaluation of how different parts of a programme were received and understood. In this way, the programme producers were able to see what worked and what did not work (Fisch & Truglio 2001:17; Morrow 2008:58). Similarly, at the end of a season of programmes, more academic studies were conducted by independent university research teams to produce conference and journal papers to disseminate 'good' ideas for teaching children using television (Fisch & Truglio 2001:41). These notions of formative and summative feedback were not only important in the programme development process as Morrow (2008:77) points out but extremely successful in measuring educational outcomes overall (Fisch and Truglio (2001:140).

Hence, both formative and summative feedback were considered important concepts for possible inclusion in any model of edutainment.

2.4.4 University Managers

University managements were perhaps the least interested of all the professional stakeholders in any novel teaching strategy. Their main interest was to see statistics of student awards showing upward positive direction with increasing numbers of research papers from staff and students alike and all of this with falling or at least static budgets. However, edutainment may be able to have an effect on all of these management criteria as well. If this thesis were to show that an edutainment approach improved student assessment grades and, if, as the final edutainment model may include, staff were to be encouraged to participate in practitioner research as part of adopting the model, then improvements to all management criteria may be achieved. And the cost? Apart from the initial cost of some staff training – there would be no extra cost; edutainment was unlikely to be a resource-driven initiative – it's only effect would be to encourage a change of teaching methods.

2.4.5 Educational Funding Bodies

This thesis is about enhancing the learning of adults studying cyber security, a subject which consists primarily of technical IT skills and knowledge as shown in table 1.1 and 1.2 in the Introduction and based almost entirely upon STEM (Science, Technology, Engineering and Mathematics) skill sets. According to BBC News (2014a) the teaching of both STEM and cyber security subjects are of major importance to western governments; they are both areas of concern in which the general population need to be more educated. Both UK and USA governments are concerned about teaching more professional IT people in cyber security techniques, the general public so they may keep themselves safe and even teaching cyber security awareness to children in primary schools (BBC News 2014b).

The UK National HE STEM Programme, with £20 million of funding, ran from August 2009 to July 2012 and aimed to contribute to the development of a national higher education (HE) STEM sector with a programme that helped students develop skills required by employers, gave them experience of STEM disciplines, and sought to widen participation in these subjects among school students. An independent evaluation of the programme found that the National HE STEM Programme was an 'effective and valuable contribution to the challenges facing the supply and

diversity of STEM graduates in England and Wales.' Nonetheless, fears for the UK were expressed in the Times Higher Education website THE (2015) when the House of Lords Digital Skills Committee, intimated in their report 'Make or Break: The UK's Digital Future' that "Digital is everywhere, with digital skills now seen as vital life skills. It's obvious, however, that we're not learning the right skills to meet our future needs," In the USA, too, the President, at the Third Annual White House Science Fair, April 2013, said "how [do]we create an all-hands-on-deck approach to science, technology, engineering, and math… We need to make this a priority to train an army of new teachers in these subject areas, and to make sure that all of us as a country are lifting up these subjects for the respect that they deserve." The President's 'Educate to Innovate' initiative has brought on various educational initiatives such as the Children's Television Workshop's 'Sesame Street' team to enhance the teaching of logic, mathematical and practical design/engineering skills. The President noted that efforts to improve STEM education were going to make more of a difference in determining how the USA would fare as a country than just about anything else as they were essential to economic prosperity, competitiveness, national defense, a clean energy future, and longer, healthier, lives. The President's plan was to create a national STEM Master Teacher Corps which would receive resources to champion STEM education and to mentor math and science teachers.

The UK Cyber Security Strategy was released in November 2011 and earmarked £650m to accomplish four objectives over five years (Clemente 2011). As part of the Action Plan for Objective 4 the UK Government outlined several actions they were going to take of which one very significantly was '*Encourage, support and develop education at all levels, crucial key skills and R&D'*. The government had in mind the building of awareness amongst the population in general, the extension of university education to encompass cyber security teaching to more people and the retraining of persons from other professions and areas into the cyber security professions. This thesis, revolving as it does around developing a model for enhancing learning of cyber-security subjects, might have something to offer here. Certainly, UK higher education has identified the need for improvements in cyber security teaching not only for producing students as new professionals for industry, and ensuring that that said students are ethically aware so that they themselves do not become perpetrators of wrong-doing, but also for the universities to protect their own IT assets (Chadwick et al 2007). A spin-off from Objective 4 above is that the UK National Audit Office landscape review on the UK cyber security strategy, identified a shortage of cyber security skills as a key challenge. In February 2013, a review by the UK National Audit Office noted that employers consistently raised concerns about the quality of the skill-sets of

computing graduates and, if the UK was to be equipped to deal with cyber threats, and the cyber security sector was to grow, then more was needed to prepare students for entry-level security career opportunities – (HEA 2014). To this end the Higher Education Academy (HEA) and the Department for Business, Innovation & Skills (BIS) announced the availability of Development Fund grants of up to £40,000 for innovative projects by higher education providers, preferably in partnership with industry, that will improve cyber security teaching and learning. They had in mind projects to employ exemplary techniques, methods or materials already developed and used successfully, which must have had potential to impact across the discipline, institution and the sector beyond, and build upon existing practice and pedagogic research. Examples would include industry/education collaborative course design/delivery; innovative methods of course delivery; entry-level professional qualifications; industry placements for staff; student sponsorship and work experience; and generally raising the profile of cyber security learning and teaching. An edutainment model, such as that being built within this thesis and based around cyber security learning, may well have a role here as (i) an innovative method of course delivery and (ii) raising the profile of cyber security learning and teaching.

2.4.4 Lifelong Learning

The issue of Lifelong Learning is also a consideration of the funding bodies. The discussion of several definitions of edutainment in the Introduction chapter concluded with a working definition for this thesis of "Edutainment is a synergistic blend of education and entertainment that through the use of fun and play, supporting creativity and curiosity, can produce a deeper and lifelong learning experience". The concept of equipping adults for lifelong learning appears to be a highly desirable goal for most educational systems around the world. Education is no longer limited to the first 21 or so years of life. More and more people are having to learn for longer and longer into their adult lives, about topics that impact their working, and sometimes, family lives. With the increasing pace of science and technology, adults are having to learn topics that are completely new to them in both theory and practice, and learn quickly as only limited time can be gleaned from a busy working life. It is clear that there is an international drive to increase the uptake of education in all its forms by people beyond their early twenties and the OECD has published a policy briefing to this effect (OECD Policy Brief 2004). So there are political pushes to make lifelong learning a mainstream issue in formal education. There is no doubt that a model of edutainment may prove a useful tool here providing possibly more palatable ways of learning, minimising the dissonance of older students coming back into main stream education, enabling a

positive emotional environment in which to re-career and providing scaffolding for new ways and topics of learning.

2.4.5 Professional Bodies and Employers

Some of the terms commonly used in job advertisements according to Kneale (2009: 99) are: critical thinking, creativity, problem-solving, decision-making, personal effectiveness and commercial awareness. An edutainment approach cannot contribute to all of these but the use of games as an entertainment theme may certainly encourage problem-solving skills, the use of the multiple-perspective approach of edutainment could certainly ignite creativity in those able to find it and commercial awareness (business awareness) is certainly something that a good edutainment model should encourage possibly through the story-telling of anecdotes from working life either the lecturers own working life or those of others. Such anecdotes are important for students because they have the ring of reality about them, they connect the academic curriculum to the working world and they form 'mental hooks' as Rose (1985:72) put it.

And what of the professional bodies themselves? According to the BCS (2014) website, the British Computer Society shows its interest in educational matters with it's recent initiatives. The BCS helped create CAS (Computing At School) group to help teachers ensure every child has a computing education, developed the Barefoot Computing project for primary schools and helps run the Network of Teaching Excellence in Computer Science which aims to create a national infrastructure for providing computer science CPD to teachers. The BCS also runs a DfE funded scholarship scheme for trainee computing teachers undertaken with industry partners including Microsoft, BT, IBM, Google, HP, Toshiba, Morgan Stanley, Compare the Market, Ocado, and Metaswitch Networks. Similarly, ISACA has an academic liaison officer who visits universities to give talks on professional matters, to see how the teaching is done and to encourage students towards submitting their extended projects for an ISACA Dissertation Prize. The ISC^2 is another IT security organisation that sends speakers out into universities and takes an interest in teaching matters.

It is quite probable that the above three professional bodies will take an interest in the use of edutainment for teaching cyber security.

2.4.6 Software-based Serious Games Industry

In the Introduction it was pointed out that one of the rationale for undertaking this thesis was the overuse (and misuse) of the word edutainment. It seemed that any game-based software with a smattering of learning built-in was termed as 'edutainment' purely as a marketing ploy and it was this that this thesis set out to remedy. However, there is much to be said for games purposefully and thoughtfully designed for learning purposes and the delight of young people in the use of games for learning has found a new home in the software games industry particularly for the so-called 'serious games' . The term 'serious games' has been defined as 'a mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy and strategic communication objectives' (Le Compte et al 2015:204). The military, particularly, have become very interested. Serious game design in the area of cyber security has resulted in products such as CyberCIEGE a hands-on virtual laboratory developed by the US Navy, where users can spend virtual money to operate and defend their networks by configuring workstations, servers, operating systems, applications and network devices. Users have to make decisions to maintain a balance between budget, productivity and security; and they get to see the eventual consequences of their choices (Greitzer et al 2007:7). SimBLEND, developed for the US Airforce to deliver interactive cyber security training, even designed itself specifically to match the six levels of Bloom's Taxonomy, a classification of different levels of cognitive learning objectives that educators may set for learners. These levels comprise (from the lowest level) knowledge, comprehension, application, analysis, synthesis and evaluation (Buchanan et al 2011). The UK government has even sponsored serious games for promoting cyber security training and skills amongst young people; the Cyber Security Challenge (2015) is a website that discusses various games (usually team based) put on in various venues where teams compete with each other to solve a problem or even create a problem within a specified time frame. This initiative has been particularly successful with secondary schools and universities. But, above all, it seems that the so-called software-based serious games can embody not only the game element of edutainment but also many, if not all, of the other elements such as humour, characterisation, narrative and music. Buchanan et al (2011) in their paper on cyber security games and the relationship with Bloom's Taxonomy stated 'the narrative genre games, particularly the "choose your own adventure" variations are well suited to the synthesis learning objective'. And regarding the characterisation element of edutainment, Greitzer et al (2007:5), discussing enhancing training effectiveness in serious gaming contexts, point out that 'during

game play, players can participate in many different roles (e.g. decision-maker, team leader, thinker, and team player)' and they see this as a highly desirable learning objective. It seems therefore that serious games often include the entertainment elements of narrative and characterisation as well as the puzzles and problem-solving that all games present. It seems that serious software-based games are not only a subset of edutainment but themselves contain several elements of edutainment within. However, in the use of games for cognitive development of some kind (most serious games), there is potential for great expansion as software-based games of any kind can enable real-world simulations and emulations to be devised which are of great value to the prospective cyber security practitioner (Greitzer et al 2007:3). Le Compte et al (2015:205) in their paper 'A Renewed Approach to Serious Games for Cyber Security' have suggested a possible framework for classifying and planning 'simulation' type games involving topics, technical features, target audience and didactical capabilities which loosely correspond to the features of the edutainment model devised herein. Therefore, the area of serious games appears as a strong candidate as a beneficiary of any edutainment model.

2.5 Literature Review: Synopsis.

Several interesting issues arose from this literature review that were contenders for inclusion as components for the final edutainment model. These were the five entertainment themes (Humour, Narrative, Games, Characterisation, Music) explored in phase I section 2.1 and how they could synergise with education using various psychologies (primacy, recency, repetition, Von Restorff, Zeigarnick, Eidetic and Cognitive Loading) , the PPP model of Prosser & Trigwell with it's timeline-process and notions of surface and deep learning and learning environment dissonance, the notion of andragogy as elucidated by Michael Knowles as a teaching approach for adults, the importance of practitioner research as espoused by Diana Laurillard and Sesame Street and, finally, the DPK (Discipline –specific Pedagogic Knowledge) approach advocated by Berthiaume and Shulman suggesting a process for blending teaching approach and content; all had something to contribute to a final model.

Lastly, the literature review also produced the three operational goals of edutainment: attentive, affective, cognitive. These were important as they could show if edutainment was truly effective in enhancing education. To see if and how some of these things might be useful let us investigate a short edutainment exercise and see how they might apply. Fig. 2.10 shows a simple edutainment vignette based on O'Shea (2005: 7) given to cyber security students at the start of a short course of lectures on cryptography (codes and ciphers).

Read the text below and decipher it. What is the rule by which it was encrypted? What does this tell us about cracking ciphers in general?

I bet you cdnuolt blveiee that you cluod aulaclty uesdnatnrd what yur'oe rdanieg. It deosn't mttaer in what oredrn the ltteers in a word aer, the olny iprmoatnt thing is that the frist and lsat ltteer be in the rghit pclae. The rset can be a taotl mses and you can slitl raed it wouthit a porbelm. Tihs is bcuseae the human mnid deos not raed ervey lteter by istlef, but the word as a wlohe. Amzanig sfutf huh?

Fig. 2.10 Introduction to Cryptography: vignette based upon (O'Shea 2005:7)

Didn't take too long to work it out, did it? Did you work out the rule? Let's analyse this from an edutainment perspective using some of the issues outlined above from the literature review.

It is clearly a simple entertaining puzzle to draw students into the topic of cryptography on their first meeting with the lecturer. From a DPK viewpoint this was an introductory exercise to amuse and capture the interest of a cohort who were novices (student characteristics), there was a suggestion of a 'rule' underlying the encryption technique (epistemology) and an easy example that could be solved (it is a game using the learning psychology of the generation effect). It is not too difficult, so creates self-confidence, and embodies useful properties that novice cryptographers need to pick up on at an early stage and will probably remember from this scenario.

In terms of edutainment goals, it ticks all three of the operational goals of edutainment: attentive (improving attention span), affective (inducing positive feelings into the learning environment) and cognitive (scaffolding to help understanding of intellectual concepts). Attention is grabbed immediately - the preamble mentions deciphering which is always an attention grabber – as everyone likes the challenge of unscrambling a hidden message and finding out how it is done. Emotionally, the message is quickly understood giving a feeling of achievement and a sense of wonder about what exactly is going on here; curiosity is one of the most powerful of the emotions that motivate learners. The scaffolding element is that this exercise is a practical organised way of introducing important concepts behind ciphers such as transposition of letters (altering position), changing word lengths and so forth – very important in cipher and code making.

The rule for encryption used in the scenario? Did you work it out? In terms of surface and deep learning – the surface learner will see the rule that the letters may be scrambled but the brain can

identify the word if the first and last letters are in the right place (that was the rule applied – check it for yourself). But this is basic understanding – the deep learner, if coaxed a bit more, would hopefully identify that cryptanalysis is all about pattern-matching and that you don't need all the data in order to make a good guess.

Overall, this Literature Review chapter has provided some useful theoretical principles that could be applied in the building of an edutainment model. The next chapter, Methodology, shows how such a model was built and trialled in practice with a cohort of students. The following chapter, Data Collection and Analysis, shows the feedback from students and staff on how well the edutainment model enhanced learning and was accepted.

3. METHODOLOGY

3.1 What Is Methodology?

> 'Methodology refers to the way you design and do your research and test the validity of your findings' (McNiff 2014:77).

McNiff's statement may be true but Clough and Nutbrown (2010:preface) caution "…selecting which methods to use indicates a particular 'take' on the world and how it operates". 'Take' or perspective, world-view or *Weltanschauung*, whatever it may be called, was important in this thesis. The main question for this thesis was '*Is it possible to Define A Formal Model of Edutainment That Enhances Learning of Cyber Security Subjects by Higher Education students?* The word 'learning' in this question, as stated in 2.3.1.2 in phase III of the literature review, was deemed to mean that students internally constructed their own learning reality – the concept of Constructivism as described by Piaget and supported by Papert, Vygotsky and others. It was also posited in the literature review, in section 2.3.3, that the role of edutainment was as support for this constructivist approach using three areas of interest: Attentive, Affective and Cognitive. In practice these were improving students' attention spans (Attentive), maintaining a positive learning environment (Affective) and scaffolding support to learning (Cognitive). So the 'Take' herein, and which guides the methodology, is how to show from the literature, the case study analyses and the classroom experiment that learning through edutainment based upon constructivism is best served through the three approaches: attentive, affective and cognitive.

The research methodology was initially considered to be that of grounded-theory but this was dismissed as being inappropriate – see literature review phase 3. However, as a main part of the primary data research was active classroom-based experimentation with the prospect of changing teaching practice, the methodology veered toward what is termed 'action research' as described in Cohen et al (2005: 228) and Arar et al (2015:2). Cohen gives some characteristics of action research which include (amongst other things): makes for practical problem-solving, enhances the competencies of participants, is undertaken in situ, seeks to understand the process of change in social systems, frequently uses case study, is methodologically eclectic, contributes to a science of education, is collaborative and strives to render the research to be of practical use. These same characteristics appear to be endorsed by many other sources (Kemmis & McTaggart 1992; Hult & Lennung 1980: 241-50; Zuber-Skerritt 1996:85; Winter 1996: 13-14). All these characteristics appeared relevant to the research within this thesis especially as Arar et al (2015:5) described how

they themselves chose an action research methodology in their research investigating participation of students and staff in educational and administrative school processes and practices. Arar et al (2015:3) attempted to measure educational outcomes and students' perceptions using multiple case studies and with the use of a mixed methods approach using qualitative and quantitative data. Their investigation seemed so similar to the research undertaken hereto that action research seemed the most appropriate approach for this thesis as well. However, there was one particular problem: all the researchers mentioned above identified collaborative action as being an essential part of action research and this criterion could not be met as this thesis was undertaken by a lone researcher. But, despite the long list of 'collaborative' supporters given above there were some others who disagreed and proposed that action research could be 'individualistic' (Whitehead 1985:98; Stenhouse 1975; McNiff 2014:24). Stenhouse talked of the teacher-as-researcher whether as individual or otherwise and McNiff observed that "First-person action research is about individual researchers enquiring into their own practices …" all of which fitted well with how the author hereto saw himself. Therefore the question of whether action research was only and always collaborative or could be individualistic seemed to be unresolved in the literature and therefore permitted this thesis to align itself within the action research (individualistic) paradigm.

However, Clough & Nutbrown (2010:23) also made three further points of interest. The first was that research methodology should be *'constructed* 'for particular purposes (ibid:18); secondly, methodology should be '*justifiable'* and ultimately give credence to, or call into question, the findings; and thirdly, that methodology should be asking *'questions'* (ibid : preface). Important words here are 'constructed', which suggested the researcher needed to structure chosen methods into a coherent whole designed around the needs of the actual tasks in hand, a viewpoint also supported by Chadwick et al (2001)); 'justification', which suggested the researcher needed to show why such constructions were being used in a particular way and 'questions', which firmly grounded methodology in the realm of inquiry rather than the following of rules for their own sake.

Clough & Nutbrown (2010:27) also identified three types of questioning to be taken into account: personal questions (that the researcher must ask of their own stance and values), research questions (to form the major planks of the enquiry) and field questions (which help direct the collection of data to meet the research questions). All three types of questioning were undertaken during the execution of the methodology hereto with personal questions and field questions being addressed

as and when they arose during the investigation. However, right from the start, the two research sub-questions had been expressed as :

(i) What are the principles of successful edutainment? and
(ii) How can the effect of these principles to enhance learning be assessed?

With regard to the first sub-question, it was clear that there were two types of principles that might be integrated into a final model of edutainment: (i) theoretical principles i.e. those derived from the researched literature, and (ii) practical principles i.e those derived by the researcher himself from real-life case studies. Each of these needed to be collected and analysed differently and this, in itself, would guide the choice of methods. However, the theoretical principles would be used as a basis for analysis of the practical case studies and the principles from both theoretical and practical would be used to construct the draft edutainment model to be trialled in the classroom-based experiment. All findings could therefore be used as input into the final edutainment model.

With regard to the second sub-question, it was clear that several methods of assessing the edutainment model would be required in order to be sure of any enhancement of learning. Any model derived from a combination of the theoretical principles (from literature review) with the practical principles (from case studies) would need to be trialled in real student-based classroom setting. There would need to be a collection of as much indicative data as possible in order to increase the integrity of any findings and warrant firm conclusions. There would be three immediate stakeholder groups with an interest in the findings of any trial: the students, the lecturers and the university management. It would be necessary to prove that students enjoyed learning and that the learning improved, it would be necessary to show that lecturers' enjoyment and involvement with teaching improved and the university management would like to see improvement of student assessment statistics. A mixed-methods approach of measuring outcomes was therefore needed something supported by the action research case study of Arar et al (2015:3) which also collected both qualitative and quantitative data. For assessing the feedback from the student cohort after the classroom trials, official student surveys, and questionnaires and face-to-face interviews of students was decided upon. The official university assessment statistics on student performance were also to be used as well as feedback from the lecturer actually teaching the edutainment materials. This approach was 'justified' on the basis that it would pin down whether the edutainment approach trialled in the classroom, and based upon the findings from the literature review and the practical case studies, really did enhance learning or not.

But, from a pragmatic viewpoint, the very first acts of methodology were to address the ethical constraints on the thesis and to plan the actual operational stages within the thesis which would lead to successful completion. The first of these, the ethical considerations, was addressed by application to the researcher's own university research ethics committee (UREC). The researcher made it clear to the UREC that the research required a questionnaire and interviews to be completed by a cohort of students concerning a teaching approach (edutainment) delivered by the same researcher in the role of the students' lecturer. There was clearly a possible suggestion of undue influence or conflict of roles in that students may have felt obligated to cooperate or even have expected some reward for co-operation, both of which outcomes were undesirable. The recommendation of the UREC was that this situation should be seriously addressed. It was therefore decided that the researcher would only survey and interview students who had fully completed their programme of study and received their final marks – in other words, very recent alumni. In practical terms this proved to be only a slight inconvenience and probably improved the integrity of the students' replies.

The second act in methodology was to get 'constructed' a plan outlining the necessary steps of the research process and this plan appears in Figure 3.1. This was recommended by Rudestam & Newton (1992: 77) who said "Often the analysis in one phase will be conducted before the next phase begins …a table [should] be presented that describes each time point and the operations to be carried out within that time point". Such a stepped approach was further supported by Arar et al (2015:7) who identified four stages in their own work being i) data collection followed by (ii) analysis to obtain baseline data, followed up with (iii) development and implementation of change strategies and (iv) finalisation with a further data collection/analysis to reveal the impact of the said change strategies. Such a stepped approach also appeared highly desirable for this thesis as it would also require several instances of data collection, analysis and strategy implementation that flowed one into the other, a process of cycles of data collection and update consistent with the action research approach undertaken by Arar et al and as hinted at by McNiff (2014:73) who wrote "Action research stories often take the form of cycles of action reflection, where the learning from one cycle informs the next over time. These cycles are emergent and transformational".

A result of the above considerations is the Fig.3.1 construct which shows the six steps in the methodology created hereto. Rudestam & Newton (1992:77) directly supported a stepped structure to methodology by pointing out that there were five logistical considerations to any project: those for the project as a whole, those of the field excursions prior to going into the field, the logistics of field excursions whilst in the field, those of activities following field excursions and finalising

with the logistics of closure and termination; the steps shown in Fig 3.1 map well onto these five logistical considerations. Additionally, each of the six steps in Fig.3.1 was deemed to produce a research deliverable of some kind that could be quality-controlled, documented and fed forwards to the next step. The entire process was to be iterative eventually feeding back to selection of further case studies and so forth; however, for this thesis, only one iteration was practicable due to time constraints.

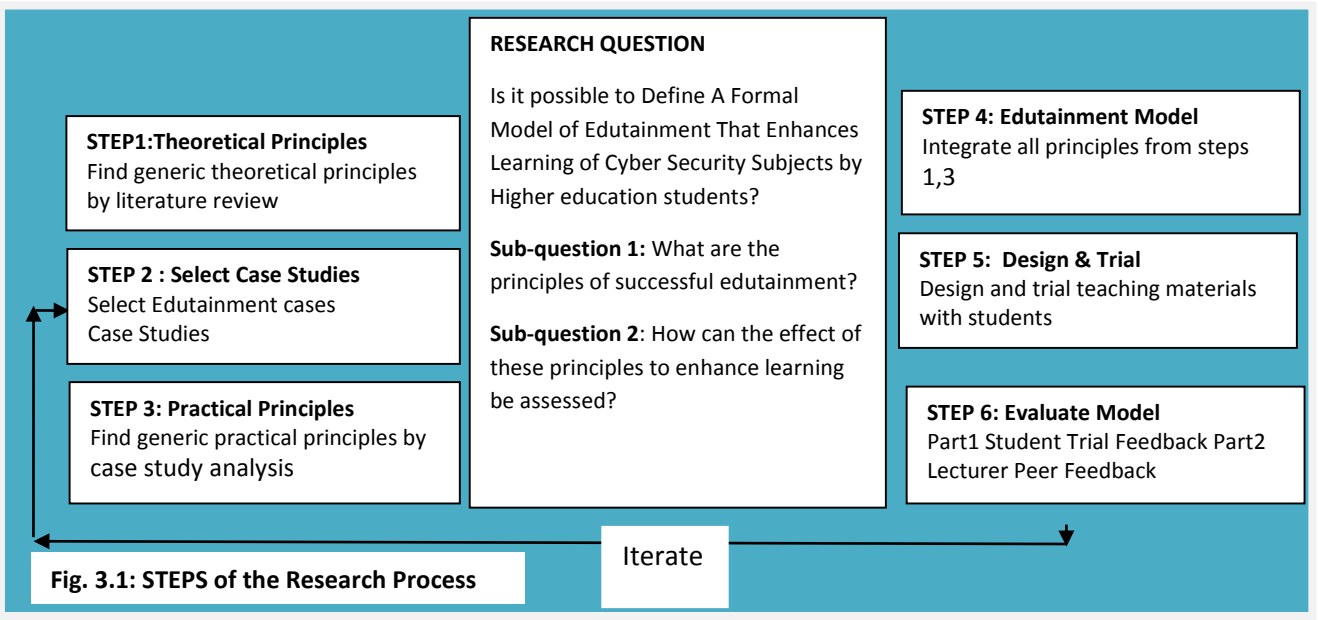


Fig. 3.1: STEPS of the Research Process

3.2 STEP1: Selection of Theoretical Principles for Model

This step was about gleaning from the literature sources a selection of sound principles for what edutainment should be composed of and what a learning model should be composed of.

The first area of interest was to determine what edutainment actually was in practice – were there any practical examples extant in the real world? To answer this an initial set of edutainment examples was required – this was needed to orient the researcher as to what edutainment in practical examples was actually composed of. An email was sent to colleagues of the researcher and they were simply asked for real-world examples of what they thought edutainment was. This was important as the people concerned were the researcher's peer group, they taught at the same higher education level and they taught the same subjects of cyber security as covered in this thesis

title. The result was a simple list of titles as shown in the literature review phase I. From these a simple application of cross-case synthesis and pattern matching as mentioned in (Yin 2014: 143,164) would identify the basic entertainment themes that appeared to be instrumental in forming robust edutainment examples. In addition, the whole of the literature review in phase I furnished important material on what entertainment was and, particularly in 2.1.7, the possible psychological principles that might enable synergy between entertainment and educational practices. The second area of interest was to find pertinent educational models, case studies, already proven in use that could help to structure a final model of edutainment.

The research deliverables for this step were a list of issues from the literature considered to be pertinent to forming a model of edutainment.

3.3 STEP 2: Selection of Case Studies for Analysis

3.3.1 Why Use Case Studies?

Although the entertainment themes (humour, narrative, characterisation, games, music) used in edutainment had been identified in the literature review phase I page 3, it was still necessary to ask the question - How do edutainment examples, already in existence, actually use entertainment in practice? This necessitated the selection of a few case studies (six) and their close analysis. The case study analysis approach was chosen as it would give indications of the 'how' of usage in the real world including how such usage processes had been designed, how artefacts templates were used, how problems might have been solved, how theory might have been created and how the model worked (or didn't) in various instances. According to the literature the case study was the most preferred approach for 'how' type questions of this sort (Yin 2014 : 11). Additionally, case studies could be used to explore generic processes in different contexts so the underlying themes could be more easily recognised and better theories thereby designed to explain such phenomena (Ragin & Becker 1995:10). Cohen et al (2000:181) also point out that cases also give a "unique example of real people in real situations" which was important to identify pertinent issues of edutainment that could be incorporated into specially designed teaching materials for trial in a class of cyber security students in higher education with the students subsequently being questioned on those teaching materials. This was also supported in the literature with 'a case study ahead of a survey can give direction to that survey not possible without the understanding built from the case study' (Punch 2009:123).

3.3.2 Criteria For Selecting Case Studies

It was deemed prudent to ensure that all the six case studies chosen for deep analysis were a genuine attempt at edutainment. It was deemed a waste of time to look at models that were not deliberately designed as 'a synergistic blend of education and entertainment that …can produce a deeper learning experience" as per the working definition derived in the Introduction Fig. 1.1. It was also deemed important to reject cases that were not successful or had not met the test of time and acceptability. It was therefore decided that a case study worthy of research herein had already to have a proven track-record defined by various criteria. These criteria were chosen as being:

1. Applicability: the case study had to have been designed intentionally as education and entertainment together with the sole purpose of embellishing or enhancing the educational aspect. This indicated the synergy aspect mentioned in the definition in Fig 1.1 Introduction.
2. Longevity: the case study had to have stood the test of acceptance over time i.e. it had to have been consistently and successfully in use for some years. This suggested the case contained some 'universal truths' that transcended passing generations so the edutainment case study was not just a time-bounded artefact that only worked under certain conditions.
3. Acceptability: the case study had to have been widely accepted as being a successful model of edutainment i.e. being accepted nationally, preferably internationally. This suggested that the case had to have some worth that was widely recognised.
4. Academically Critiqued: the case study had to have had some academic involvement in some way either as academic input into the example itself from the onset or to have been academically critiqued in papers written or published about it. This indicated worthiness of academic consideration for inclusion in this thesis.
5. Universality: case studies were to be chosen from a wide range of different contexts such as application media e.g. text, spoken word, video and different catchment groups e.g. children, adults. This was to give diversity to the multiple case studies – see later for justification for this from Yin (2014) and Vaughan (1995).

3.3.3 Why Multiple Case Studies?

Yin (2014:57) made the point that evidence from multiple case studies was often considered more compelling with the overall study being regarded as more robust as such studies have the benefit of replication (similar phenomena recorded in more than one place) so making conclusions more

defendable (Yin 2014:63). Of course, one might have thought that the case studies should be as homogeneous as possible so that commonalities could be easily identified but Vaughan (1995: 181) argues forcibly in favour of the heterogeneous approach with: "cases [should be] chosen to maximize differences in the contexts of similar phenomena, so that what is common appears more clearly and its relevance to different contexts, its generalizabilities [sic], can become clear". Vaughan, herself, did much work on deviancy from a sociological perspective and much of her well-known work was based upon three main case studies – involving the family, the police force, and the space shuttle Challenger disaster. At first sight, it seems inconceivable that these three domains could have anything at all in common !!! …But the common theme is 'deviancy' of some kind being breach of social values within the family, law enforcement protocols regarding the police and, with the space shuttle Challenger disaster, an example of deviancy in management. Similarly with this thesis, the use of very different case studies is to be defended on the grounds that it will more clearly highlight what edutainment is and how it is used. As Vaughan herself put it: "Cases are chosen because 1) they are potential examples of research topic X, 2) they vary in size and complexity … and 3) they vary in function ... We analyse cases sequentially. We treat each case independently of others, respecting its uniqueness so that the idiosyncratic details can maximize our theoretical insight" (Vaughan 1995:175). Vaughan's approach was further reinforced by Berthiaume (2009) who selected four very different lecturer case studies for his discourse on Teaching in the Disciplines and justified this with "they were selected for the differences associated with the disciplines they teach …[and] the fact that they were purposefully chosen for their difference increases the validity of the model .. that is derived from their experience". Vaughan's and Berthiuame's approaches therefore supported the use of the six very different case studies in this thesis precisely because they were so different.

For each of the six case studies, it was decided that there would be a minimum of three data sources for analysis with each source representing a different perspective; this would eliminate the possibility of only receiving one viewpoint, possibly biased, and of avoiding the charge of cherry-picking sources that supported only a particular viewpoint. Importantly, Yin (2014: 119) stated that there was evidence from the literature that "…case studies using multiple sources of evidence were rated more highly, in terms of their overall quality, than those that relied on only single sources of information". This deliberate attempt at choosing three very different sources of data for each case study was not a case of data triangulation as there was no seeking of common findings amongst the sources - although common replicated findings might have arisen and would be welcomed this was not the main purpose. This approach, used for finding out as much as possible

from varying perspectives so that a rounded extensive body of knowledge for each case study could be obtained, was termed by Yin (2014:120-121) as 'Non-Convergence of Multiple Sources of Evidence'.

Deliverables: six case studies suitable for further analysis with each case study supported by a minimum of three data sources.

3.4 STEP 3 : Analyse Step 2 Findings To Identify Principles

Arar et al (2015:10), in their analysis of multiple case studies, attempted to define the underlying principles that were common to all. In order to accomplish something similar hereto, it was clear that, as the case studies were all composed of three different sources each, then a coding approach was probably the most suitable. This then begged the question of what codes should be used – what information should be sought? At this point, the research returned to the original PPP model of Prosser and Trigwell (2001) which was originally used in the literature review phase 2 Fig 2.2 as a model of adult learning. This model was here requisitioned for use as a guide in the case study analysis as it contained a good timeline of a change process starting with the prerequisites (Presage), the timeline functionalities (Process) and a concept of a resultant artefact (Product) at the end. The original Prosser and Trigwell Adult Learning model was adapted for use herein – see Fig. 3.2.

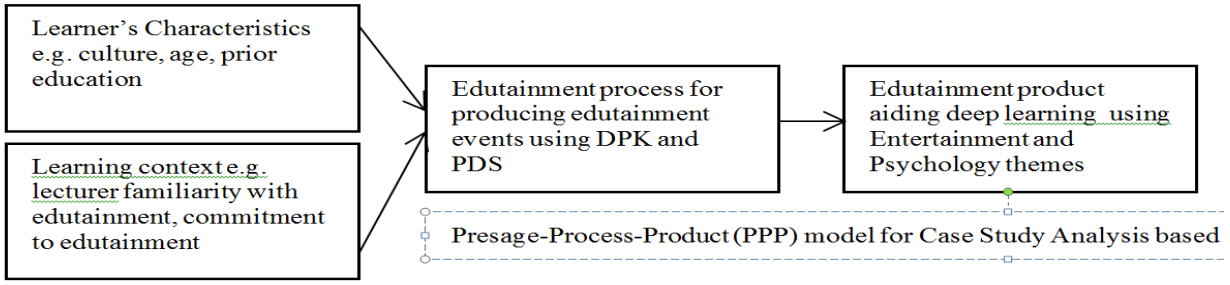


Fig 3.2 Presage-Process-Product Timeline for Case Study Analysis

The Presage stage of the original PPP model from Prosser and Trigwell (2001) showed two entities: Student Characteristics and the Learning Context. These also seemed useful headings for a Presage in case study analysis as well although Students was better replaced with Learner as most of the case studies were not designed for use in formal education settings. It was clear that

Learner characteristics had to be known before any edutainment design process was begun. The Learning Context was also a useful heading as it threw light on the background necessary to make the case study edutainment example successful. So Presage was the search for evidence in the case study that there was proper commitment and preparation for creating a model that would enhance learning – such a commitment was considered important within the literature generally (Yin 2014: 95).

The Process stage of the original PPP approach from Prosser and Trigwell (2001) was mainly about the goal of taking students from surface to deep learning. Similarly, it was considered that any model of edutainment must also have a Process of some kind which would guide users from the Presage stage and into how to create an edutainment event including how to design edutainment artefacts for classroom use. It seemed likely that the DPK (Discipline-specific pedagogic Knowledge) and PDS (Pedagogy as Design Science) approaches, identified in the literature review phase IV sections 2.4.1.1 and 2.4.1.2, would be useful here as they were both functional processes that caused change and led to the creation of teaching artefacts.

The Product stage of the original PPP approach from Prosser and Trigwell (2001) was the outcome of the Presage and Process stages and was meant to be a student exhibiting deep learning. However, in this adoption of PPP for producing edutainment for classroom use, the outcome was to be a product or artifact that would act as a template for the design of an edutainment event. The Product phase would therefore cover the design of teaching materials for lectures, tutorials and laboratory session using the themes of entertainment outlined in the literature review phase 1 section 2.1.

The above three PPP categories were considered to be a useful start for the case study analysis. However, because the sources of data for each case study were limited to three, it was acknowledged that it might not be possible to obtain data on everything from each case study. Some cases would be richer than others in some of the coding categories but it was expected that with six case studies overall there would be sufficient data in all categories to make some definite conclusions. "Coding is the ascription of a category label to a piece of data with the category label either decided in advance or in response to the data that have been collected" according to Cohen et al (2005:283) so that for each of the PPP headings a set of 'things to identify and look for' was drawn up based upon the findings of the literature review and so the codes were decided in advance and a list was created as shown in Table 3.1. It was accepted that new codes might have to be created "in response to the data that have been collected" Cohen et al (2005:283) as the case

analysis progressed and new things were uncovered that had not been identified in the literature review. However, Table 3.1 does give clear direction on what the analysis was looking for based upon important areas identified in the literature review or as Yin (2014:127) states "the principle is to allow …the derivation of any evidence from initial research questions to ultimate case study conclusions". Rudestam & Newton (1992:114) further refines the use of codes by stating that coding methods must be based upon inductive reasoning composed of the two functions Unitizing and Categorising; Unitizing was a simple process of identifying relevant information units in the text and Categorizing was the placing of such units into categories according to similarity in meaning. Apparently, this process was also similar to the 'constant comparative method' of grounded theory as per Vygotsky(1962), see 2.3.1.3, and although their grounded theory method was not being used in this thesis their similar use of a Unitising & Categorising approach was considered supportive of the use herein. Important to note here was that the codes were chosen to be the same for all the case studies however different the cases were from each other. This was based upon Yin (2014:120-121) who insisted that data triangulation, as he called it when data from different case studies was analysed using the same criteria, should be accomplished using similar codes in order to corroborate common findings. Yin called this corroborative process 'Convergence of Multiple Sources of Evidence' (in contrast to the Non-Convergence of Multiple Sources of Evidence as used in step2).

PPP	**Meaning in this context**	**Prefix- Code**
Presage	Attributes in place or required to be in place before production of edutainment can commence.	Pe
Process	Timeline functions required to produce edutainment artefacts	Ps
Product	The contents of an actual edutainment artefact (notes, tutorials ..	Pt
	Table 3.1: PPP prefix- codes for Case study analysis	

Deliverables from this stage were a set of six case studies analysed using various codes.

3.5 Step 4 : Create Edutainment Model

It was in this stage that a draft edutainment model was constructed using the principles derived from the literature review (Theoretical data from step1 above) and those derived from case study analyses (Practical data from step3 above).

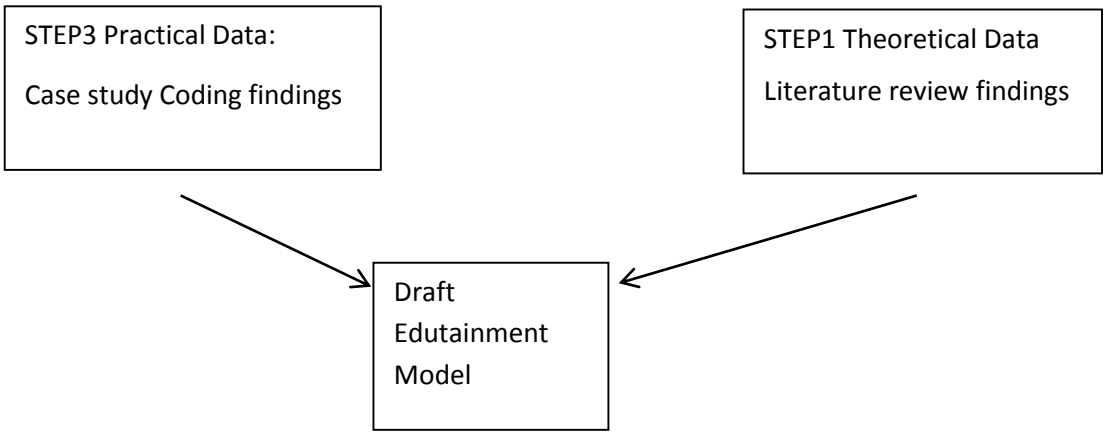


Figure 3.3 Methodological Triangulation Approach for the Edutainment Model

Steps 1 and 3 represented the two main areas where data for the proposed edutainment model were actually discovered or produced within this thesis; the deliverables and findings from these steps were therefore considered in the making of the model.

3.5.1 Methodological triangulation

The approach towards integrating the deliverables of theoretical (literature review) and practical data (case study analyses) was triangulation defined by Cohen et al (2005:112) as "the use of two or more methods of data collection in the study of some aspect of human behaviour". The precise method used here was that of Methodological Triangulation as recommended by Cohen et al (2005:113) and Yin (2014:120) as it was clear that the two data sources (Theoretical, Practical) had been collected by very different methods. Triangulation was here looking for (i) replications: matching findings for identical phenomena across the case studies (ii) anomalies: contrasting findings for identical phenomena across the case studies and (iii) omissions: mention of some seemingly useful phenomena in some cases but not mentioned at all in other cases.

Of course, each of these areas, including those where quantitative assessments were made, were open to subjective interpretation; this could not be helped. The overall research paradigm within

this thesis was not positivism – it was not based upon the notion that there were fixed laws within the universe that could be uncovered by data collection, hypothesis and replicable experimentation as stated in Cohen et al (2005: 13-19) – in fact, it was better explained by the total inverse statement: "the belief that human behaviour [was not] governed by universal laws and characterised by underlying regularities" (ibid). Consequently an element of interpretation by the researcher was to be expected. The researcher (who was also the lecturer, the interviewer and the data analyser) brought his own opinions, beliefs and perceptions into this stage. The question raised here was just how biased was this party – a partial answer to which is to be found in the researcher's own statement in appendix S?

In summary, the draft model needed to incorporate the deliverables and findings from each of the steps 1 and 3 outlined in this Methodology; the theoretical principles derived from the literature and the practical principles derived from the coded analysis of the case studies using the theoretical principles as a basis. These would then be integrated into a draft edutainment model for later trialling with students.

3.5.2 What is a Model?

Firstly, we need to ask 'why bother with a model at all? Why not just finalise with a list of good practice guidelines for the use of practitioners. However, this thesis author had decided from the onset to adopt the action research paradigm and as can be seen from Cohen et al (2005:228) and McNiff (2014:15) there are six basic methodological criteria for using the action research paradigm as outlined in the Methodology 3.1, of which the last was 'Change practice and thinking …'. Of course there are many ways to change practice and thinking but the creation of a simple model, especially if it is graphic and easily understandable to those working in the field, might be the most effective way. Graphic models have the advantage over reams of text in that they can usually be seen in their entirety in one or a few glances and can more clearly show the interaction of elements coming together and affecting each other which text, because of its sequential nature, often does not accomplish.

As Smith (1999) said "sometimes people get models and theories mixed up" and Cohen et al (2005:16) suggest that both can be seen as explanatory devices or schemes that have a broadly conceptual framework. However, Smith (1999) went further and implied that models do tend to

be characterised by the use of analogies or metaphors to give a more visual or graphic representation because their task is to simplify phenomena as an aid to explanation and conceptualisation; but sometimes this process of simplification gives rise to a second characteristic often associated with models – that they operate at a more general level.

However, in the building of any model, Knight et al (2000:44) point out there needs to be consideration of what constructs should be included in the model as clearly not everything investigated during research can be included – some topics must be more relevant than others and some not relevant at all. Writer and philosopher Edward De Bono even cautioned against complexity in educational models with his comment that teachers often complained to him "…give us something simple we shall not be impressed … because we shall claim to do it anyway. Give us something complicated we shall be impressed … but unable to use it because it is complicated" (De Bono 1976). Clearly any edutainment model had to be non-trivial but not too complex – a constraint borne in mind but not without difficulty. So, what to include and what to leave out? Jung & Latchem (2011:7), in their paper concerning the building of a model for e-education, stated that theoretical frameworks and models were central to the vitality and development of fields of practice and that sound theories (i) create conceptual order, (ii) provide simple ways of describing complex phenomena and (iii) illuminate areas where further theoretical and empirical inquiries are needed. These three areas were adopted as criteria for choosing what should be included in the final model and simply resolved into the need for an ordered approach with simple descriptors and including some feedback so that further research areas could be identified. The data collection and analysis, see next chapter, was therefore conducted with these three areas in mind.

3.6 STEP 5: Designing Teaching Materials

This was the most important stage of the thesis – designing the actual edutainment-based materials to be used with students and on which their feedback would be elicited. The obvious question which arose here was: why bother at all when you have already gathered theoretical findings and analysed case studies - why is hands on experience necessary as well? But McNiff (2014:62) answered this kind of question succinctly with "As an action researcher you actively engage in the action of understanding practice and generating theory from within. Unless you are willing to engage you will never change anything". At this stage it was necessary to have a clear idea of what edutainment in the classroom setting was to accomplish and how it was to accomplish it. The 'what to accomplish' was met by the definition of edutainment used throughout this thesis (and

originally devised in the Introduction chapter) which stated that the purpose of edutainment was to produce "a synergistic blend of education and entertainment that through the use of fun and play supporting creativity and curiosity can produce a deeper and lifelong learning experience". The 'how to accomplish' needed to meet the three operational goals of edutainment posited in the literature review chapter phase II which were: (i) affective: to encourage the creation of a positive emotional learning environment (ii) attentive: to improve the attention spans of learners and (iii) cognitive: to provide 'scaffolding' for the curriculum content learning itself to lessen the ZPD. The design of the edutainment based teaching materials clearly had to meet all or some of these defining criteria. Lastly, in terms of detailed design of edutainment events and materials for the classroom, there obviously had to be a 'synergistic blend' of both education and entertainment to meet the definitional requirement as above. This meant, at the very least, that the entertainment themes (Humour, Acting, Narrative, Games and Music) had to be used in close integration with the curriculum topic material (Cyber Security topics) using the psychologic effects (primacy, recency, frequency, Zeigarnick, Von Restorff, Generation and Eidetic) to create synergy. To accomplish this a structure of some kind was required to bring all these elements together (to create more synergy).

3.6.1 Structuring the Design process

The PPP model from Prosser and Trigwell (2001), which was adapted for case study analysis in step 3 above, was so successful in step3 that it was used again as guidance for the design of teaching materials for the classroom-based experimental stage. So the three headings of Presage, Process and Product were used for structuring the design and delivery of the four teaching material artefacts e.g. lecture-plans, lecture notes, tutorials and assessments.

In this design context, the headings for the Presage section of the PPP model also retained the two entities, Learner Characteristics and Learning Context. It was clear that Learner characteristics had to be known before the edutainment design process was begun as edutainment had to be a 'fit' with the student cohort, their level of academic ability, average age range and work experience so that possible causes of dissonance could be identified and accommodated - an important issue discussed in the literature review phase II page 33.

In this design context, the Process section of the PPP model for creating classroom materials revolved around how to design explicit scenarios for inclusion within the teaching materials and obtain feedback on how well things were meeting the needs of the learners. This section needed

a structured model of some kind to anchor and bring together the various elements that were to be required and to integrate them functionally in order to acquire the synergy specified in the initial definition of edutainment devised and shown in Fig. 1.1. As will be seen in the following chapter a Discipline-specific Pedagogic Knowledge (DPK) model was chosen for this structuring task. However, in the literature review phase IV, it had been noted that the existing DPK models had not given enough emphasis to the learner characteristics and this had been considered important. Hence, the learner was included as an entity within the DPK model brought forward from the literature review. This inclusion of the learner meant that no edutainment materials would be designed without first considering the age range of the learners, whether they were undergraduate or postgraduate students, the proportion of overseas students and the proportion of students already with work experience. This was done in order to obtain a good 'fit' with the student cohort to prevent exclusion, alienation, embarrassment or confusion to any members of that cohort. In fact, an example of what was to be avoided, especially in use of humour, was that in the Reith lecture joke recounted in the literature review page 15 and concerning Germans (actually, it was quite surprising the BBC permitted this to be said on radio 4!). The general DPK model used for design of materials was that of Fig. 3.4.

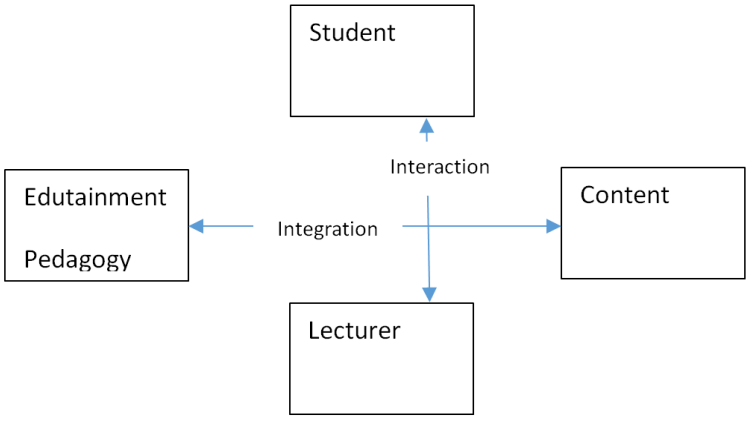


Fig 3.4 Process model for Classroom Teaching (Based on DPK model in Berthiaume 2009)

In this design stage, the Product stage of the PPP model was the actual teaching artefacts such as lecture plans, lecture notes, tutorials and assessments containing edutainment events. It was clear that the artefacts had to embody some of the entertainment themes and to employ some of the psychological effects that induced 'synergy' between entertainment and education. The

assessment, too, needed to be '…one that encourages conceptual understanding as opposed to rote-learning…through the increased use of problem-solving, case studies and the like ,where knowledge has to be used rather than just learnt' (Fry et al 2009: 35) .

3.7 STEP 6 : Evaluate Model: Student and Lecturer Peer Feedback

The overarching goal of the step 6 evaluation stage was to determine the efficacy and acceptability of the final edutainment model. There were two parts to this: part 1 was collection and analysis of feedback data from the student trial to determine if student education had been enhanced because of the use of the edutainment model and part 2 being collection and analysis of feedback data from other lecturers on what they thought of the edutainment model.

3.7.1 Part 1: Evaluating Student Trial Feedback

For phase 1 six sources of feedback data were chosen: five from the students and one from the lecturer involved in the teaching (also the researcher hereto). Table 3.2 shows these data sources which were: DS1: the official university statistics calculating the recorded average (mean) statistics for the full cohort for the two years 2012-13 non-edutainment control year, 2013-14 edutainment experiment year) ; DS2: the official university end-of-year survey of the students for years 2012-13 and 2013-14; DS3: a questionnaire designed by the researcher and offered to all of the full learning cohort, and DS4: personal interviews conducted by the researcher with a smaller group self-selected from the full cohort. These four sources DS1 – DS4 were sources all concerned with student feedback of some kind whereas the source DS5, was a record of the lecturer's own perspective of the entire teaching process and the last source DS6 was an attempt at measuring attendance of students at lectures over the two years. These six sources, taken together, were an attempt at getting to the heart of sub question 2 and answering how to measure whether enhancement of learning had occurred. The choice of so many data sources (six), see Table 3.2, was to cover as many different perceptions of the edutainment learning experience as possible. This was defended by Perry & Sherwood (2008:34) who stated that "the quality in learning provision was to be judged by the level of benefit experienced by each individual learner" a definition they said worked on "pragmatic, logical, ethical and technical levels" and which they claimed had four main benefits:

(i) unlikely to be rejected by teachers,

(ii) put the student 'customer' first which fitted well with adult learners,

(iii) was an approach which encouraged productive debate between teacher, learner, manager and any independent assessor and lastly

(iv) that 'benefit' could be accurately measured as the distance travelled between an initial assessment of knowledge and another conducted after learning.

All these four criteria were considered important in choosing the six data sources to be used in this thesis. DS1, DS2 and DS6 clearly met the criterion (iv) of the Perry and Sherwood requirement above, DS3 and DS4 met criterion (ii) and all sources DS1 through to DS6 , if well executed, were likely to meet criteria (i), and DS1, DS2, DS5 and DS6 to meet (iii). Table 3.2 summarises these criteria. Of course, the question of whether enhancement of learning had really occurred was resolved into using all data sources in answering two underlying questions: Did the students find the edutainment method to be a positive aid to their perceived learning of the subject matter? and 'Did the official assessment statistics show real improvements in the student performance?

Data Code	Data Source Name	2012-13	2013-14	Perry & Sherwood's Domains
DS1	Official Student Assessment Statistics	✓	✓	(i), (ii),(iii),(iv)
DS2	Official Student Annual Survey	✓	✓	(i), (iii), (iv)
DS3	Researcher Student Questionnaire		✓	(i), (ii)
DS4	Researcher Student Interviews		✓	(i), (ii)
DS5	Lecturer Personal Statement		✓	(i), (iii)
DS6	Student Attendance Statistics	✓	✓	(i), (iii), (iv)

Table 3.2 Part 1 Data Source Characteristics for Student Trial

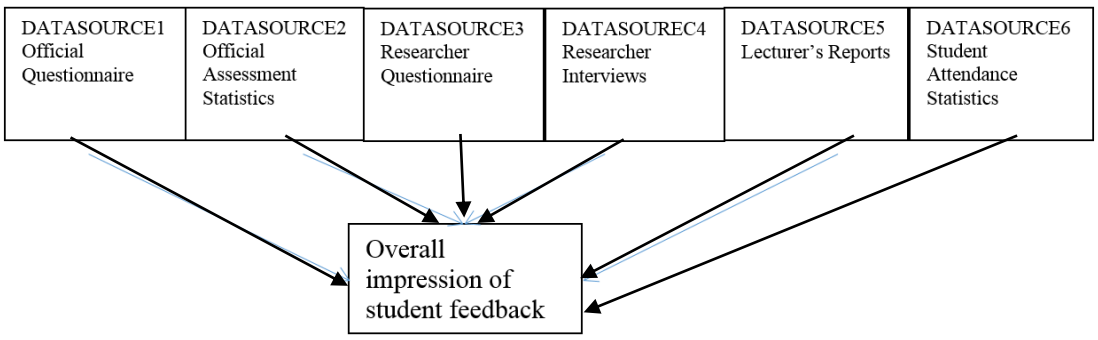


Fig 3.5 Part 1 : Six Data sources used for gauging Overall Impression of Student feedback

In the study of human behaviour, triangulation has often been used to indicate that two or more methods of data collection may be used in a study in order to check the results against each other (it doesn't necessarily limit itself to three methods despite the 'tri' prefix). The underlying notion behind this, according to Cohen et al (2005:112) was that one could be more confident with a result if different methods pointed to the same result. In this thesis, which was dealing entirely with human experience of and reaction to a particular phenomenon (edutainment), it was considered prudent to collect that data on human experience from different perspectives using both quantitative (normative evidence) as well as qualitative (interpretative evidence) data sets. This was not only to give confidence to any common findings from the data but to minimise the problem of 'method-boundedness' or results being mere artifacts of the method of collection as cautioned by Cohen et al (2005:113). Several types of triangulation technique were available to the researcher at this point: methodological, investigator, time, space and theoretical as listed by Cohen et al (2005:113) although a slightly different list was given by Yin (2014:120) regarding case study method (methodological, investigator, data and theoretical).

Two of the available triangulation types were chosen as a basis of analysis and comparison amongst these four data sources: data triangulation and time triangulation. Time Triangulation was chosen for the data sources DS1, DS2 and DS6 in comparing the two years 2012-13 (control year) and 2013-14 (experimental year) with each other; the two years contained comparable data from similar cohorts of students, assessed in the same way with no discernible changes in cohort composition or teaching schedule and assessment logistics. Basically the question here was 'Did the formal official assessment statistics show any improvement over the two years: the control year 2012-13 and the experimental year 2013-14?

Data triangulation was used with the three data sources DS2, DS3 and DS4 for the single year 2014 as they were all evidence of personal student feedback on the course itself and collected at the same time. The title 'data triangulation' was chosen in preference to 'methodological triangulation' as they were all data sources collected by the same broad method of questionnaire of some kind (even interviews had a list of questions to guide them), with the same data subjects (students) and were all basically attempting to ask the question 'What, as a student, did you feel about this edutainment-based course – did you like it or not?' They were therefore three different data sources but not collected by three appreciably different methods. The data source DS5 was treated as a separate entity as it was from the lecturer's perspective rather than the students'.

Hence, using six different data sources the two triangulation methods were used to assess the same single phenomenon of whether the course with its edutainment content was perceived to aid student learning and whether the official statistics showed that student performance was actually improved. The actual capture of the data was considered carefully taking into account the two criteria of fidelity and structure as suggested by Rudestam & Newton (1992:76) and it is believed that all six data sources were faithfully recorded and structured for simplicity of understanding. An important factor here was that using six data sources gave a wide spread of different perceptions and angles on the same phenomenon. The data sources came each from a different stakeholder being student, lecturer and university administration. Each of these had a different perspective: the student wanted to have an enjoyable time learning and to perform well, the lecturer wanted the students to enjoy the teaching and to perform well at minimal emotional cost to himself (and to possibly enhance his own standing as a lecturer and researcher) and the university wanted improved performance statistics with positive feedback from students. If each of these data sources in the classroom trial reported a positive outcome from the use of edutainment then each of these stakeholders would have been satisfied (or at least, not dissatisfied).

3.7.1.1 DS1 Official Student Assessment Statistics

The assessment statistics for the total cohort were the official university figures calculated from the students' individual grades for each coursework and examination. The figures used were purely statistical from which no individual student's results could be viewed or deduced.

The intention behind using these statistics was to determine whether any 'cognitive' effect, one of the three domains of operational effect posited in the literature review phase II 2.2.3, could be recorded; in other words was it possible to measure whether the students really had learned more because of edutainment? If this was a positive outcome then the university management, as stakeholders in any new teaching approach, should be satisfied. However, there was an unspoken assumption made that the recorded assessment marks were to be considered as true indications of the extent of deep learning – the higher the marks of a student the more their demonstration of deep learning, the lower the marks the more surface learning was demonstrated. It is axiomatic that these official figures on student performance must have real meaning as the course assessments are moderated for quality internally and externally, the marking of assessments are moderated internally and externally, the course execution is moderated at a board meeting (the Subject Assessment Panel). The official figures on student performance are used to grade the final

degree award so they must be accepted as meaning something real by all stakeholders – students, lecturers , university management and employers.

These statistics for the experimental year of 2013-14 were compared with a control year 2012-13 in accordance with the 'true' experimental design of pretest-posttest control group design mentioned in Cohen et al (2005:213). For this comparison of cohort assessment averages over two years, it was taken for granted that the cohorts from the two successive years consisted of students of similar ability. There was no indication that students from the edutainment trial cohort of year 2 were somehow more intelligent or gifted with higher entry qualifications than the non-edutainment comparison cohort of the year 1 previous year. The official statistical records show the mean (average) of cohort students' examination marks (worth 50% of total marks), the mean of cohort students' coursework marks (worth 50% of total marks), and the mean of cohort students' overall marks (coursework + examination).

3.7.1.2 DS2 Official Student Annual Survey

This was the end-of-year departmental questionnaire that all students were required to complete for each course undertaken by them; it was anonymous, not actually compulsory, but students were strongly encouraged to complete it. The intention behind using these statistics was to determine whether any 'affective' effect, one of the three domains of operational effect posited in the literature review phase II 2.2.3, could be determined; in other words was it possible to measure whether the students really had enjoyed the learning because of the edutainment approach? If this was a positive outcome then the university management, as stakeholders in any new teaching approach, should be satisfied. Although not the feedback required by the National Student Survey it was that data required to give students a 'voice' at departmental and course level rather than at university level (McKimm 2009). Results were used for assessment panels that gave feedback amongst staff on how well individual courses had faired. The rationale for such questionnaires was to guarantee 'quality' of the outputs of an educational course, the student learning experience

or the teaching provided. The Quality Assurance Agency (QAA), which assures such quality in UK higher education institutions, defines quality as 'how well the learning opportunities available to a student help them to achieve their award' (QAA 2007). As edutainment was considered one of these 'learning opportunities' it was deemed acceptable to use these official questionnaire findings as data on the efficacy of the use of edutainment.

3.7.1.3 DS3 Researcher Questionnaire

The intention behind using a broad questionnaire to all the students in the cohort was to determine whether any of the three domains of operational effect (attentive, affective, cognitive) posited in the literature review phase II, had been noticeable to the students.

The use of a questionnaire with closed questions was to obtain broad opinions on specific issues such as student perceptions of the entire course and its teaching and learning materials (lecture notes, tutorial notes). Closed questions with discrete answers enabled analysis of replies using the statistics package SPSS. The questions in the survey are shown in Appendix Q. The intention behind using such a questionnaire was to determine whether any of the operational effects of attentive, affective or cognitive, posited in the literature review phase II, were noticeable to the students; in other words to what extent could it be measured that the students had perceived receiving benefit from the edutainment approach?

In addition, in order to explore how edutainment in assessments (coursework specifications) had been received a further smaller questionnaire was given to a specific cohort of students studying the specialised cyber security topic of computer forensics. This cohort had been given an edutainment-based coursework specification and which was a good example of what could be done with edutainment even in the setting of assessment tasks. The specification for the coursework is shown in appendix U(a) and the questionnaire below it in appendix U(b).

3.7.1.4 DS4 Researcher Interviews

The intention behind using interviews was to determine whether any of the three domains of operational effect (attentive, affective, cognitive) posited in the literature review phase II, had been noticeable to the students. The use of free-form, open-ended and personal student feedback using interviews was considered crucial in that, according to Clough and Nutbrown (2010: chapter 4), it gave the students a '***voice***' something they thought was extremely important. 'Voice' included seeing verbal utterances from respondents within their context and within their use of language. Additionally, as mentioned in the literature review phase III 2.3.3, both Brookfield (2000:89-101) and Pritchard (2009:27) point out that adult learning is different from child learning in that adults have 'consciousness of learning' or 'metacognition' suggesting that adults become aware of the learning style to which they are subject. This is important in that it justifies the deep questioning of adult learners about teaching styles they experienced and the effect of the experience upon their learning (this may not be the case for children who may not even be aware that they are learning

even when they are). Cohen et al (2005:269) mentioned that the personal interviewing of students was fraught with the charge of interpretation bias and this was a particular concern here as the interviewing researcher was the same person who had taught the students in the first place and had the most to gain from positive replies. To obviate this, all students interviewed were chosen from those who had recently graduated from the programme altogether, in other words those who were no longer students as such but were recently graduated alumni with nothing to gain and nothing to lose in terms of grades. Of course, there was still the possible charge that even ex-students might wish to please their previous lecturer and so interviewing with another lecturer was considered; this would have reduced any conscious or unconscious bias, but such a lecturer, not being the original teacher, may have missed various points of reference made by the respondents and the implied significance of them. It was decided therefore not to adopt an alternative lecturer approach.

The different methods of conducting interviews were identified as being by face-to-face, by telephone or by email. The very first interview was conducted face-to-face and proved problematic in execution. Although body language was easy to note the actual body language showed the interviewee to be somewhat uncomfortable answering questions about the interviewers teaching style and perhaps feeling under pressure to be overly positive even though they had been previously advised to be as candid as possible and there was no longer any professional connection between themselves and the interviewer (the interviewee now being an alumni). It was a case of the Hawthorne Effect (or Observer Effect) or perhaps Heisenberg's Uncertainty Principle. Although follow-up questions, supplemental to the main questions, were easy for the interviewer to present there was a feeling that the interviewee had not sufficient time to think through their answers. It was therefore decided to view the first interview as a pilot study (although keeping the material for subsequent analysis) and to treat the remaining four interviews using the medium of email. Although email removed the clues from body language and Cohen et al (2005:281) have cautioned against this saying "it is frequently the non-verbal information that gives more information than the verbal communication", it did permit the interviewees to think through their answers, craft their wordage and express their opinion far more openly, including less positive comments, than face-to-face; additionally, it removed the need for physical meetings over great distances. On balance, the email option was considered the better option and follow-up questions were still possible. The broad questions used for directing the interviews were as shown in appendix P.

3.7.1.5 DS5: Lecturer's Personal Statement

In addition, data was included from another research participant apart from the students – the lecturer. The intention behind such a statement from such a source was to determine how the practitioner viewed whether the three domains of operational effect (attentive, affective, cognitive) posited in the literature review phase II, had been noticeable; in other words was attention improved, did the students seem to enjoy the work, and did the students seem to pickup on new concepts quickly? If this was a positive outcome then the lecturing community, as stakeholders in any new teaching approach, should be satisfied. It was considered that the lecturer was entitled to a 'voice' about the success or otherwise of the class-based experiment and this was particularly important as "In action research people should speak for themselves … You [the researcher] are the main actor" according to McNiff (2014:74). The lecturer was certainly one of the actors and their viewpoint was significant as, although the students could give feedback on their experiences, good or bad, only the lecturer could mention things that were tried but which were unsuccessful and of which the students were possibly totally unaware. Such feedback, too, could be invaluable to other lecturers considering emulating the approach taken here in their own classes and universities. It was considered that this feedback data – see appendix S - was just as valuable as the student feedback data. However, for this thesis, the lecturer and the researcher were one and the same person and so, indeed, was the designer of the materials, all of whom, had different viewpoints from their different roles. The issue of identity became relevant. Identity needs to be carefully handled and McNiff (2014:92) makes the point that for a practitioner commenting on their own research there is not only the problem of which identity they speak from but which identity others give them. However, this thesis takes the view that there is little that can be done about this except to be aware of it and as Cohen et al (2005: 121) warned "the most practical way of achieving greater validity is to minimize the amount of [researcher] bias as much as possible". Cohen et al (2005) were concerned that there may be conscious or unconscious tendency on the part of the researcher to (i) fall back on his/her own attitudes, opinions & expectations, (ii) see research subjects in his/her own image, (iii) seek answers that support his/her preconceived notions or (iv) be a victim of his/her own misperceptions in analysing and interpreting the data. All of these four issues had to be considered when the lecturer (same person as the researcher and designer) was called upon to give his own responses to the above questions - to be found in his own report in appendix S. Suffice it to say, the data derived from the DS5 lecturer's report (appendix S) was not triangulated with the student data from DS1 to DS4 but remained as a stand-alone item.

3.7.1.6 DS6: Official Student Attendance Statistics

The intention behind using these statistics was to determine whether any 'attentive' effect, one of the three domains of operational effect posited in the literature review phase II, could be recorded; in other words was it possible to measure whether the students really had attended to the lecturer and the materials better because of edutainment? If this was a positive outcome, or, at least, not a negative outcome, then the university management, as stakeholders in any new teaching approach, should be satisfied. It was decided that measuring 'attention' was problematic – just how was attention to be measured? Eventually a rudimentary metric was decided upon – the extent to which attendance in the class might or might not have improved over the two trial years. The clear assumption here was that, if edutainment was really enjoyable to the students, then they were more likely to attend the classes. Clearly, this was a controversial idea and a metric with coarse granularity – the students were mainly overseas and so already required to maintain good attendance for UKBA (UK Border Agency) and their own embassies and fee-paying bodies so any improvement in attendance would be marginal, if at all, and attendance could even go down if a bad influenza epidemic struck in the trial year. But this was at least an empirical attempt to measure what was an otherwise elusive effect; no doubt other techniques such as eye-ball tracking (to see where people were looking) and MRI scanning (to see which parts of the brain were engaged) would have provided much better data but they were completely beyond the remit for this project.

3.7.2 Part 2 : Evaluating Lecturer Peer Feedback

This part, part 2 of the evaluation stage, was simply to obtain feedback from other lecturers, at the same university and beyond, on what they thought of the final edutainment model created hereto. At the time of initial thesis planning, the action research (individual) approach that was chosen only required improvement to the researcher's professional practice – it was not required that other professionals also benefit by it. Also, it was not known if such feedback could be obtained due to time and logistical constraints.

However, on the assumption that it was possible to obtain such feedback, two inputs were envisaged: firstly, it was intended that the final edutainment model would be passed to lecturer peers for themselves to 'trial' in some teaching context of their own choosing and secondly, that

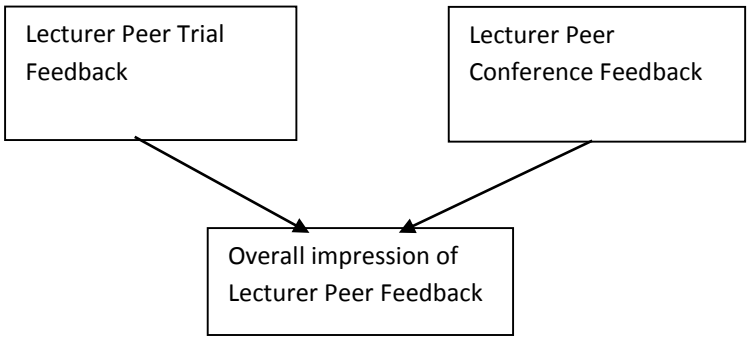


Fig. 3.6 Data sources used for gauging Lecturer Peer Feedback

several conference papers would be produced and, if the papers were accepted, the feedback of conference attendees would be collected. The rationale for the first input was to rule out the possibility of all student trial feedback data from part 1 of this stage being merely artefacts of the lecturer/researcher's own personality; in essence, if the model, or parts of the model, could be used successfully by other lecturers then it would add to both its acceptability and its credibility. The rationale for the second input was to establish to what extent the academic practitioner research community would accept the (possibly very novel) concept of a model of edutainment for use with adults in higher education. It was determined that a minimum of three papers would be produced for diverse conferences covering cyber security, cyber forensics and higher education teaching in general and the opinions of conference attendees would be recorded.

3.8 Overall Weightings Given to Data Sources

However, perhaps the ,most important area of interpretation of the findings was that of the weightings to be given to the six data sources used for gauging Student Trial Feedback shown in Fig. 3.5 , and the weightings to be given to the two data sources used for gauging Lecturer Peer Feedback shown in Fig.3.6 , in order to determine how effective was the final model in enhancing education. The Lecturer Peer Feedback was treated from the outset as being supplementary data rather than integral data to determine effectiveness and so was included purely as supportive data. This was because the research paradigm used herein, Action Research(Individual) required only that the model created should improve the individual practitioner's performance – it was not required that the model should be shown to improve performance of all practitioners. Clearly, however, if the model was highly acceptable to other practitioners as well then this would further support any conclusions that the research practitioner had improved their own performance.

However, the more difficult weighting decision necessitated the weighting amongst the six data sources for the Student Trial feedback, Fig. 3.5. The Methodology hereto decided that these six

sources were to be considered as having equal weighting with each other and that each data source was appraised in a discrete fashion – in other words, only a Yes or No answer was required as to whether the data source indicated a positive indication of educational enhancement or not as per the thesis question. On this basis enhancement success was to be determined with at least three sources of the six being positive. However, some provisos were considered advisable. Datasource DS2 Official Student Assessment Statistics was highly significant as the only empirical measure of the students' actual academic performance and whether their educational outcome had measurably been enhanced by edutainment or not. If this source had shown a drop in average assessment grades over the control and experimental years then the outcome of this thesis may have been more questionable; the DS2 source was therefore highly indicative of success oir not. . The other data sources DS1, DS3 and DS4, being based upon questionnaires and interviews concerning the student experience, were assessments of the students' perception of the education they had received; these are also highly relevant. Students' performance and perception were arguably highly significant inputs for assessing the true usefulness of edutainment. However, DS5 (Lecturers Statement) and DS6 (Student Attendance Statistics) were more in the nature of supportive data and so perhaps held a lower value than the other four data sources. Overall, of the six data sources from the Student trial Feedback, it was decided that a minimum of success would be indicated if a positive (or non-negative) result for DS2 plus positive (or non-negative) results for a minimum of two of DS1, DS3 and DS4. Data sources DS5 and DS6 were supportive data but could not, in any way, be considered indicative, or otherwise, of success of enhancement in any way. Only this minimum could be acceptable to be able to give an overall positive (or non-negative) view of whether enhancement had occurred or not; Anything not meeting these minimum criteria would have given a more questionable outcome.

4. DATA COLLECTION AND ANALYSIS

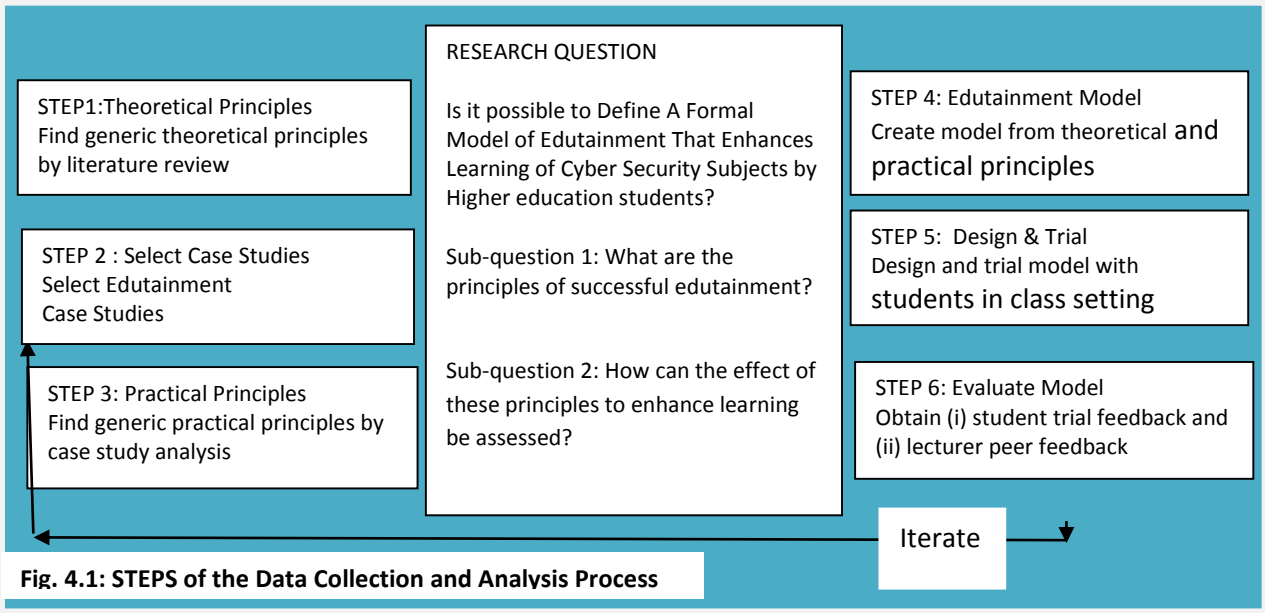


Fig. 4.1: STEPS of the Data Collection and Analysis Process

4.1 STEP 1 : Theoretical Findings

During the four phases of the literature review, data was collected on areas of theoretical interest that might have some bearing on a practical model of edutainment; but not everything uncovered in the literature review was considered to be relevant. The Methodology chapter has already pointed out that three inclusion criteria were adopted from Jung and Latchem (2011:7). Their paper concerning the building of a model for e-education, stated that theoretical frameworks and models were central to the vitality and development of fields of practice and that sound theories (models are a graphic form of the principles of a theory) (i) create conceptual order, (ii) provide simple ways of describing complex phenomena and (iii) illuminate areas where further theoretical and empirical inquiries are needed. These three criteria were taken as the framework for choosing which concepts from the literature might be included in a possible edutainment model; they suggested that there had to be order and structure within the model so that it may be readily understood and followed, sufficient detail to explain the complex phenomena behind combining education and entertainment and indications where users of the model may themselves undertake further research. The literature review had covered many topics of which some were considered to be useful in the construction of a model whilst others could be discarded. To this end five distinct concepts were chosen from the literature for possible usage in the forthcoming case study analysis

and the classroom based experiment. The need for order and structure (principle (i) above) was to be met by use of the PPP (Presage-Process-Product) timeline model as well as the DPK (Domain-specific Pedagogic Knowledge) model. The need to simply explain the complex phenomena of edutainment (principle (ii) above) in the Higher Education context is met by the inclusion of the five Entertainment themes with their Psychology effects and the concept of Andragogy. Lastly, the need to illuminate further areas for research was covered by the concept of feedback from the PDS (Pedagogy as Design Science) literature. These six areas, see table 4.1, are discussed further below.

Topics	**Mapping to Model Criteria**
PPP	(i) create conceptual order
DPK	
Entertainment themes plus Psychology effects	(ii) provide simple ways of describing complex phenomena
Andragogy	
Feedback	(iii) illuminate areas where further theoretical/empirical inquiries needed.
Table. 4.1	**Mapping of Topics from Lit Review using Model Criteria of Jung and Latchem**

4.1.1 The 5 Entertainment Themes

These were first noted in the literature review phaseI 2.1 where Entertainment was defined by Oxforddictionaries (2014) as "the action of providing or being provided with amusement or enjoyment". Wright (2007:6), in his exploration of comedy, further expanded upon this suggesting that 'amusement' and 'enjoyment' would cover, at the very least: humour, story-telling, acting, games and music – practices which pleasurably engross the attention. Although other themes might be included it was this list of five items that this research concerned itself with. Associated with the entertainment themes, and closely integrated with them as means by which synergy may be obtained with the education content (see literature review phaseI 2.1.7) were the psychological effects: primacy, recency, frequency, timing/duration, Von Restorff, Zeigarnick, Eidetic, Cognitive Load and Generation.

4.1.2 PPP (Presage-Process-Product) model

This was derived from Literature Review phase II and refined in Methodology – see Figure 4.2.

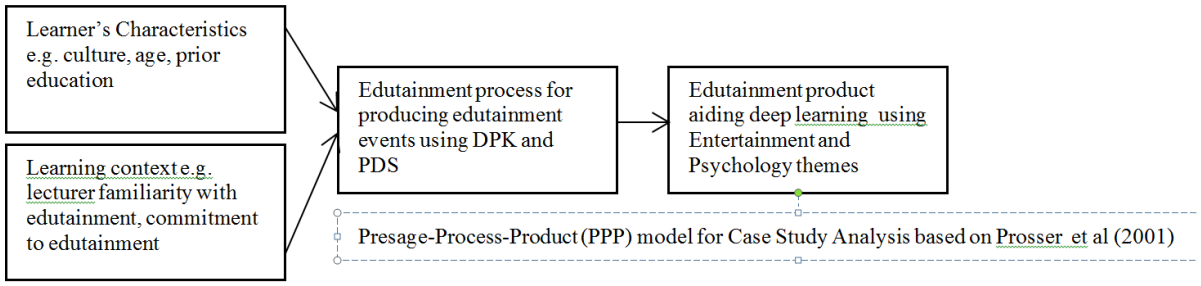


Fig 4.2 Presage-Process-Product Timeline for Case Study Analysis

This model was considered most pertinent in this research as it not only explained why a novel approach to teaching was required to alleviate the dissonance between Student Characteristics and the Learning Context and therefore gave a rationale to this entire thesis, but was itself a useful timeline process model that could be used a s a basis for the final edutainment model, the main deliverable of this thesis. The PPP model encompasses starting characteristics (Presage) , milestones and functions (Processes) and goal outcomes (Product) – all features which a final edutainment model would possibly require. It was therefore decided to include PPP as a framework upon which to build.

4.1.3 DPK (Discipline-specific Pedagogical Knowledge)

DPK, uncovered in literature review phase4 2.4.1.1, was considered important as a possible means of giving flexibility to the model to accommodate the teaching of any subject to any student cohort. It was considered essential to address DPK as a component of edutainment as it would meet the requirement for 'synergy' in the adopted definition of edutainment derived in the Introduction.

4.1.4 Feedback

The notion of teaching feedback was explored in the literature review phase4 2.4.1.2 under the PDS (Pedagogy as Design Science) research of Laurillard (2012). It encompassed the usefulness of feedback to the lecturer/teacher on how well the teaching was progressing, and also acted to encourage ongoing adjustments to be made to the edutainment throughout a given course. Overall, it would encourage teachers/lecturers to become involved in in their own practitioner-based research so encouraging a body of knowledge for all practitioners. This is further reinforced by Cohen et al (2005:230) who suggested that "teachers are more likely to change their behaviours and attitudes if they have been involved in the research that demonstrates not only the need for such change but that it can be done". Feedback was deemed necessary to empower and interest teaching staff without whom the final edutainment model, whatever it included, would simply not

work. This notion of ‘practitioner research’ is essential as despite much rhetoric concerning the importance of academic guidance for educational practice, there is still a gap between research conducted in higher education institutes and the daily practice of principles and teachers (Arar et al 2015:2; Chadwick 2002: 5-7). An excellent example of this was the work of Professor Margaret Ross MBE of Southampton Solent University; for many years Margaret ran the INSPIRE series of conferences on the teaching of software quality – (Chadwick et al 1999, 2000). The INSPIRE conferences concentrated on bringing together HE practitioners to exchange research ideas and the practicalities of teaching delivery with regards to the specific area of teaching software quality. This was done in association with the BCS (British Computer Society) thereby addressing the need for teaching-practitioner research to be at the heart of the appropriate professional body. In a further example, the HEA (Higher Education Academy) attempted to bridge this gap by presenting forums and conferences in specific academic subject areas where academics could meet and present papers on teaching methods. For example, the HEA had formed a particular subject area of STEM (Science, Technology, Engineering, Mathematics) within which were smaller included groups where academics were annually encouraged to present papers at conferences and workshops. Some academics personally took on the role of conducting these conferences and workshops in order to bring together practitioners also researching the area of teaching. An example here was the work of Professor Alastair Irons, of the University of Sunderland, who began a series of annual workshops on the teaching of computer forensics. Alastair brought together HE teaching practitioners to contribute to this new and barely understood area, to demonstrate their tried-and-tested practices, novel ideas and concepts and to exchange everyday teaching practices – (see (Chadwick et al 2015a, 2010; Chadwick & Gan 2011b). Both Alastair and Margaret were innovators as they realised that it was the classroom practitioners who could lead the way in new teaching methods and that the professional educational researchers (who perhaps did very little teaching themselves) were not the only source of teaching innovation. Consequently, practical feedback from practitioner to practitioner (interpersonal feedback) and from practitioner to him/herself (intrapersonal) were considered significant factors for inclusion as an integral part of this model.

4.1.5 Andragogy

The student cohort to be experimented upon in the classroom based trials (step5) were to be postgraduate with an age range 25 – 35 years many of whom had been in prior work or were still working part-time. They were therefore somewhat different from the usual HE cohorts of 18 – 22

year olds, straight from school, with limited prior subject knowledge and with limited or non-existent work experience. Consequently, the pioneering work of Michael Knowles on andragogy, and discussed at length in the literature review phaseII 2.1.6, was chosen for consideration as a possible feature of any final model. Knowles (1980: 43) had said that adults learned best when they: 1) moved from dependency to self-directedness; 2) drew upon their reservoir of experience; 3) were ready to learn when they assumed new roles; and 4) wanted to solve problems and apply new knowledge immediately, and these four features needed to be taken into account.

4.2 STEP 2: Select Case Studies For Analysis

The literature review (phase I) also produced a list of ten examples of real-world applications of edutainment, gathered from lecturing staff at the researcher's university and which cou ld potentially be short-listed to a fewer number of case studies for fuller analysis. These were:

The Royal Institution Christmas lectures by the British television broadcaster BBC
The 'Horrible Science' series of books by Nick Arnold and Tony De Saulles.
Typical English pub quizzes by typical English pub landlords
The Teletubbies children's programme by British television broadcaster ITV
The 'Hitch-hikers Guide to the Galaxy' book by author Douglas Adams
'Alice's Adventures in Wonderland', a book by author Lewis Carroll
The Sesame Street TV series by the Children's Television Workshop in the USA
The Archer's radio programme by the British radio broadcaster BBC
Soul City website an initiative of South African HIV/AIDS health awareness programme
Johnny Ball's 'Mathematical Puzzles'

4.2.1 Criteria for Selecting Case Studies

From the above list, a small number of case studies were selected for further analysis with six being the maximum that could be dealt with in the time-frame available. The ten edutainment examples listed were analysed using the following criteria: applicability, longevity, acceptability, academically-critiqued and universality. These criteria were chosen to select examples that had an element of recognition and robustness about them. Table 4.2 gives the analysis of all ten examples using these criteria. From this table four of the examples were immediately excluded as case studies for further analysis; they were: TeleTubbies because the educational element was so minimal and the example so discredited in the media that it was considered unsuitable for further

	SELECTION CRITERIA				
	Applicability	**Longevity**	**Acceptability**	**AcademicCritique**	**Universality**
Alice books	Designed by Lewis Carrol (Charles Dodgson) as edutainment for teaching logic.	150 years since 1865 publication of Alice .	Published globally in many languages Age range 10-adult	Hundreds of papers written world-wide by researchers for literary agents, universities etc	Books: scenarios for children + young adults; logic, numeracy and plays on word meanings. Child and fictious characters.
Sesame Street	Designed as edutainment from onset.	45 years since inception in 1960's	In 20 languages. Broadcast in 25 countries. Age-range 2-5.	Estimated over 1000 research papers in universities around the world.	TV: skits on literacy, numeracy, social skills for pre-schoolers. Human + puppet performers.
Archer's	Adult Edutainment as method of educating farmers into new farming techniques.	60 years since early 1950's.	Broadcast into 10 English-speaking countries. Age-range adult.	Several research papers written.	Radio: factual farming information for adults.
Royal Inst' Xmas Lectures	Annual science populariser with leading academic since first with Michael Faraday.	180 years.Xmas lectures since 1825 (not WWII),	Distributed to 20 countries. Age-range 10+.	No research papers written but programme based upon academic research itself.	TV: On TV since 1966. Scientific narrative on particular theme with numerous vignettes.
Horrible Science	Designed as edutainment	13 years	Distributed in UK. Age range 10-15	No research papers but authors have won many awards for their style.	Book series: science themes written with in 'nasty' way.
Soul City	Designed as health edutainment to teach low-literacy groups in S.Africa	20 years	Only broadcast on S. Africa TV. Age range teens to young adult.	Research papers written but mainly S African universities	Radio and TV plays to give social messages on health issues eg. HIV, STD
HitchHiker Guide to Galaxy	Entertainment , no educational purpose	20 years	Age range 15 +	Not much academic research on this.	Broadcast on radio, TV and on film.
Tele Tubbies	Entertainment small educational interest	15 years	1-3 years	Very negative media reports on this.	Broadcast on TV, books.
Johnny Balls' Maths Puzzles	Educational but entertainment factor is minimal.		15+	Not academically critiqued at all.	Book although based loosely on Johnny Ball's TV programme.
English Pub Quizzes	Entertainment only, no real education	Probably decades	Age range 18+	None found.	English pubs only but quiz variants are everywhere TV, Radio, Books.

Table 4.2 STEP 2 :Case Study Criteria-based Selection

use, while the other three, HitchHiker, Pub Quizzes and Johnny Ball's Maths Puzzles, were all unclear as to whether they were originally designed with an educational purpose in mind or were meant as just pure entertainment. The remaining six examples appeared as good case study candidates with one particular exception being Soul City. Soul City was deliberately included not only for what it was but also for what it wasn't. Being based in South Africa it wasn't in a western, industrialised country with good education provision; it was included because it was in a non-developed country using edutainment for adult education on health matters directed at a population characterised by low literacy. Although statistics on this kind of edutainment usage were hard to come by (in the UK) there were good reasons for taking the view that applications such as this were probably more wide-spread throughout the world, and much more under-researched, than those used in developed countries. For this reason Soul City could not be omitted from the final list of case studies; as Vaughan (1995: 181) argued in the Methodology chapter: "cases [should be] chosen to maximize differences in the contexts of similar phenomena, so that what is common appears more clearly and its relevance to different contexts, its generalizabilities, can become clear" and this was the view that was taken in this thesis.

The six selected case studies covered different media such as books, TV and radio; all age ranges from 2years to adult; different inception periods from mid-19th century to early 21st century; different functions from teaching farming to teaching about health issues to teaching science, maths/logic and basic literacy; and exhibited survival times from initial inception of 10 years up to 150 years. The selection was therefore as heterogeneous as it was possible to obtain.

4.2.2 Data Sources For Each Case Study

For each of the six selected case studies a minimum of three sources were chosen for analysis (although with Soul City this had to be limited to two sources). Three sources were chosen to give a balanced selection of viewpoints (Bell 2002:111). The explanations for why each of the sources for each of the six case studies was chosen was explored in the literature review phase 1 with more detail given in the corresponding appendices C to H.

CASE	MAIN SOURCES
Alice Appendix C	Carroll (2001), Wilson (2009), Gardner (2001), Bayley (2010)
Sesame Street Appendix F	Fisch & Truglio (2001), Morrow 2006), Davis (2009), Gladwell (2001)
Archers Appendix H	Whitburn (1997), Smethurst (2000), Dillon (2011)
Horrible Science Appendix D	Arnold and De Saulles (2009a), Arnold and De Saulles (2009b), Horrible Science (2014), Deary (1997), Ganeri (2008)
Soul City Appendix G	Soul City (2014), Singhal et al (2002)
Roy Inst Xmas Lecs Appendix E	RICL (2012), RICL (2013), RICL(2014)
Table 4.3 STEP 2 : Data Sources for the Six Case Studies analysed in Appendices C-H	

4.3 STEP 3 : Case Study Analyses using Presage-Process-Product (PPP)

4.3.1 Case Study Coding using PPP

The above six case studies, each with their three data sources, were analysed using a coding approach. The goals of this coding analysis were to explore whether the principles, identified as being useful for a model of edutainment in theoretical findings of step 1 above, were actually identifiable within the six case studies and were common to them or, as Vaughan (1995: 181) had stated "what is common appears more clearly … generalizabilities, can become clear". It was also an opportunity to identify how these principles, if they existed, were used in practice in different situations or as Vaughan put it "relevance to different contexts … can become clear".

As the data sources for the six case studies were very diverse in author, style and function a robust analytical structure was required to identify commonalities ('generalizabilities') amongst the case studies. Without some kind of a structured approach to analysis and some notion of what to look for true analysis and comparison of the different case study material could not have been made. To accomplish this a system of codes was used as a basis for case study analysis and these were based upon the three stages of the PPP approach (shown in Table 3.1 in Methodology) – the code

prefixes were Pe for Presage, Ps for Process and Pt for Product. Each of these prefix codes was then further sub-divided with the use of appropriate suffices into the principles under investigation. The full list of analysis codes is shown below in Table 4.4. During this analytical process the codes were used to identify and record the relevant themes within the text. The application of these codes to each of the six selected case studies and their data sources can be found in the appendices C through to H.

	Meaning in this context	**Prefix- Code**
Presage	Learning Context and Learner Characteristics	Pe-Co, Pe-Ch
Process	DPK Andragogy Feedback	Ps-DPK Ps-A Ps-F
Product	Edutainment: Humour, Narrative, Games, Characterisation, Music	Pt-H,Pt-N,Pt-G,Pt-C,Pt-M
Table 4.4	**STEP 3 : Codes used for Case study analysis**	

4.3.2 ANALYSIS of Case Study Results using PPP

The actual analyses of each of the case studies using the codes above are to be found in appendices C through to H but Table 4.5 summarises the findings for each of the case study analyses. It appeared that the five themes actually existed within the case studies although data for each theme was not necessarily available to the researcher (although it may otherwise have existed).

PPP: The PPP theme was found to be very useful in understanding each of the case studies. After only a short while, it became very apparent that each case study had Presage content in terms of the learner characteristics (code Pe-Ch) and the learning context (code Pe-Co) and that both of these would be important in forming any model of edutainment for practical use. It was also evident that each case study had some Process data i.e. a set of principles by which the final edutainment product was created and in this analysis data was sought on evidence of DPK, Andragogy and Feedback being the three process functions identified in the literature review that would affect the creation of an edutainment product. Lastly, Product data described what types of entertainment were used in the case studies.

		Alice in Wonderland Appx. C	The Archers Appx.D	Roy. Inst Xmas Lecs Appx. E	Sesame Street Appx. F	Soul City Appx. G	Horrible Science Appx. F
PRESAGE	**Learner Characteristics** **Pe-Ch** **Learning Context** **Pe-Co**	Child, Adult, Mathematician Book	Public, Farmers Radio	Child, Teacher TV and Public Talk	Child, Parent TV	Adult TV	Child, Teacher Book
PROCESS	**DPK Ps-DPK** **Subject specific** **Feedback Ps-F** **Andragogy Ps-A**	Logic Numeracy No data available None	Farming Formative Feedback Significant	Science No data available Some	Multiple subjects Summative/ Formative Feedback None	AIDS Summative Feedback Significant	Science Topic No data available Some
PRODUCT	**Edutainment-type** **Pt-H,Pt-N,** **Pt-C,Pt-G,** **Pt-M**	H, N, C, G	N, C, No G Some H,M	G, N,H Some C	H,N,C, G,M	N,C,M Some H	H, N, C, G
	Table 4.5 STEP 3 : Results of Case Study Analyses from Appendices C – H: Evidence of Usage						

Of course, not all of this data was available for each case study as each case study was limited to three data sources for analysis (see step 2 above) and the process data was that least likely to be available in the public domain either because it was not considered important to record it at the time (as per Alice case study data sources which do not record much about how Carroll created his works) or because it was commercially sensitive (as per Horrible Science books).

DPK: For the DPK theme (code Ps-DPK) there was strong evidence in all case studies that the edutainment had been deliberately designed to be learning topic specific. Most cases showed signs of a blend of entertainment themes with the education and all had attained good synergy.

Feedback: For the Feedback theme (code Ps-F) not all the case studies exhibited feedback of any kind but those that did such as Sesame Street, Soul City and the Archer's gave useful detail. The best example was found in the Sesame Street case which had two types of feedback: formative and summative. Formative feedback was the feedback from child focus groups on how well skits proposed for a forthcoming programme might be received and how well skits used in past programmes had been received. This feedback was undertaken by the CTW (Children's Television Workshop) staff such as producers, writers and educational/psychology advisors. The summative feedback was that from studies undertaken of cohorts of children as they progressed through the formal educational system and measured how well they performed educationally relative to those cohorts that had not watched Sesame Street as children. This summative research was undertaken by agencies independent of CTW, mainly universities and government research agencies, to evaluate the effect of using pre-school television based education. This CTW model appeared very successful and the notion of formative and summative feedback seemed important for inclusion in the edutainment model hereto. The Archers also factored in audience feedback as part of their feedback process.

Andragogy: for the andragogy theme (code Ps-A) it was recognised from the start that only those case studies involved with adult or young adult education would contain such data and that others concerned with mainly young children, such as Alice and Sesame Street, would have little in this area. The Archer's , deliberately designed from the outset as education for professional farmers, showed the most andragogy-type evidence with work-related language, work- based scenarios and narratives based around farming issues suggested by the programme's farming consultants, the Ministry of Agriculture and the National Farmer's Union. Soul City, concerned with issues of HIV and STD, was based entirely around adult language and narratives. It was noted that even young-adult case studies, such as Horrible Science and the Royal Institution Lectures, introduced issues of becoming a professional scientist and narratives concerning professional scientists; as these were work-related they were considered under the andragogy banner.

Entertainment: the entertainment themes (codes Pt-H, Pt-N, Pt-G, Pt-Ch, Pt-M) all appeared to occur in the case studies but not necessarily all in the same case study. Overall the use of codes gave ample confirmation that edutainment events were indeed composed of the five entertainment elements of humour, characterisation, narrative, games and music although in the case studies analysed hereto music did not appear often. However, one very important factor did arise for, although it had been identified in the literature review phase 1 under Humour, the notion of timing and duration of edutainment events had been completely underestimated. Table 4.5 table shows

quite clearly that timing and duration were extremely important in edutainment delivery. Although this had been hinted at regarding Humour, it was not until the case study analysis was performed that the real importance of timing and duration became manifest.

CASE	TIMING-DURATION
Alice in W'land	One vignette every 1.5 pages
Sesame Street	No skit longer than 2 mins
Archers	Each broadcast: 60% entertainment, 30% information, 10% education
Horrible Science	2 books each 144 pages=288;Vignettes 137+152 =289: 1 vignette per page
Soul City	No data
Roy Inst Xmas Lec	17 skits in 55 mins: Frequency 3.2 mins per skit

Table 4.6 STEP 3 : Timings: Results of Case Study Analyses from Appendices C – H

4.4 STEP 4: CREATING THE EDUTAINMENT MODEL using Presage-Process-Product

This was the most important stage of the thesis – designing the actual edutainment model to be used in a class based experiment with a student cohort and from whom feedback would be elicited. The five elements identified in step 1 above and evaluated in the case study analyses of step 3, (PPP, DPK, Andragogy, Feedback, Entertainment) were to be put on trial in the practical setting of classroom teaching. Since the PPP model was an already tried and tested timeline process model (tried in case study analysis) its three stages of Presage, Process and Product were followed during the entire trialling period. Presage was those conditions that needed to be understood or in place before any design of materials was undertaken at all so for this stage the learning characteristics and learning context components were retained from the original Prosser and Trigwell (2001) model. Process represented those functions that needed to be undertaken or put in place for the act of creating the final product, the edutainment events themselves that were delivered to the students. These functions were identified as being DPK, Andragogy, Feedback and Entertainment themes. For the product stage, the final deliverable would be the actual classroom materials for teaching. Figure 4.3 gives graphic overview of the PPP approach used in design of the class-based materials.

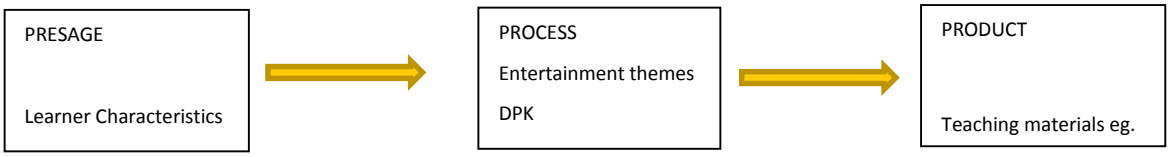


Fig. 4.3 STEP 4 : Experimental Trial - Stages of Classroom Experiment

4.4.1 PROCESS of Model Creation

The process stage of creating the edutainment materials was to encompass those functions necessary to produce the edutainment materials. As shown in Fig.4.3 DPK, Andragogy and Feedback and the Entertainment themes were identified as process inputs and accepted as such into the process stage. The DPK function was seen as the most central component of the edutainment creation process itself as it integrated all components of the production process and any materials to be used in the classroom experiment and was based upon the model of DPK described in Berthiaume (2009) and discussed in detail the literature review phase IV with some amendments. This model was considered especially important for achieving a 'synergistic blend of education and entertainment' as per the guiding definition of edutainment from the Introduction chapter and used throughout this thesis e.g. *'Edutainment is a synergistic blend of education and entertainment that through the use of fun and play, supporting creativity and curiosity, can produce a deeper and lifelong learning experience'.* To achieve this 'synergistic blending' in the process stage the DPK model of Berthiaume was put at the heart of the process stage as it was a tried and tested model, already in use in many teaching situations, and with an excellent development provenance over many years from Shulman's original paper (Shulman 1986) on PCK (Pedagogic Content Knowledge). It would therefore act as a useful template for producing good edutainment materials with it's three highly relevant sections: Knowledge Base, Disciplinary Specificity and Lecturer's Epistemology. However, one further element was added to this DPK model: Student Characteristics. This thesis maintains that neither Shulman's simple model nor Berthiuame's more complex model adequately deals with students as a separate entity – both these models are lecturer-content-pedagogy oriented. This thesis maintains that the student is such an integral part of the edutainment approach that their concerns must be considered as a separate entity within the DPK model. The student and his/her attributes cannot be ignored - undergraduates would be taught differently from postgraduates who would be taught differently from mid-career police-officers investigating cyber-crime; mathematically- oriented students would be taught differently from those less gifted, those with a history of employment would be treated differently from those whose experience was purely academic. This inclusion of the student, or learner, as an element in the DPK model, was well supported by John Sweller's Cognitive Load Theory that said "Cognitive Load depends on the interaction of three components: the learning goal and its associated content, the learner's prior knowledge, and the instructional environment" (Clark et al 2010:5). Sweller recognised the importance of including the learner's prior knowledge as an integral part of the design of learning materials and went so far as to say

"since learning involves a gradual transition from novice to expert, ideal instruction should be dynamically adjusted to accommodate evolving expertise" (ibid:243) suggesting that teaching instruction needed to fit not only the student cohort expertise at the start of instruction but needed to change as the course of learning progressed. Therefore feedback on student progress from lecture to lecture seemed important. This implied that a model of DPK that failed to include the student as a separate entity had to be lacking in something. If education is considered the 'transfer of knowledge from teacher to student' as per Ausubel's expositiory model of teaching (Stapleton 2001:67), then there must be a transferee as well as a transferor; if education is considered 'a facilitation of learning', as per Bruner's discovery learning model outlined in Stapleton (2001:65) , then, in addition to the facilitator, there must a facilitatee. Therefore, it was appropriate, if a DPK representation based upon Berthiaume's model were to be used as a component of the final edutainment model, that it should include students (learners) more specifically – see Fig. 4.4. Knowledge Base For Teaching had to definitely include elements of entertainment. The Student component had to include andragogy firstly because the student cohort was postgraduate (so needed a work-based approach for more career-minded persons) and secondly, because the knowledge base for teaching had to include use of the five entertainment themes otherwise edutainment could not result. Disciplinary Specificity had to identify those curriculum content areas that were to be taught using edutainment methods; in this instance it was one of the cyber security topics namely cryptography, a highly logical subject well-grounded in the STEM arena. Lecturer's personal epistemology was somewhat problematic.

Lecturer's Epistemology was the most controversial of the items included in the DPK model. The Oxford Dictionaries (2015) online dictionary defines the word 'epistemology' as "The theory of knowledge, especially with regard to its methods, validity, and scope, and the distinction between justified belief and opinion" or, more simply put, epistemology is the study of how we know what we know. But, why include it at all in this model? After all, De Bono (1976) had reported that teachers had told him "Give us something complicated we shall be impressed … but unable to use it because it is complicated' so some caution had to be observed about including a concept that lecturer's might not have been acquainted with. An ad-hoc poll of this thesis author's fellow lecturers found that only one person in five knew the word 'epistemology' but all understood it's meaning when explained and all advised that they took account of epistemology in their own practice. In addition, according to Claxton (2010:30), who collected opinions from practising teachers asked to answer what things children should be taught in a 'Curriculum for [coping with] the Unknown', many teachers mentioned ' epistemology'; an astounding finding given that few

people know what the word means but think that children need to know what it means. However, if these teachers really did consider teaching epistemology was important for children then how much more important must it be to teach it to adults? It seemed therefore pertinent to make the concept more implicit in adult teaching and encourage reflection on practice. As McNiff (2014:29) put it "Epistemologies (how we think) influence practices (how we act), and practices influence the development of new cultures of practice". As it was a possible new culture of practice that this thesis was modelling it was considered necessary to include Lecturer's Epistemology in the model. But what epistemologies to include? It appeared that, in the teaching of cyber security, the lecturer had two epistemologies to address; that of the content to be taught and that of the teaching method. For teaching the content, cyber security, the lecturer needed to be aware of the Positivist (Scientific) research paradigm as this topics was very much a logic and mathematical based discipline. For the teaching method epistemology, the lecturer had already accepted the Constructivist view of Piaget and Vygotsky (discussed in literature review phase 3).

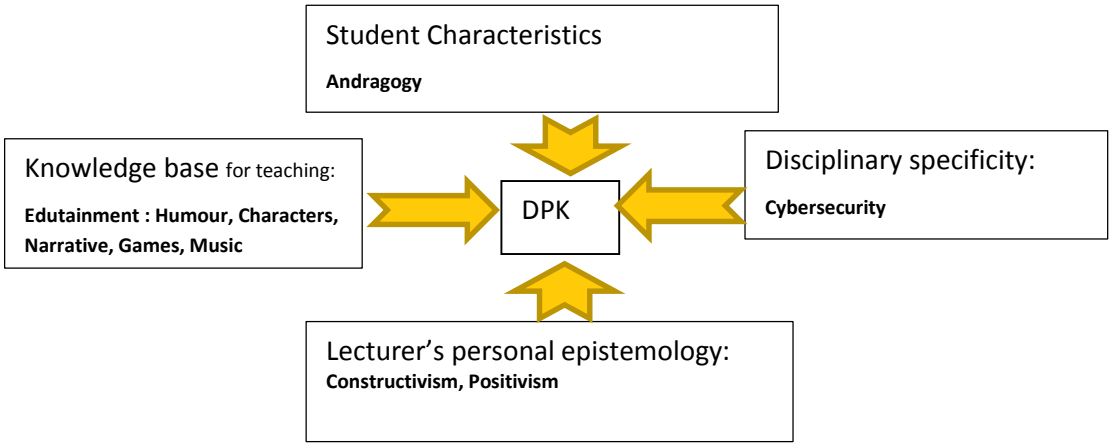


Fig 4.4 STEP 4 : Process stage – based on Berthiaume (2009) with Student Characteristics

4.4.2 PRODUCT of process of Model Creation

Fig. 4.3 shows the product stage of the experimental trial of the edutainment classroom materials which fall into three categories: lecture plans, lecture notes (for students) and tutorial notes (for students). As all these artefacts were the final products of the entire edutainment process, the Product stage had also to include some notion of feedback. Feedback had been identified in the literature review as possibly being a valuable component of a final model when Laurillard (2012) mentioned the importance of practitioner feedback and practitioner initiated research in teaching. Coupled with this was the finding from the case study analysis of Sesame Street where formative and summative research were found to be integral and invaluable to the CTW (Children's

Television Workshop) approach to producing the Sesame Street children's programmes. The formative and summative feedback concepts described in (Fisch and Truglio 2001:17, 41, 140; Morrow 2008:68,77) were used extensively; formative research was carried out rom programme to programme by the production team to prevent recurrence of mistakes, and to inform programme design with what worked and what didn't work; summative research was carried out by the academic community (the universities) to have the whole concept of pre-school TV-based learning independently assessed for effectiveness. Hence the concept of feedback as a component part of the edutainment model could not be ignored.

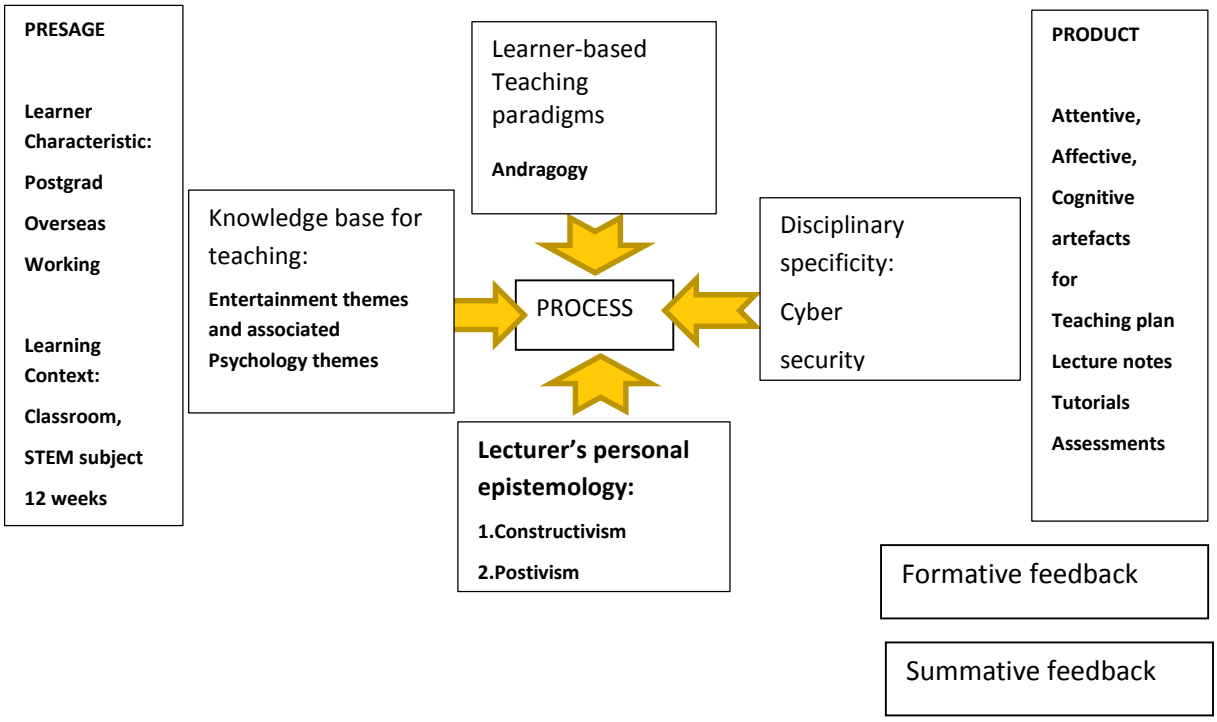


Fig 4.5 STEP 4 : Specific Edutainment Model covering cyber security for postgraduate students

4.5 STEP 5 Create Teaching Materials Using PRESAGE-PROCESS-PRODUCT

This was a complete run-through of the draft edutainment model shown in Fig.4.5 in a real teaching environment. Again the PPP (Presage-Process-Product) approach was used adapted from the original model by (Prosser and Trigwell 2001).

4.5.1 PRESAGE in the Class-Based Experiment Trial of the Draft Model

As per the draft model in Fig.4.5 this was to include the two components of learning characteristics and learning context. The Learner Characteristics analysis identified that the student cohort for 2013/14 consisted of postgraduate students, 54 in total, of whom 45 were from overseas (from university statistics). They all possessed a first degree in a Computing or IT subject, but not necessarily from the UK, and at least half the cohort had previous IT experience (many of the overseas students were seconded from their employers to attend). Again, for at least half the cohort, English was not their first language – although a competency IELTS level was a requirement. In addition, ages ranged from 22 to 42 years. So they were a very diverse cohort of mainly mature students and it was immediately acknowledged that the edutainment process and product would have to acknowledge certain basic requirements of ethical production and these were specified in Fig 4.7. The Learning Context analysis identified that the teaching curriculum was to be mainly cryptography, classroom based but with lab-based practical sessions and tutorials. There was to be a mix of theoretical and practical–based work aimed at equipping the learner cohort with practical skills for the workplace with an understanding of the principles behind the incorporated technologies.

4.5.2 PROCESS in the Class-Based Experiment Trial of the Draft Model

As per the draft model this was to include a DPK approach as in Fig.4.5 with its four components: Learner-Based Teaching Paradigms , Knowledge Base for Teaching, Disciplinary Specificity and Lecturer's Personal Epistemology. Each of these four components were used to fashion the products or learning artefacts of lecture notes, tutorial and lab notes, teaching plan and assessment specifications.

For this trial the Disciplinary Specificity encompassed a range of subjects from cryptography (data obfuscation) and also steganography (data hiding). These topics were integral to the teaching of cyber security. They were considered ideal for this trial as they were fundamental to work-based operations, students often had difficulty with them (often some just didn't get it at all!) and involved a range of academic and practical skills that were technical, logical and with some mathematics. They seemed well suited to a trial of edutainment as any improvements in learning would be quickly noticeable to the staff.

The Learner-Based Teaching Paradigm, Andragogy, was based upon the learner characteristics from the Presage stage (see above); they were all adult students so it was decided that andragogy was to be the preferred teaching paradigm. As much as possible narratives were chosen to be work-oriented or at least adult-oriented and to involve problem solving in accordance with Michael Knowles' work (Knowles 1980: 43). As often as not, the requirements and strictures of the professional bodies (BCS, ISACA, ISC^2) were highlighted.

The Knowledge base for teaching was, of course, the Edutainment approach involving application of a range of the five entertainment themes (humour, characterisation, narrative, games, music) as outlined in the literature review phase I. The psychological principles underpinning both entertainment and education (primacy, recency, frequency, Zeigarnick, Von Restorff, Cognitive Load, Generation and Eidetic) and which aided synergy between the two disciplines as discussed in the literature review phase I, were also taken into account.

Lecturer's Epistemology was the most controversial inclusion in the model and the most difficult to use in practice. In fact, so difficult, it was briefly considered something to ignore completely for there were clearly two epistemologies: firstly, the epistemology of the curriculum content being taught and secondly, the epistemology of the teacher's personal belief of what constitutes learning. These were identified as being positivism (the scientific method which applied to all technology constructs and understanding) and, in this case (with the researcher as lecturer), constructivism as the learning epistemology. However, both of these seemed essential in terms of what the lecturer needed to bring to the teaching and make a good job of it even if the students were not aware of them (which they probably were not).

Included also under Process is the feedback, both summative and formative.

4.5.3 PRODUCT in the Class-Based Experimental Trial of the Draft Model

The actual classroom trial involved the purposeful design, creation and use of more than twenty edutainment events each involved in creation of the most common educational artefacts: teaching plan, lecture and tutorial notes, and assessment specifications. All of these twenty edutainment events were deliberately designed, as far as possible, to incorporate the three posits from literature review phase II: attentive, affective and cognitive, so they were designed deliberately to capture the attention, create a positive emotional atmosphere in the learning environment and to provide scaffolding for the learning of cyber security topics using the basic principles of an andragogy

approach. To achieve this, as many as possible of the five entertainment themes (Humour, Narrative, Characterisation, Games and Music although music was beyond the researcher's ability to include) were included. The events, as far as possible, were designed to incorporate some of the learning psychology effects of primacy, recency, frequency, timing/duration, Zeigarnick, Von Restorff, Cognitive Load, Generation and Eidetic. It was envisaged that with all these factors in operation the students would immediately be well equipped to form their own memories and learning structures and achieve the desired goal of a deep learning experience.

It is not possible to discuss all twenty artefacts created in total but what follows is a description and discussion of a typical lecture showing: lecture-plan, lecture notes, tutorial handouts and assessment specifications.

4.5.3.1 Artefact 1 : Lecture-plan

Below is shown a typical lecture plan devised using the model created in the process stage above. It shows two short-narratives (scenarios 1 and 2) within the long narrative behind all five lectures the Joe-Sue on-off relationship.

	Event 1	**Factual Content**	**Event 2**	**Factual Content**	**Event 3**	**Factual Content**	**Event4**
Timing-Duration	5mins	25mins	10mins	25mins	10mins	25mins	5mins
Lecture phase	Scenario1: Poem as revision of last lecture material	Curriculum content	Scenario 2: Man-in-the-middle attack	Curriculum content	Scenario 2: Why is Sue angry?	Curriculum content	Scenario4: Night-time Call-out
Edutainment	Game, Humour		Game, Narrative Characterisation + Eidetic imagery		Game Narrative Characterisation		Narrative, Humour, Characterisation
	Table 4.7: STEP 5 : Typical Lecture Plan Showing Edutainment Scheduling						

The Lecture plan consisted of blocks of curriculum content (taught with normal teaching methods) interspersed with edutainment events incorporating entertainment themes occasionally based on andragogical principles. Timing of the edutainment events was considered most carefully based upon the maximum period which a student might be expected to pay attention without deliberate intervention. This maximum period was arrived at from the literature review phase II especially

the Yerkes-Dodson Law referenced in Stapleton (2001:103), the work of Wilson & Korn (2007) and the heuristics mentioned by Pritchard (2009:102). These, along with consideration of the data on timing derived from the case study scenarios – see Table 4.6 above, suggested a maximum of 25 minutes per block for a 100 min lecture (roughly a two hour scheduled lecture slot with in-built break time of 20 minutes prior to the following lecture) with each block being interspersed with formal edutainment events. The frequency of the edutainment events was therefore four in a typical lecture at 20-25 minute intervals. Shown in the lecture plan of Table 4.7 are four edutainment-based events: events 1 through to 4 dividing the formal teaching material on curriculum content. The first scenario was at the beginning of the lecture and was using the primacy psychological effect to make an impact and capture the attention from the very start. The second and third were to explore curriculum content taught in the lecture and as they were interspersions in the normal teaching they were examples of Von Restorff psychological effects. The last was to make use of the Zeigarnick effects auguring the learning content of the following week and aiming to leave the students with a whetted appetite for the following week. The four edutainment scenarios are explained in detail below.

4.5.3.2 Artefact 2: Lecture Notes

Edutainment Event 1: Revision from previous lecture

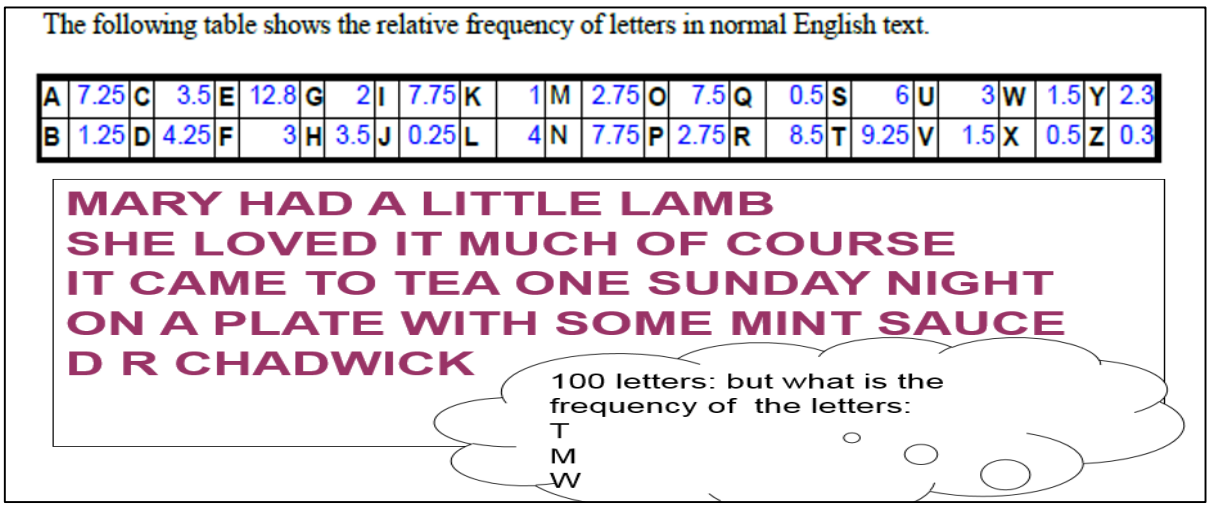


Fig. 4.6 STEP 5: Edutainment Event 1 re. letter frequencies in English

Fig. 4.6 is introducing a method of cracking secret alphabetic codes by comparing frequencies of letters (or symbols) in the secret message with the frequency of letters in English; in this way a guess might be made of how the original English letters were substituted by something else to form the secret message. It is important that students grasp this concept of frequency analysis as it crops up everywhere (it was one of the methods used at Bletchley Park in WW2 for cracking the

German Enigma code). Again, rather than just explaining the concept an amusing scenario was created thereby fixing the concept more firmly in the students' heads.

Edutainment Event 2: Current Content Based Event: Man-in-the-middle Attack

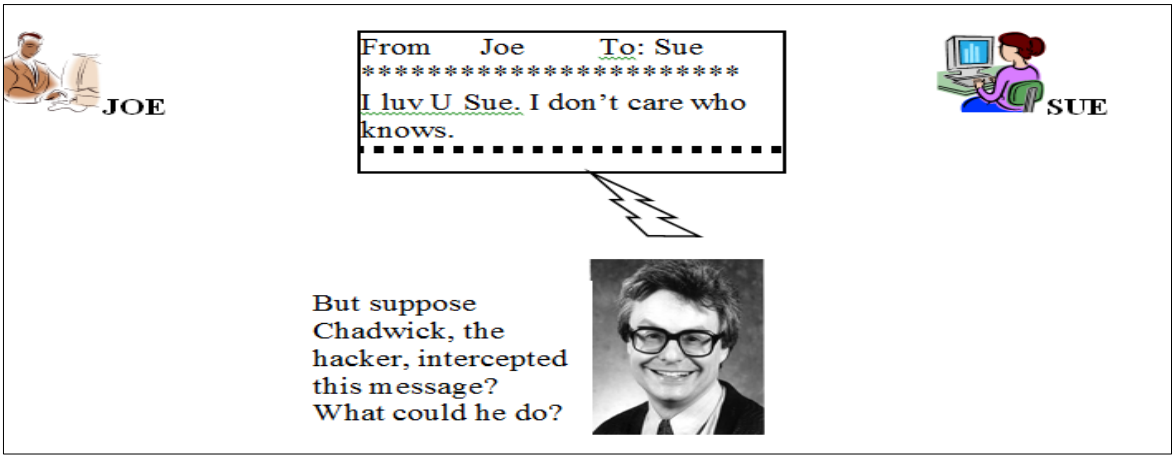


Fig 4.7: STEP 5 : Edutainment Event 2 : Man-in-the-middle attack

This depicts a short edutainment narrative within a longer edutainment narrative (spread over 5 lectures) of Joe and Sue who are having an on-off relationship which is threatened by international hacker Chadwick who is secretly a love-rival with Joe for the hand of Sue. Simply put, in edutainment event 1, Joe is sending Sue a message declaring his love for her but the message is intercepted by Chadwick the hacker. The students are required to determine what Chadwick, who is also an admirer of Sue, might do next. It's fairly obvious really – Chadwick the hacker will change the message to 'I hate U Sue. I don't care who knows' in order to disrupt the relationship. The students will then be questioned on how this message changing could technically be prevented; a fairly challenging operation. This scenario contains strong characterisation – it introduces the couple Joe and Sue and shows their flowering relationship. It also introduces Joe's nemesis, his arch rival for Sue's affections, Chadwick the hacker. This scenario contains humour for the watching students as the photo of Chadwick the hacker is actually a photo of their lecturer and the inclusion of this photo, as well as the name, introduces some eidetic imagery into the scenario to make it more memorable. The importance of eidetic imagery in edutainment was explained in literature review phase 1. This is highly relevant as it sets the scene for several following scenarios in which the same three characters will re-appear. This type of technical scenario, involving message changing, is a threat to business communications the world over, and students, now that their attention has been captured and their emotions engaged, can move easily from the Joe-Sue scenario to work-based examples which they will need to master. The importance of narratives in teaching or informing people was evidenced in the case studies; Alice, Sesame

Street, Soul City, Horrible Science, the Archers and even Royal Institution Lectures all used the narrative technique for gaining attention and passing information – see analysis of case studies in step 3 above and the relevant case study analyses themselves in appendices C though to H.

Edutainment event 3: Current Content based event

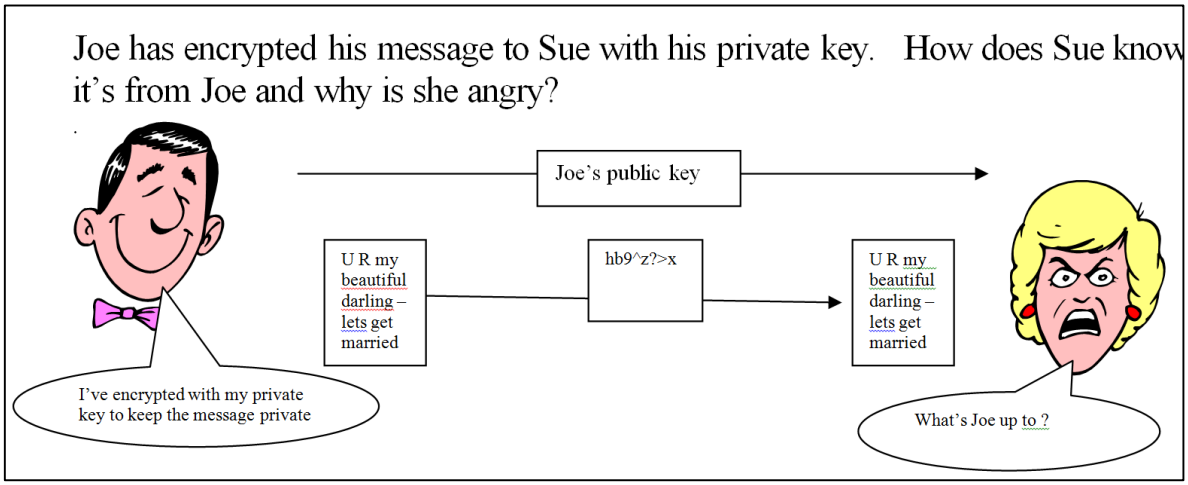


Fig 4.8 : STEP 5 : Edutainment Event 3 : Encryption scenario 'Why is Sue so angry?'

This depicts another short narrative within the longer narrative of Joe and Sue and their off-on relationship. It concerns Joe sending a message to Sue which makes her angry on receiving it. From an edutainment viewpoint this scenario depicts a short narrative within a longer narrative exhibiting edutainment aspects such as: humour, characterisation and game coupled with eidetic imagery. It also encompasses a short game element as it is a problem for the students to solve. Sue would have liked this message 'U R my ….' to have been kept a secret but it is easily read by anybody listening in to their communications. This is depicted in the picture and is why Sue is angry as she didn't want others to know this (not yet anyway). The technical explanation, which the students were expected to find as part of the game element, was that Joe had two keys – public key and private key – and the private key is kept a secret to him (hence the word 'private') but anybody can get hold of his public key (hence the word 'public'). The keys work together in that either key can be used for encryption but decryption can only work if the other key is used. In normal use, one encrypts with the receiver's public key and the receiver decrypts with their public key hence keeping the message secret in transmission. In this scenario Joe has got mixed up – he think if he encrypts with his private key and sends his public key to Sue then she can decrypt the message which will have been kept secret during transmission. Sadly, although Sue can indeed decrypt the message so can anybody else who had Joe's public key.

Edutainment Event 4:

This edutainment event was a verbal description of a work-based scenario. It was a short narrative with strong characterisation (the main character was the lecturer himself) and it contained humour in the final statement. It contained psychological effects such as the Zeigarnick (interruption) effect as the audience looked forward to the resolution of the narrative. In terms of cognitive load theory (John Sweller) it was a 'cue' or 'signal' to herald some important content to follow – in this case a discussion about managing business continuity when some adverse IT event occurs. As per Sweller's research, the cue and the content were differently presented, with the 'cue' being verbally delivered whilst the following content was mainly textual with verbal descriptions. In terms of the three operational domains of edutainment, it was certainly an attention trapper (attentive) and an emotion raiser (affective) and acted as introductory scaffolding (cognitive) to the following discussion of IT business continuity.

I once worked for the IT dept of a company that created large metal products and had it's own smelter and furnaces on site. To ensure IT systems were always operational, all the IT staff were scheduled on a 24/7 rota to cover in case of emergency. On one occasion, I was the designated Immediate Contact point and received a telephone call in the middle of the night to say the computer system had halted and no output was happening. This was serious as the output was pay slips and bank instructions for payment of wages into employee bank accounts the following day. However, industrial relations were very poor at that time and there was a great chance of a walkout by the employees, something which would have been disastrous as, unattended, the furnaces would have cooled down and taken days to get up to temperature again. I sprang into action, raced to my car and drove into work. It wasn't long before I found out the night staff had a file set to read-only and so no update could be written by the computer. I released this and the system began working properly.

I drove home satisfied, keen to get back to bed and finish my night's sleep. Almost home when a flashing blue light in my rear view mirror ushered me to stop. A police officer strode up to my window.

"Driving a bit fast aren't we sir?" he asked.

"Well, actually officer I was on my way …."

"Get out of the car please sir"

"I'm almost home and …"

"Get out of the car" he ordered.

I did as he asked but …you cannot imagine how embarrassing it was for me to be standing in the middle of the road in my pyjamas.

Fig. 4.9 STEP 5 : Edutainment Event 4: IT Immediate Incident Response Team: On call scenario

4.5.3.3 Artefact 3 : Tutorial Notes

Only clever people can solve this so if you think you've solved it sthen email answer to your tutors:-

Moriarty Smith works for WetNast Bank and you suspect him of sending customer details to credit card fraudsters by email. You confront him but he sneers at you and says "You have no proof because you will never break my cipher. In fact, in my next email I will tell you when I think you will catch me". From observation of his encrypted emails you suspect that he is encrypting his text using a Caesar substitution cipher (key 5) and a columnar transposition cipher (key 5). You intercept his very last email containing the short message TSJSFRHGTJQTNZS. What does it say?

Fig. 4.10 STEP 5 : Edutainments Event 5: Tutorial question using game and challenge

Edutainment event 5 (Fig. 4.10) shows a tutorial question representing a game, something the students had to actively work upon without lecturer intervention. Games psychologically embody what is called the Generation Effect), one of the psychology factors described in Hirshman and Bjork (1988:1), and also St. James et al (1992:149), and both of which are described more fully in the literature review phase 1. Experimental psychology has shown that learning gained via generation effects is easily remembered and integrated with existing learning. A well-crafted game can induce 'flow' conditions in which the participant gives 100% attention to a task and almost lose themselves within it as described more fully in (St. James et al 1992:65; Csikszentmihalyi 1990:1; Kirremuir & McFarlane 2004:9) in the literature review phase 2. This particular tutorial question also embodies 'challenge' or as Knowles (1980: 43), puts it "apply knowledge immediately and solve problems" which is an important part of the andragogy approach.

A second tutorial question went as shown below:

"I recently met a cyber security officer who reported the incident of a company where the manager used to drape his jacket over the server box next to his desk. Of course, the server, being an electronic device giving out heat and with no ventilation, got hotter and hotter and eventually a fire started. Very quickly, the manager's jacket turned into a blazer."

What measures should be in place to prevent fires from occurring?

Fig. 4.11 STEP 5 : Edutainment Event 5: Another Tutorial question: fire and physical assets

Fig. 4.11 shows humour used in a tutorial question on physical security of hardware – introducing the subject of fire prevention and protection of informational assets. It's an old joke but when you're young it sounds funny. However, all electronic equipment gives out heat and fire is a major hazard to data centres and business operations could be severely affected so it is imperative that the students' attention is captured when introducing this topic. It makes use of a short narrative that is easy to identify with and is structured like a typical joke with a punch line after a short pause

much like the delivery of the Laurel and Hardy joke – see literature review 2.1.7.7. This edutainment scenario also uses the findings of Sue Cowley that students like 'plays with words' (Cowley 2003:117).

4.5.3.4 Artefact 4 : Assessment Specifications

The best example of edutainment-based assessments identified for students was that of Dr Diane Gan and her associates in the C-SAFE (Cyber - Security Audit Forensics Education) team (of which this thesis author was a member) at the University of Greenwich, London UK, who used an edutainment approach in the setting of a cyber forensics coursework specification. The coursework emphasis was placed upon generating student attention, involvement and interest through the use of three of the edutainment themes discussed earlier: narrative, games, and characterisation. Dr. Gan's team created a cyber forensics coursework in two parts (appendix U): part 1 was for students to form into teams and for each team to create a crime scenario and hide forensic data in a variety of ways on a computer hard-drive; part 2 was for each team to obtain a copy of the hard-drive of another team and attempt to find the hidden forensic data. In this way the students acted as both criminal and investigator – essential skills for cyber forensics investigators. The teams were assessed on both parts with short reports – the first report was to describe their ability to use their knowledge of hiding techniques to hide evidence and the second report was to show their ability to uncover evidence that had been hidden by someone else. This approach was very well received by the students and produced good lab work and written reports; they apparently enjoyed the initial challenge of creating a crime narrative (and role-playing the criminal) and then the second challenge of unravelling the hidden evidence and possible crime-scene narrative in another team's scenario (role-playing the investigator). Psychologically, this coursework worked on several levels – it was a challenging game in two parts containing strong elements of the Generation (participation) effect and of the Zeigarnick (interruption) effect as it involved all their cleverness to understand the taught material in order to use it to outsmart, at a later time, the other team. The exercise also contained elements of Sweller's cognitive load theory as it demonstrated that one can become a better investigator by trying to think like a criminal - a concept of varied context examples espoused by John Sweller in his Near v. Far Transfer Learning concept described in Clark et al (2010:218). In addition, this coursework went some way to meeting some of the themes of good formative feedback as described in Irons (2007:4); it certainly involved students in the feedback process, it was clear to students on what the feedback was trying to achieve and how it contributed to their learning. Overall, Diane Gan's assessment was not only well received by the

students but also well received by lecturers from other universities when reported in a paper presented at an HEA (Higher Education Academy) conference (Chadwick et al 2010).

4.5.3.5 Artefact 5: Formative and Summative Feedback Artefacts

Summative and formative feedback had been adopted from the Sesame Street case study and included in the final model. For the classroom trial formative feedback was maintained by the lecturer reviewing the latest lecture and tutorial and simply seeing what worked and what didn't with some explanation. The lecturer called this his Formative Database (although any term would suffice) as it was kept on a computer and was easily searchable under many headings (a computerised database was not really necessary – a notebook of any kind would have been sufficient). This was the closest to emulating the formative feedback in the Sesame Street case study where the whole team would meet, review their findings and keep formal notes for later reference.

Summative feedback, that feedback produced at the end of the whole course and reported in academic studies as feedback to the whole academic community, was also undertaken as part of this trial. It resulted in several conference papers for dissemination to the wider academic community (Chadwick 2015; Chadwick et al 2015a; Chadwick et al 2015b) which were well received, engendered some interest, and produced offers of collaboration with other universities. It was felt therefore that the summative feedback element of the model had been well trialled in practice.

4.6 STEP 6 : COLLECT AND ANALYSE THE FEEDBACK DATA SOURCES

This step divided logically into two parts: part 1 being feedback on the six sources of data for the student trial and part 2 concerning feedback on six data sources for concerning lecturing staff acceptance of the final model.

4.6.1 Part 1: Data Collection and Analysis of Feedback on Student Trial: Six Sources

For Part 1 the student cohort consisted of 52 postgraduate students of whom 41 were overseas, and 25 were female; but not all 52 students participated in the surveys and interviews. There were six data collection methods, five involving data on students or from students and one involving feedback from the lecturer concerned. The reason for six data sources was firstly, the sample was rather small to obtain statistically significant findings from any one or two sources so a broad

coverage of different data sources was decided upon; secondly, it was deemed essential to have some measures on each of the three operational domains of edutainment: attentive, affective and cognitive (which was accommodated); thirdly, it was deemed necessary to accommodate views and perspectives from all three major stakeholders (students, lecturer, university administration were all represented in some way); fourthly, it was decided to have a mixture of quantitative as well as qualitative data to increase objectivity and lastly, it was deemed advisable to make use of as much university generated official data as possible as it was already available. The overriding goal was to form an impression of whether this edutainment model enhanced education or not – to answer Yes or No - it was not a goal to state this edutainment model improved educational performance by X% this and Y% that. So, overall, this was accomplished with the choices shown in fig. Fig. 4.12 which cover as many different sources as possible and which were easily available or produced.

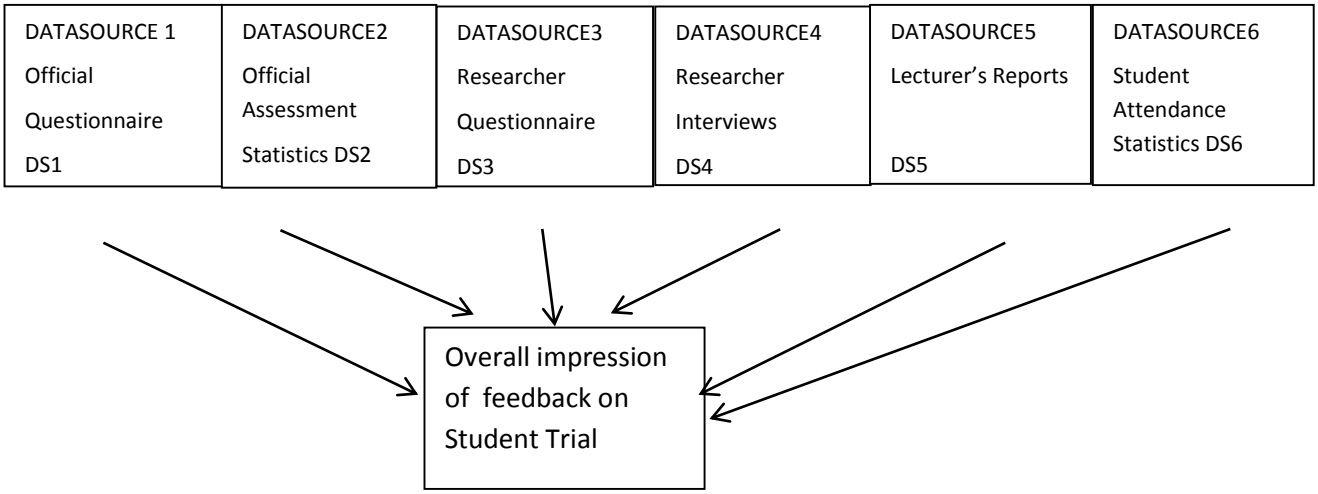


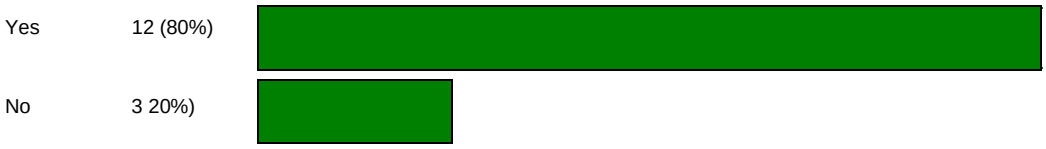
Fig. 4.12 STEP 6 Part 1 :Six data sources for Student Trial Feedback

4.6.1.1 DATASOURCE 1 : Official University Questionnaire

The bar charts were from the official Assessment Of Course From End-Of-Year Student Feedback Survey, a survey run by the university and encompassing all students on all courses – see Appendix R. The number of students answering the survey 2012/13, from the full class cohort of 54, was 15 students and for the 2013/14 year, with a full class cohort of 58 students, it was 35 students. The student feedback showed an improvement of 12.5% between control and experimental year so the findings shown in Fig 4.5 do seem to indicate that the students in the experimental year 2013/14 seemed more content with the course than those in the previous year.

2012/13

Overall, I am satisfied with the quality of the course



2013/14

Overall, I am satisfied with the quality of the course

Fig. 4.13: STEP 6 Part 1: Official Questionnaire: Student Feedback data

This Official University Questionnaire, does indicate an improvement in student perception of the course from the base year 2012/13 to the experimental trial year 2013/14. The two years do not involve the same number of respondents so this may be a skewing factor although the 2012/13 year does have a minimum of 15 respondents which is sufficient for comparisons to be made.

4.6.1.2 DATA SOURCE2: Official University Assessment Statistics: 2012/13 and 2013/14

The SAP (Subject Assessment Panel) report was that official report made by the lecturer on the running of the subject in the past academic year – see Appendix R. The figures for Mean calculations were provided by the university based on the official statistics. The findings did seem to indicate that the year 2013/14 was a more fruitful learning experience for the student cohort than for the previous year 2012/13. The average (mean) TOTAL assessment figures showed an improvement in marks overall of 8.3%.

Mean	EXAM	COURSEWORK	TOTAL
YEAR 2 2013/14	60	70	65
YEAR 1 2012/13	57	63	60

These official university assessment statistics, for both the years 2012/13 and 2013/14 show a distinct improvement in students' average marks. Importantly, there were no discernible

differences in cohort composition from year to year: The two years appeared not to have any particular differences in curriculum content and delivery (apart from the edutainment material), they had the same lecturer, the same room, and approximately the same day and time of day. Similarly, there appeared no differences in the make-up of the two cohorts from year to year – they were all postgraduates from much the same backgrounds and prior qualifications, with similar ratio of male to female, similar age ranges and with similar ratio of overseas to indigenous. There were no particular differences in national origin of the overseas students – no specific cohorts for instance of government employees from the same country (as sometimes does occur). Overall the two intakes were homogeneous over the two years. Similarly, the quality of the assessments over the two years was ratified by the same university moderation system so one must presume that the quality of the assessments, although different in content, were comparable. It appears therefore that the one obvious difference – the use of edutainment in the trial year 2013/14 is a likely candidate for the improvement in average assessment marks although this cannot be proved beyond doubt.

4.6.1.3 DATASOURCE3 : DS3: Researcher Questionnaire of 54 Students:

The original questionnaire is to be found in Appendix Q. It was only possible to question students on the use of the entertainment themes in the teaching materials. It was, for instance, not possible to ask 'what did you think of the DPK approach?' or 'what did you think of the lecturers PPP approach?' as these terms would have been meaningless to them; the students could only reasonably be questioned on what they directly experienced in the classroom sessions. However, a reasonable assumption was made that the quality of the final product, the edutainment events themselves, was a function of the quality of the process that produced them so that students' perceptions of the edutainment events was also a comment upon the creation process. As part of the questionnaire some demographic data was collected. It was not known whether questionnaire results could be correlated with gender, or students capability in English, or previous educational experience but these questions were asked nonetheless as they may have led to useful findings as not all the student cohort may have found the edutainment approach to be acceptable.

Question 1 : Use of Humour: Of the total 54 respondents (out of 58 on the register) 51 respondents chose options 3 or 4: which is 94% strongly approving of the use of humour.
Option 3 was "I like this - humour helps me pay attention during the lecture"
Option 4 was "I like this – humour helps me remember the real things I have to learn"

Question	Choice 1	Choice 2	Choice 3	Choice 4
Q1	3	0	39	12

Question 2 : Use of Characters: Of the total 54 respondents (out of the total 58 on the register) 51 respondents chose options 3 or 4: which is 94% positive about characters

Option 3 was " I like use of characters - it helps me pay attention during the lecture"
Option 4 was "I like use of characters - I remember them afterwards and this helps my memory"

Question	Choice 1	Choice 2	Choice 3	Choice 4
Q2	3	0	35	16

These results may be interpreted to show that the students considered the use of humour and characters to be important for their learning. The student interview results seem to indicate that edutainment was considered of positive benefit. The questionnaire provided four possible choices for selection and respondents were quite able to choose a non-positive answer. Clearly this was not the case as very few respondents saw no merit in it. As the replies were entirely anonymous and the survey was undertaken after all assessments and examination boards had occurred for that programme so the respondents were effectively alumni and not students at all, the students were under no pressure to be 'nice' to their old lecturer or to hope for favour of some kind. These survey results are interesting in that they do seem to echo the overwhelmingly positive feedback obtained in source 1 the university's own formal student survey. In addition, even if actual performance improvements as per source 2 cannot be proven beyond doubt it does seem as though the students enjoyed their learning experience; this possibly counts for something in itself. More results on the student survey are reported later where gender differences are explored – see Table 4.8.

In addition, with regards to the coursework in cyber forensics designed by Dr Diane Gan and her team at the University of Greenwich, London UK, a short questionnaire was given to the students to determine their perspective on the novel edutainment-based coursework (questionnaire reproduced in Appendix U(b). There were just eight questions, two of which (questions 5 and 8) were open questions and are not mentioned here. The closed, more indicative, questions were answered as shown below. Basically, questions 1 and 3 show the coursework to have been challenging with 24/29 replies being 'yes'. Questions 2 and 4, asking about the use of characterisation and role-playing of both criminal and investigator, gave a 13/13 response. Questions 6 and 7 were about how the cognitive factors were delivered and obtained 23/26 positive feedback.

QU No	QU Descriptor	Yes	No	Blank
1: Part 1	Was Part 1 challenging? Did you have to think deeply and use most of the taught skills?	13/13		
2: Part 1	Did Part 1, which put you into the criminal's mind, give you insight into the criminal mind?	13/13		
3: Part 2	Was Part 2 challenging? Did you have to think deeply and use most of your taught skills to accomplish it?	11/13	2/13	
4: Part 2	In Part 2, was your 'crime' to be investigated particularly interesting to you?	9/13	1/13	3/13
6: All parts	Did you like the course approach of having FOUR experts as lecturers?	13/13		
7: All parts	Did you like the order in which the topics were delivered?	10/13		3/13
Table 4.8	**STEP 6 Part 1: Questionnaire replies on assessment feedback**			

4.6.1.4 DATASOURCE4: DS4: Researcher Interview of 4 Students

See Appendix P for the four interview transcripts. The respondents were asked generally to answer the following four questions in their own words:

Q1) In what way did you find the use of humour in lectures helped in your studies?
Q2) In what way did you find the use of story-telling (anecdotes etc) in lectures to be useful?
Q3) Do you think you might use such techniques yourself in the future ?
Q4) Is there anything else you might like to say about the lecturer's edutainment teaching style?

Transcripts were carefully read and themes identified. Strong feelings and observations were recorded and are reproduced below under the question headings and with the respondent number identified (so this synopsis can be cross-referenced with the actual transcripts in the Appendix P). The number of interviewees involved, five, was too small to enable any statistical analysis but the interviewees' comments do offer some anecdotal insights – see Table 4.9. Firstly, the replies do seem to support the overwhelmingly positive outcomes of the student feedback recorded in the source 1 and source 3 surveys. No negative comments were received at all even under question 4 which was effectively an open 'tell me what you want' question. Overall, the comments were very positive with various themes strongly evident. Humour and story-telling (narrative) come out well as entertainment techniques and their use as attention capture techniques and aids to memory seem to be clearly recognised.

Qu1	helped [me] to remember (R1), helped [me] to memorise (R2), humour makes learning more enjoyable, especially, some of us are not having English as the first language, listening to a flat lecture can be daunting time. Humour keeps us up and helps to more alerts and ,consequently, to remember and understand things better (R3), entertainment factor that you used in the lectures was very helpful for me as I realised that I took the content in better when I was concentrating but relaxed, helped me to remember the stories you told us about case studies (R4)
Qu2	I come from a culture of folk tales [so related well to this approach] (R1), story-telling offered a different perspective (R2), Human have been transferring knowledge from generation to generation through story-telling. It put hard-concept into a context where everyone can paint his/her own picture (R3), Ordinarily with normal lecture styles I would not be able to recall such information so long after the lectures (R4).
Qu3	will use techniques myself in future (R1), I have used same techniques for ITIL and CISA exams (R2), Yes (R3), If I was planning … a lecture or talk I would definitely try to employ these techniques as the results of doing so stand out very strongly against traditional speaking (R4).
Qu4	simple to relate to teaching, furthering professional studies (CISA), referred to funny stories when recalling topics (R1), looked forward to classes, no boring moments (R2), At the result, students attend more and learn more from his classes (R3), It was the combination of humour, entertainment, story telling, graphical display (projector notes) as well as detail that made the delivery very effective (R4).
Table 4.9 : STEP 6 Part 1 : Synopsis of interview replies	

Question 1 : In what way did you find the use of humour in lectures helped in your studies?

Overall replies here seem very positive and interpretation of the actual words in a positive light seem to show : 2 respondents (R1 and R2) suggest humour helps as an aide-memoire to facts and 2 respondents (R3 and R4) mention the attention-capturing effect of humour. An interesting, finding is that one of the respondents said that humour was helpful for those for whom English was not their first language. This may possibly be very significant as postgraduate education moves even more towards a global marketplace and further research needs to be done to see if the effect is well founded.

Question 2 : In what way did you find the use of story-telling (anecdotes etc) in lectures to be useful?

All respondents spoke positively of the use of story-telling. Most interestingly, and again an overseas student (from an African country), spoke of coming from a culture of 'folk-tales' a comment that may have greater importance than at first seen. One of the case studies, Soul City, was deliberately chosen as being from a non-Western country characterised by low literacy rates, and where story-telling might be useful but it was not thought this issue would itself be broached by students in an actual educational context in the UK. Consequently, the literature on 'story-telling cultures' was not explicitly explored in the literature review hereto. However, this does not detract from the fact that this may be a most pertinent finding for the use of edutainment in postgraduate settings where overseas students are prominent.

Q3) Do you think you might use such techniques yourself in the future ?

Perhaps the most surprising finding from this question, and one not at all expected, was that two of the respondents, R1 and R2, mentioned adopting similar techniques for themselves for the future. R2 even mentioned privately preparing for cyber security professional examinations ITIL and CISA (see Glossary).This is significant as at no stage in the teaching itself were students advised of future use or their need to devise their own techniques. This finding is surprising as it was initially considered that whatever the effect of edutainment might be, especially it's scaffolding effect, it would be used only in situ, i.e. in the current learning situation, and would be immediately forgotten once the curriculum learning had been effected. However, the students appear to have adopted edutainment techniques themselves quite voluntarily having 'learned how to learn' by participating in the classroom sessions. This may be a most significant finding for 'lifelong learning' advocates.

Q4) Is there anything else you might like to say about the edutainment teaching style of the lecturer?

This was a general question and students answered most positively.

4.6.1.5 DATASOURCE5: Lecturer's Personal Observations: 52 students observed

The lecturer's personal observations were recorded in appendix S. Particularly noteworthy from these is the discussion of both formative and summative feedback shown in the draft model of Fig. 4.5. and which both occurred during the experimental trial of the draft edutainment model. Formative and summative feedback were terms borrowed from the Sesame Street case study where they were used to great effect; the CTW (Children's Television Workshop) team used formative feedback after each programme release to appraise how the programme had actually performed. They recorded their feedback in a database for later use as an advisory manual of what worked and what did not work. In this thesis, the same idea was used with formative feedback occurring between lessons so that edutainment products could be improved upon on an ongoing basis. As in the Sesame Street case study reported in appendix F this process was found to be very useful. Here is an example of formative feedback occurring during the experimental trial describing a mistake that occurred when a short narrative about the use of acronyms with passwords was delivered to

the class – see Fig. 4.14. At first sight it seems the perfect edutainment scenario: it has narrative, it has humour, it has a game element in that everyone tries to think what the acronyms might stand for. But, most of all, it actually teaches important points about password policy: that passwords should be a reasonable length, should contain other characters as well as alphabetic characters, should appear meaningless but be easy to remember, should never be written down, should be changed frequently and that there should be layers of password control (here there are two layers individual + team). On the face of it, it was a perfect edutainment scenario.

At XXXX plc I was a member of a systems development team. In addition to their own personal password, each member of the team was given the same password for entry to an area of shared data for that team. This password was changed every week for security purposes.

One week the password was given as RRWATR?. This was somewhat difficult to remember and we were banned from writing down passwords so we asked the security administrators how to remember it. They replies it was an acronym of : Romeo, Romeo, Wherefore Art Thou Romeo ?. This was easy to remember.

The following week the team password was changed to PYIKHWH. We racked our brains as to what this could be an acronym for taking into account there might be a Shakespearean theme but we couldn't figure it out. Eventually we went back to system administrators and they told us : Poor Yorick I Knew Him Well Horatio.

The next week the password changed to SWAT7D. Again we racked our brains for what this could mean, some thought it was a quote from Richard III, some thought it was from A Midsummer's Nights Dream. Eventually we gave up and asked the security administrators. They told us: Snow White And The Seven Dwarves.

Fig. 4.14 Password Acronym Scenario

However, the problem with the scenario in Fig. 4.14 became evident as soon as it was verbally told to the class. The class, being predominantly composed of overseas students, turned out to have little knowledge of Shakespeare and his plays and so the humour of the acronyms was lost upon them. Even worse, coming from non-western cultures, they did not know who Snow White was. On top of all that was the possible charge that speaking of 'dwarves' was politically incorrect and it should have been 'vertically challenged persons'. The scenario completely failed as a piece of edutainment although the students accepted it as an anecdote from which they could learn something. However, it did give immediate useful feedback to the lecturer on how important it was to ensure the edutainment was a good fit to the characteristics of the student cohort. A list of

student characteristic domains for edutainment framing were immediately drawn up – see Table 4.8 and this table was fed forward to the edutainment process for the next lecture. In this way, the mistakes and failures of one lecture were learned from and the lessons applied immediately in time for forming the next lecture. Formative feedback really did work during this trial just as it did in the Sesame Street case study.

DOMAIN	EXPLANATION
Culture and Nationality	Edutainment scenarios were not to be culturally or nationally specific unless this aided the education. To minimise exclusion as students from different cultural, religious or political belief backgrounds.
Language	Edutainment scenarios using verbal humour require good English listening and understanding skills and were to be treated with caution. To minimise exclusion of students for whom English was a second language..
Age, Gender, Race & Disability	Edutainment scenarios were not to be offensive to any persons on grounds of race, disability, age, gender or sexual proclivity. No explicit references to the sex-act itself were to be made. To minimise embarrassment or alienation
Table 4.10	**STEP 5 : Student Characteristics criteria**

However, summative feedback, also borrowed from the CTW approach, unlike formative feedback, is not an integral part of the DPK process of forming edutainment as it only occurs after an entire course is delivered and is a feedback procedure to other practitioners through papers, either conference or journal, and formally delivered into the wider academic community. However, the lecturer/researcher hereto delivered three papers to meet the summative requirement of the edutainment model. The three academic papers were written and submitted to conferences or workshops on various aspects of the experimental trial (and of the entire thesis work to date) representing practitioner to practitioner feedback on novel methods of teaching. The first paper was that of Chadwick (2015) delivered at Liverpool John Moore's University in June 2015 and concerning edutainment as a means of improving teaching of cyber security; the second paper was that of Chadwick et al (2015a) delivered at a workshop at Sunderland University in November 2015 and concerning the use of narratives to improve the teaching of computer forensics; and the third paper was that of Chadwick et al (2015b) delivered at the Annual SRHE (Society for Research into Higher Education) conference in December 2015 and concerning edutainment as a means of improving teaching of STEM subjects.

4.6.1.6 DATASOURCE6: Student Attendance Statistics

The average class attendance figure for year 2012-13 (control year) was 78%. For the year 2013-14 (the edutainment trial year) the same figure was 81%. These figures show that attendance had improved very marginally. However, no firm findings can be made from these figures. The difference is very small as was expected as the students, being mainly overseas, were required to maintain good attendance anyway as part of their obligations to UKBA (UK Border Agency) and to their own embassies and fee-paying institutions. It cannot be discerned therefore if the slight improvement was due to the application of edutainment or not. However, had there been a reduction in attendance, then, in the absence of any underlying reason such as a terrible influenza epidemic or transport strike, it might have been concluded that the students had been deterred from attending by the edutainment approach which they had presumably found distasteful; at the very least, this negative connotation has been avoided.

Overall, the above findings appeared positive (or, at least, not negative) in every one of the six data sources analysed. There seemed to be few, if any, contraindications that the final edutainment model had worked in practice. All six of the data sources either supported the model or did not, at least, negate it. However, there was one weakness that the above findings were all exposed to. Although they showed very positively that the edutainment model appeared to work in practice with the researcher's own student cohort, it was still necessary to show that other lecturers, apart from the researcher, could accept the model and use it for real.

4.6.1.7 Demographic Cross-Referencing

The findings from all five data sources all tend towards a positive outcome for the edutainment trial. This, of course, does not prove that edutainment has a beneficial effect although it may prove that, at the very least, it does not have any obvious negative effects.

However, further to the above straightforward analyses of the four student-based data sources two other demographically based analyses were conducted concerning whether students were male/female and whether they were overseas/indigenous.

4.6.1.8 Gender

For data sources 1 and 2, the official university statistics, there was no breakdown by gender of the respondent cohort so no analysis was possible. However, for data source 3, the researcher survey, there were 13 females, 41 males in the respondent cohort of 54 (although 58 students were registered in total not all answered the survey).

s

	Likes Humour	Likes Humour	Likes Characters	Likes Characters
	Qu2a Likert	Qu2b Options	Qu3a Likert	Qu3b Options
Total Likert scale average	4.55		4.37	
Average Likert Female scores	4.6		4.47	
Average Likert Male scores	4.53		4.34	
Options Count 3,4		51		51
Options Count 1,2		3		3

Table 4.11 STEP 5 : Summary of Survey Results from appendix Q

Although the number of females in the sample was too small to produce statistical results significant at the 95% level there was an indication that female students liked the use of both humour and characterisation marginally more than the male students when looking at the average Likert scales – see Table 4.8 (also in appendix Q). This was a surprising finding as no gender difference was expected at all and this finding, if borne out by later studies, could be highly significant in adult education. Both the UK and USA governments, over many years, have been quite concerned to encourage more girls to study STEM-type subjects and especially IT-related subjects of which cyber security is clearly one. In December 2015, Fiona Twycross, chair of the London Assembly Economy Committee, said, in a report entitled *A mayoral manifesto for the digital economy* , that tech companies in London were "crying out for people with the right digital skills … but we need to ensure that this thriving sector is as diverse as possible with opportunities for women, and local young people". It was salutary that December 2015 saw the 200th anniversary of the birth of Ada, Lady Lovelace, widely known as Lord Byron's daughter but not so widely known (except in the IT community) as the first ever computer programmer for her work with Charles Babbage on his difference engine (CS4FN 2015:2).

Although the uptake of girls into STEM subjects is on the increase there appear to be no definite rules on how further female participation may be gained. Therefore, it might be quite significant that, in this thesis' findings, girls appear to be sensitive to the way in which they are taught independently of the content they are being taught and that an edutainment approach is considered to be somewhat attractive to them. Why this should be so is not clear as no separate survey or interview of female students was undertaken to explore this issue further. However, purely informal discussions with female students, did seem to indicate they liked the use of characters and relationships between characters as they could more easily relate to the technical scenarios.

Of course, this is purely anecdotal and the data was not scientifically collected in any way and the original statistical finding may have merely been an artefact of this data set, so any conclusion must remain as pure conjecture.

No female students participated in the interview sessions.

4.6.1.9 Students without English as First Language

No data on such students was available from data sources 1 and 2 and the data set of source 3 was too small to give results statistically significant at the 95% level so no firm conclusions can be drawn. However, the data does seem to suggest that students, who did not have English as their first language, were marginally more in favour of humour and characterisation than their English-as-first-language counterparts, a finding that was entirely unexpected. Even before the edutainment trialling had begun, it was thought that non-English speaking students would struggle with the whole concept of edutainment in any form. It was believed that most of these were probably overseas students who came from countries where the English language provision was somewhat limited, and also possibly from where educational systems were very different from the UK, where education was didactic, lecturer dominated and containing much rote-learning, certainly far from the entertaining and andragogic nature of the edutainment they were exposed to in the trial classroom experiment. It was therefore surprising that they liked it at all.

The researcher-based interviews of the five respondents reported in data source 4, all of which were from overseas students, there was one respondent who mentioned their own background of a 'story-telling culture' and another who implied that use of humour made lectures more interesting so that limitations in English were more easily overcome. If these two last statements can be verified by further work then this might be very significant for the teaching of non-English persons.

4.7 STEP 6 Part 2 : Data Collection and Analysis of Lecturer Peer Feedback

This part, part 2 of the evaluation stage, was simply to obtain feedback from other lecturers, at the same university and beyond, on whether they could use the model and what they thought of it. There were seven feedback sources expressed over two broad inputs: Lecturer Peer Trial and Lecturer Peer Conference– see Figure 4.5.

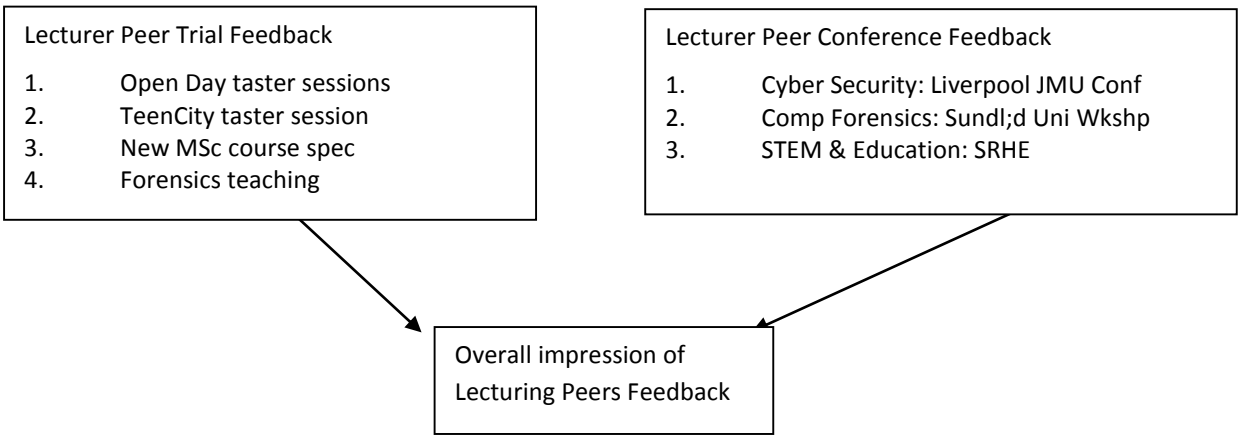


Figure 4.15 STEP 6 Part 2 : Lecturer Peer Feedback: Trial and Conference Feedbacks

Firstly, for the Lecturer Peer Trial feedback, the edutainment model was passed to lecturer peers, colleagues of the researcher at the same university, who opted voluntarily to trial the model in their own teaching. Secondly, for Lecturer Peer Conference feedback, conference papers were produced, accepted, and delivered at various venues to different audiences of academics all within the higher education academic research community and their feedback elicited.

4.7.1 Lecturer Peer Trial Feedback

For the lecturer peer trial feedback, there were three instances where lecturing peers (teaching colleagues) adopted or accepted the edutainment model hereto as part of in-house teaching in which they were involved. The first lecturer peer trial was that lecturing colleagues of the thesis researcher, used the edutainment model devised within this thesis to plan their own two 'taster' sessions for secondary school pupils visiting the university as potential applicants for entry to cyber security BSc programmes. The two taster courses were 1.5 hours in duration and were given in a light-hearted, jokey manner with short games-based scenarios consisting of problems that the would-be students could solve with only brief preparation. The idea was to give these school students a taste of university facilities, university teaching and the type of work involved in cyber security. This thesis researcher was not involved in the design of the taster sessions, this was entirely left to the other lecturers independently using the edutainment model, - the only involvement of the researcher in these sessions was to construct a questionnaire for the school

pupils to answer. The questionnaire itself and the results of the questionnaire given to the 'taster' students are shown in appendix U. They indicate that the students enjoyed the sessions and were attracted to the university because of it. This was not perhaps the full trial, with lectures and tutorials and proper assessments for a whole course that might have been hoped for, but it was indicative that the devised model could be understood and used successfully by others and had the effect of removing the researcher's personal influence from the trial process. The second lecturer peer trial involved an awareness raising short course put on at Olympic Park in London as part of the 2014 TeenCity careers and education exhibition for school-leavers. The session involved taking a small group of interested young people for a 30 minute cyber security session in which they were shown some of the dangers of using Twitter accounts, how hackers hacked games to improve their own gaming scores and how hackers could steal passwords; although these may sound ethically inappropriate the emphasis was placed upon continuing to undergraduate studies in cyber security to learn to prevent this kind of behaviour and ultimately secure good professional positions. The two lecturers involved here made use of edutainment elements of humour, games and short narratives to quickly excite the audience to capture attention, hold attention and motivate them to want to learn more. The lecturers reported that the sessions went well but it is not known to what extent this converted into genuine applications to the university. The third lecturer peer trial involved the consideration of the edutainment model as a defining teaching input to a new MSc Cyber Security (Conversion) programme that was currently being specified for application to the UK government recent £500,000 initiative to improve teaching of cyber security at universities (Computer Weekly 2015a). The lecturers involved in this process, who were the same staff as on the 'taster' sessions above, considered that as this was to be a conversion course taught to students with no prior knowledge of IT security then a more flexible, lighter touch was required than for 'normal' IT-literate students. The fourth instance in which colleagues acquiesced in the inclusion and use of the edutainment model in teaching they were also involved in was in the planning of several lectures for a course entitled Computer Crime & Forensics. For this, the edutainment element of narrative and characterisation was put into effect in the planning of technical lab-based tutorials based around narratives concerning real-world legal scenarios. The scenarios included well-known cases such as: Gary McKinnon, the hacker who hacked the USA Naval weapons establishment in Newark in September 2001 shortly after the twin towers disaster (technical issues: hacking techniques), Colin Blanchard who persuaded various women working in Little Teds Nursery to take photos of small children and send them to him for distribution throughout a paedophile network (technical issues: encryption and steganography) and the case of

Ian Huntley and Maxine Carr and the Soham murders of two ten-year-old girls (technical issues: mobile phone data). The important thing here was that the edutainment model, especially its use of narrative and characterisation, was not only used to give mental hooks on which the students could 'scaffold' the technical material, but it also enabled central themes on which the three contributing lecturers, with different skills, could liaise and integrate their collective work. This was particularly important as forensics includes a range of topics and skills ranging from the technical to the legal to the organisational all of which need binding together to form a coherent whole for the student learners. This application of edutainment was so successful that two of the lecturers involved wrote about it in a conference paper later delivered at a University of Sunderland workshop (Chadwick et al 2015a).

The acceptance of lecturing peers as detailed above in their actual teaching confirmed that aspects of the edutainment model were a useful guide to teaching practice and their independent inclusion of this thesis's model in formal HE quality control procedures (the new MSc) was considered a strong mark of acceptance by same-discipline lecturing peers. However, the one clear weakness with the lecturer feedback given here from the 'taster' session work, the forensics lectures, and the new MSc specification inclusion was that, in all instances, the lecturers concerned were colleagues of the researcher hereto and so there might always have been the charge of collusion or undue influence. To overcome this, feedback was also sought from other lecturers in the higher education field who were totally independent of the researcher hereto; this was achieved by the presentation of various conference papers and the collection and analysis of audience feedback.

4.7.2 Lecturer Peer Conference Feedback

For the lecturer peer conference feedback, papers were delivered to HE practitioners at three conferences on different themes and at different venues throughout the UK. The papers were for conferences or workshops at: Liverpool John Moore's University (LJMU) , Sunderland University (SU) and the Society for Research into Higher Education (SRHE). The LJMU paper (Chadwick 2015) was about the use of edutainment generally in the teaching of cyber security; it was well received with questions as shown in table 4.9. The SU workshop paper (Chadwick et al 2015a) was on the teaching of computer forensics using legal narratives and was about the teaching outlined above in one of the lecturer peer trials. It was well received with questions as shown in

table 4.9. The SRHE conference paper (Chadwick et al 2015b) was about the role of edutainment in enhancing learning of STEM (Science, Technology, Engineering, Mathematics) subjects; This paper was generally positively received by the audience but there were three deeply questioning comments as shown in table 4.9.

The two papers concerned with cyber security (LJMU) and forensics (UoS) were generally well received but it can be seen immediately that planning and learning how to use edutainment materials were seen as problems. This was foreseen in the literature review Part IV 2.4.1 where possible staff resistance and the need for edutainment training was identified. Planning should always be an integral part of any teaching approach and that this edutainment model does not require one-off blanket implementation – it may be adopted incrementally as the lecturer builds up confidence. The SRHE conference, where the model had been introduced in the wider context of STEM teaching was somewhat more problematic. On the issue of 'school children' this thesis took the view that if this was really what children did at school, and it worked, then this was a complimentary statement as this thesis had borrowed extensively from child learning; the literature review 2.3.3 showed that child and adult learning did not differ cognitively, only in context, attention span and self-awareness. Consequently, if edutainment worked with school children then this was further support for its similar use with adults where attention spans were longer, adult context was straightforward to apply and self-awareness very prevalent, were attributes making for easier use. In regard to the 'dumbing down' issue; over the two years (control year + trial year) of this thesis' experiment, both years had the same taught curriculum and yet the assessment results were better for the trial year than the control year with both years' assessments being inspected by the quality and learning functions of the university; there was therefore no empirical evidence of dumbing down. In summary, the seemingly negative statements from the SRHE conference could be countered and the very positive statements from the LJMU and SU venues were definite supports to the edutainment model outlined herein.

Conference/Workshop	Comments by the Lecturer Peer Audience
Liverpool John Moore's University *Cyber Security Training & Education Workshop*	'how did you plan this edutainment?' 'you're an amiable fellow so it might work for you, what about others?
University of Sunderland *Teaching Computer Forensics Workshop*	'where do you get the narratives?' 'how does one learn this approach?' 'another narrative could be that of Paul Gadd (Gary Glitter)'
Society for Research into Higher Education *Converging Concepts in Global HE research*	'it will need a lot of planning', 'it's what children do at school' 'it's dumbing down'
Table 4.12: STEP 6 Part 2: Synopsis of Lecturer Peer Conference Feedback	

Overall, in evaluating lecturer peer trial and conference feedback, this thesis takes the view that other lecturers, having used aspects of the model themselves and questioned it in peer-reviewed papers, and raised some questions, did not achieve a negative consensus that the model was seriously flawed. On the contrary there was a general positivity that the model had usefulness in the higher education arsenal of teaching tools.

In overall summary of STEP 6, which discussed in part 1 feedback from the student trial of the edutainment model and, in part 2, the opinions on the same model, of other lecturers active in higher education, there is strong evidence that the findings do support the original alternative hypothesis given in the Introduction chapter that ' ... *the use of a model of edutainment will positively enhance the learning of cybersecurity…'.* The null hypothesis that *'... the use of a model of edutainment will either not enhance or will actually hinder the learning of cybersecurity topics by higher education students…'* finds little in the way of empirical data in support.

5. DISCUSSION

For this discussion chapter, and the conclusion chapter that follows, the third party perspective will be replaced by the first party perspective as I regard these chapters as places to speak for myself. I believe that support for this first person approach is consistent with the action research methodology that has been adopted throughout and is further supported by McNiff (2014:51) who, as Professor of Educational Research at York St John University, said "[cultivate] the habit of writing as you speak not as you think academic texts should be written and I have taken this chapter in which to do so. This chapter will discuss some of the perceived and actual shortcomings of the research, offer possible alternative explanations for the overall findings, address some surprises that arose from the results as well as discuss future research areas that might build upon the work here.

5.1 Research Shortcomings

5.1.1 Rationale for this Work

The goal of this thesis research was to use the basic principles of edutainment found from the literature along with the application of those principles as demonstrated in several well-known case studies, to form a model of how edutainment works in practice. I feel the rationale for design of this edutainment model needs to clarified at this stage, although the research has developed a model, it may still not be clear why such a model was developed in the first place, what use it could be in everyday university teaching and if it has any validity as a basis for further research.

The world of higher education is an expanding environment with its drive to encompass a greater proportion of the population 18+ than ever before as well as to extend the years that each learner is involved in it. Also, edutainment for teaching children appears well accepted in practice but for adults, especially in higher education, it's incidence is sparse and woefully under-researched, despite there being a need to seek new models and methods of teaching. This latter point is a viewpoint supported by Jo Johnson, the UK Minister for Universities, who stated in September 2015 'Too many universities in England have allowed teaching to become "a poor cousin" to research' and that his proposed Teaching Excellence Framework would attempt to address this (BBC News 2015). Similarly, in the same year, the Times Higher Education journal (THE 2016) mentioned 'In the eyes of policymakers who want better status for teaching, it

seems that metrics on learning gain are the main game in town'. So, there is clearly some discontent at high levels about how teaching is treated in HE generally indicating that a need to explore teaching and learning is important.

5.1.2 Absence of Current Cyber Security Teaching Practices amongst Case Studies

An honest appraisal shows that the selection of case studies did not include any current teaching practices in universities apart from the researcher's own university. As mentioned under the Methodology chapter, other lecturer's work was initially explored but excluded as it would have been too problematic. Other lecturers may well have come forward with their own work on edutainment but it quickly became apparent that such work would have had little empirical data to back it up, few structured models to explain what they thought was going on, with an overall lack of research and, worst of all, backed by little student feedback data. I felt that such case studies would have been too unproven and lacking in data to be of any concrete use. An example of this (purely anecdotal but nonetheless illustrative) was that of a lecturer who said they practiced edutainment because 'at the start of each lecture they talked and joked about the TV programmes of the night before and this put the students in a good mood'. However, this was purely improvised with no psychological or educational underpinning, not all the students saw the TV the night before and the subject matter did not relate to the actual content of the lesson being provided. Similarly, such activities as moots, business games, and role-playing activities already in use were considered but again it was found that there was generally only anecdotal data on how well these things worked in practice, insufficient data on how they had been planned or any underlying design principles used, and lack of a proven track-record of success. Although such examples existed and were sometimes very successful, and could be considered good practice in themselves, there was too little data on how they worked and why they were successful – in other words why their good practice was actually 'good'. Consequently, the edutainment model hereto, especially if it was to provide a generic framework adaptable in many circumstances, had to be developed from first principles.

Such first principles could only be derived from well-trusted, well-proven case studies, designed deliberately to be edutainment and following definite educational or psychological underpinnings. Only well-founded robust examples, in the public domain, were actually chosen and so only successful edutainment case studies of good provenance were investigated. The other advantage of taking case studies from a field wider than just higher education teaching

itself was that commonalities could more readily be identified – see 3.3.3 where Vaughan (1995:181) points out that cases should be as diverse as possible so that 'generalizabilities' can become clear; in this context, It seems 'generalizabilities' can be taken to mean common underlying principles. The creation of such a model from first principles could, in time, prove useful as a generic baseline for evaluating practices already extant in higher education – in other words, those moots, business games and role-playing activities mentioned above.

5.1.3 Subjectivity and Interpretation Bias

The major issue here was the problem of too much subjectivity in interpretation of the many data sources used: that is, the interpretation of the main six data sources for the Student Trial Feedback and what each actually meant in reality. The seven sources for Lecturer Peer Feedback, although possibly containing some subjectivity, were considered complementary to the Student data.

With regards to the six Student Trial Feedback data sources (DS1 to DS6), the interviewing of students could be open to charges of interpretation bias as I, the interviewing researcher, the lecturer, and also the same person who had designed the teaching materials, had the most to gain from positive replies. To obviate this, all students interviewed were chosen to be those who had graduated from the programme altogether, in other words those who were no longer students as such but were recently graduated alumni and who had nothing to gain and nothing to lose in terms of grades. This was done in accordance with the requirements of the ethics appraisal exercise undertaken by the researcher's university right at the beginning and described in the methodology chapter 3.1. Of course, there was still the possible charge that even ex-students might wish to please an ex-lecturer to get a good work reference. To overcome this, an alternative lecturer was considered which would have reduced any conscious or unconscious bias, but such a lecturer, not being the original teacher, may have missed various points of reference from the teaching episodes and their significance; so this option was not considered. Therefore a certain residual bias may have been present in the interview sessions.

However, this cannot be said of the assumption made that the assessment marks were to be considered as true indications of the extent of deep learning – the higher the marks of a student the more their demonstration of deep learning, the lower the marks the more surface learning was demonstrated as implied in the Prosser and Trigwell PPP model discussed in literature review phase II. This assumption relied heavily on the lecturer's integrity and the efficacy of the university

assessment moderation process. However, this thesis accepts that the university recorded marks are an indication of the extent of deep learning; to refute this would be to call into question the entire university system.

Lastly, the weightings given to the six data sources were considered equal but each was appraised in a discrete fashion – in other words I only wanted a Yes or No to whether the data source indicated a positive indication of education enhancement as per the thesis question. Of course, some of the data sources were more significant – for instance Datasource DS2 Official Student Assessment Statistics were highly significant as an 'empirical' measure of whether education had been enhanced by edutainment or not, and if these had shown a drop in average assessment grades over the control and experimental years then the outcome of this thesis may have been more questionable. The other data sources DS1, DS3 and DS4, being based upon questionnaires and interviews, were assessments of the students 'perception' of the education they had received which is still highly relevant. DS5 (Lecturers Statement) and DS6 (Student Attendance Statistics) were more in the nature of supportive data. Of these six data sources, I was looking for a definite DS2 and a minimum of two of DS1, DS3 and DS4 to be able to give an overall positive view of whether enhancement had occurred or not; Anything not meeting these minimum criteria would have given a more questionable outcome. Of course, as it turned out, all six data sources gave positive, or non-negative, outcomes.

5.1.4 Limited Independent Appraisal of Final Model

A possible question arises concerning the limited use of independent appraisal of the final model. This thesis research was conducted using the action research(individualistric) paradigm – see Methodology 3.1 second paragraph where (Whitehead 1985:98; Stenhouse 1975; McNiff 2014:24) all supported the notion of action research performed by the lone practitioner to improve his/her own practice. Consequently, by definition, this research had only to improve the researcher's own teaching practice (borne out by the lecturer's own statement in appendix S) – it was not required to show that the practice of other lecturers would be similarly improved. However, the comments of lecturer peers have been included in this thesis on the understanding that all new ways of doing things, no matter how personal they may be to the researcher as an individual, can benefit by feedback from others; this remains a useful exercise even if peer lecturers do not themselves fully use the model.

Of course, a major problem in obtaining independent feedback was that evaluation of the model by other lecturers was clearly going to be difficult, if not impossible, as it was not feasible to force or cajole other lecturers to try it out in their own teaching practice. The only possibility of plausible input from others was if those others tried the model themselves voluntarily (and independently of the researcher hereto) or

were able otherwise to comment upon it in a formal academic setting such as a conference. By good fortune it was possible to obtain both of these types of feedback - see paragraph 3.7.2: 'Evaluating Lecturer Peer Feedback' – but this was not a foregone conclusion; lecturer colleagues may not have shown interest in the model at all and conferences may not have accepted the author's papers – there was a certain amount of serendipity in obtaining this feedback. However, once such feedback had been obtained, especially as it was positive towards the usefulness of the model in practice, it seemed counter-productive not to include it.

5.1.5 Limitation of Time-Triangulation Data to Only Two Years

With regard to the comparison over two years of students' assessment marks, it was taken for granted that the cohorts from two successive years were composed of students of comparative ability. There was no indication that students from the edutainment trial cohort 2013-14 were somehow more intelligent or gifted than the comparison control cohort of 2012-13. There were no indications that university acceptance policy on prerequisites for programme entry had altered or that the relative compositions of national background had altered or that the gender make-up had altered for some reason; in every sense the two cohorts appeared very similar in make-up.

The use of two different years, begs the question about whether the single control year of 2012-13 was insufficient and whether the assessment grades of the experimental year 2013-14 might have been better compared with more than one of the preceding years. However, although this would have been better practice, it was not possible as there were too many extraneous factors involved.

The curriculum content over the control year 2012-13 and the experimental year 2013-14 was deliberately kept the same so as to minimise disparities in the cohort teaching and not introduce variances that might be difficult to adjust for. This was highly important as true comparisons could not be made unless the two cohorts were very similar. There were many commonalities between the control year cohort 2012-13 and the experimental year 2013-14. Primarily they both covered identical curriculum content but this was not the case for the preceding year 2011-12, nor 2010-11 as in these years the course itself was called Network Security and the content was somewhat different. A change in content had had to be made as cybersecurity, as a subject, has a wider context than network security and is characterised by more rapid change and innovative developments. Also, the control year 2012-13 and experimental year 2013-14 cohorts were both taught in the same room at the same time of the week thus minimising extraneous environmental factors that might have had an affect. In addition the control and experimental years had no changes in UKBA (UK Border Agency) requirements that might have unduly altered the

student cohort make-up itself (90% of the students were from overseas) but this was not true of the preceding year 2011-12 where the UKBA had introduced more stringent rules which might have affected the makeup of the student cohort. It was therefore decided that comparing the experimental year 2013-14 with its immediately preceding year 2012-2013, however limited this comparison may have been, was preferable to the myriad of hidden distortions that may have been inherent in a wider comparison with other preceding years. To sum up, the whole rationale behind choosing 2012-13 and 2013-14 as the control and experimental years were that few extraneous factors were subject to change making it more likely that any changes between them were due to the edutainment approach alone.

5.2 Alternative Explanations

> 'A good discussion [conclusion] chapter openly acknowledges and evaluates rival explanations for the result' (Rudestam & Newton 1992).

With regards to alternative explanations for the results of this thesis I can think of only three possible explanations. Firstly, there is the possibility of absolute chicanery on my part; it might be that it is all made up, falsely fabricated beyond belief with not a shred of integrity about it. However, this is unlikely as I was closely (and very professionally) supervised, my references all (I hope) check out and, if need be, all the students could be followed up; I could have saved myself a whole lot of effort and done it much quicker if I had done this … but I didn't.

Secondly, the final model leans heavily on the work of Michael Knowles' andragogy work which emphasises work-based learning and problem-solving and also on Berthiaume's model of DPK which emphasises integration and synergy of various components. So it is possible that a PBL (Problem-Based Learning) approach might have yielded some similar results. However, comparing the five main tenets of PBL, when applied in a cyber security teaching environment as discussed in Chadwick and Gan (2011a), with those of this edutainment model gives few similarities that might result in PBL as a plausible alternative explanation – see Table 5.1:

PBL	EDUTAINMENT
Curricular content based on problem scenarios	Yes as per andragogy approach
Problem scenarios reflecting real world situations.	Yes as per andragogy approach
Encouraging students to learn by themselves	Not rejected but not mainstream to this approach
Having staff engaged as 'learning facilitators'	Not rejected but not mainstream to this approach
Encouraging students to learn together	Not rejected but not mainstream to this approach
Table 5.1 Comparison:Edutainment v.PBL	

So PBL does not look like a viable alternative explanation.

However, a much more plausible explanation, and one which must be tackled head-on, is that of a possible variation of the Hawthorne effect. Basically, the employees at the Hawthorne electrical plant in the 1920's, who were knowingly participants in an experiment to see what factors made them work harder and perform better, were later considered to have changed their behaviour due to the attention they were receiving from the researchers rather than because of any manipulation of independent variables. A simple definition of this Hawthorne effect was found in Oxford Dictionaries (2014) as: "The alteration of behaviour by the subjects of a study due to their awareness of being observed". However, the students in my study were not aware of this, they were not aware that the teaching they were receiving was in any way different from the teaching in the previous year, so the full definition of the effect is not met. However, I, as the researcher, may have been particularly conscientious and giving the students more attention than otherwise simply because I knew I was doing some research with them and that this, in itself, caused them to be happy and to work harder and not any of the artefacts of the edutainment approach itself. My belief is that I did not behave any differently consciously or unconsciously from any other year nor from any other cohort of students I may have taught and that any affects attributable to my behaviour were negligible; nonetheless this cannot be entirely ruled out. This was the thinking behind the last paragraph of the Data Collection and Analysis chapter where the final edutainment model was trialled by lecturers other than myself in fact by my university colleagues preparing materials for 'taster' courses for potential student applicants on open days. My colleagues reported favourably on the use of edutainment in this context which was encouraging but more importantly, their adoption of my model also had the effect of removing me, my character and teaching attributes, from the equation so to speak and

indicated that all the positive results from my own class trials were not necessarily artefacts of my own making. It showed to a limited extent that the model could be adopted by anybody and made to work and this is significant. Nonetheless, further work needs to be done to trial the model by other lecturers.

5.3 Surprises

The findings from the interviews in Step 5 were surprising. It had been envisaged that students, once having used the edutainment materials to learn the material required for their formal course, would then forget those materials and only remember the actual curriculum material that they should have then internalised as useful for their working careers. It had never been foreseen that students would use the edutainment techniques from the formal education to enhance how they learned in their own informal education using it as scaffolding for their examination revision and private affairs after they had left university. This was a complete surprise but a welcome surprise because it showed that the scaffolding approach of Vygotsky of teaching 'how to learn' as well as 'what to learn' had been useful.

Also surprising was that female students appeared to like edutainment more than their male counterparts. It is not known why this appeared to be so and follow-up work may be done to investigate this further. It may be that the use of humour and particularly narrative gave a softer feel to what could be hard, concrete technical concepts. My personal impression, after informally talking to some of the female students (not formally recorded here as not systematically collected in the research process) , is that the story element (narratives) involving people and their relationships were something they could identify with easily and this made the learning of the accompanying technical material much easier. Thus, this edutainment model could be a useful tool to be mentioned on websites such as GeekGurl (2015) and for mention within the STEMettes (2015) website. The 'Women In the STEM workforce' campaign reported in WISE (2015) reports that only 15% of the STEM workforce in the UK is female and that this percentage needs to be increased. It appears to me that any tool/method that might encourage girls to take up technical or partly-technical careers, and stick with them, might be welcomed. However, further work needs to be done here.

And perhaps the most surprising thing of all was that the overseas students liked it. They did not 'not dislike it' they actually 'liked it'. This was counter-intuitive for me, the researcher, as I thought

most resistance would come from this quarter. Humour and the following of narratives require good language skills and it is clear that non-indigenous students might have insufficient language flexibility. But this did not appear to be the case – again, they seemed to enjoy it. My only explanation is that perhaps the edutainment was also encouraging them to expand their vocabulary which they saw as a fortuitous extra. Again, more work needs to be done in this area.

The determination of students being overseas or otherwise was made from university statistics based upon student admissions data – not from whether the students spoke English as first language or not. It was, of course, quite possible that some students could be Home students and still not have English as first language. However, the overriding factor here was not whether students were overseas or not, it was whether those who had limited knowledge of English could fully follow humour especially as most humour is verbal. The research question for the thesis was not to establish differences in comprehension between different types of overseas students so no finer granularity of national origin was attempted- in other words, no breakdown was undertaken into African, Asian, South American and European students (all within the cohort) to see if any significant differences, nor between different countries in Africa. This is not to say that such further research might not produce some useful results and so further investigations might well form the basis of other doctoral theses.

A similar argument may be made for the inclusion of findings regarding gender differences.

From the findings it was noticed that female students might enjoy edutainment, or certain aspects of it, more than males. Again, it must be reiterated that the gender aspect was not part of the original thesis question nor it's sub-questions and so was not explored further.

Overall, the goal of this thesis was to establish whether the general cohort of cybersecurity students were positive or non-positive towards the use of edutainment in their cybersecurity teaching. Thorough investigation of peripheral issues such as the identified gender and overseas findings was not considered central to this research; however, it was considered that the role of all doctoral research was to point the way to further areas of exploration which could well form the basis of other doctoral theses.

5.4 The Future

It has been said that in everyday action research there is no beginning, middle or end … you are always somewhere in the middle, which does suggest that more work is possible. For future research, based around this thesis, I identify several courses of action: the collection of more data

sets on postgraduate cohorts studying cyber security in order to further substantiate (or otherwise) the model created hereto, the use of this model with other curriculum subjects and also with other (possible undergraduate) cohorts, and the option I would most like to pursue myself, is to find more case studies, but this time from practitioners in the field (i.e. other lecturers) and from third world countries to see what they are doing. Lastly, there is a need to explore further the edutainment psychologies behind use of humour, characterisation, games, narrative and music.

5.4.1 More Data Sets

In the methodology chapter I indicated that I had ignored fellow lecturers and their edutainment attempts because they were self-recommending, possibly haphazard with ad-hoc approaches and had little supporting data on how well their attempts worked. Now that a model is in existence it would be interesting to explore other practitioners' work as possible case studies in their own right to be fed into the model's further development. The model could then be trialled again with a new cohort of students and feedback obtained. This might indicate if the model has wide applicability to teaching in general and is truly flexible enough for ongoing revision as further data becomes available. Overall, there is no doubt that more research needs to be done with greater numbers of practitioners and students; the increased data sets might eventually yield some statistically significant proof that edutainment enhances education.

5.4.2 Examples from Third World Countries

Another area of possible future research is that of edutainment in third world countries. This thesis chose only one, Soul City, from the third world but my initial look into this shows that there are myriads of examples of edutainment all around the world most of which are unknown, unrecorded and unremarked upon by the western world academia. There is possibly much that western pedagogy could learn from these other countries if only the research were undertaken.

5.4.3 Extrapolation to a general model for Higher Education STEM Teaching

Howard and Sharp (1983:6) stated that doctoral work should "seek through methodical processes to add to one's own body of knowledge and … to that of others, by the discovery of non-trivial facts and insights" which does imply that adding to the researcher's knowledge alone may be quite a contribution in itself especially as McNiff (2014:24) commented that 'First-person action research is about individual researchers enquiring into their own practices …' . The researcher

herein has gained much from this thesis and, in addition, the model developed herein may very well be a step forward for lecturing staff in higher education generally and particularly if they are working with cohorts similar to those worked with in this thesis and covering topics similar to those herein. More statistics on students studying cyber security would validate (or otherwise) the findings herein. If all goes well the model might even be extended to cover teaching of other postgraduate teaching groups, say other STEM related subjects or even non-STEM subjects, and not necessarily postgraduate either.

A question arises whether any model produced from this research might be generalizable into use with other teaching subjects apart from cybersecurity? This appears to be highly possible as one of the reasons that general case studies were chosen rather than those already in use in cybersecurity teaching was that underlying principles of edutainment could be could be recognised – see 3.3.2 Criteria For Selecting Case Studies. The possibility of uncovering generic rules and guidelines from the literature review and the case studies analysis was considered to be a highly valuable goal much more useful than just identifying good practice principles for teaching cybersecurity alone. This model has been designed from the bottom up, from a set of basic generic principles to refinement into a specific model for a specific application. There appears to be no reason why those same generic principles cannot be adapted to fit different applications although it might be advisable to concentrate on STEM-type applications at first..

5.4.4 Expansion of the Model from Formal to Informal Education Practice

I would like to suggest that for future research the Learner –based Teaching Paradigms might need to be expanded from just andragogy to include pedagogy (for younger HE learners), through andragogy (for postgraduate learners) to heutagogy (for purely research students). In fact, I would like to add one more '-gogy': a possible 'epignosagogy' (pronounced 'epig', similar to epic, + nosser (rhymes with dosser) + gogy) derived from the Greek word 'epignosi' meaning 'awareness' and 'agogy' meaning 'teaching/learning/nurturing'). Epignosagogy would refer to techniques for teaching of awareness-raising material; so it does not set out to formally teach (with assessments, tutorial exercises, research tasks and so forth) but to informally raise awareness of areas of education as a possible precursor to more formal education. This certainly occurs in HE as I have already mentioned in the last paragraph of the Data Analysis chapter the taster sessions for school pupils given by my colleagues in the C-SAFE Centre at the University of Greenwich – see appendix T for details. It is possible that the case study Soul City (appendix G) and the Ebola Song

(appendix N) fit into this category as they are both definitely about raising awareness of social and health issues rather than teaching about them in a formal curriculum and assessment setting. This addition of 'raising awareness' to the status of an educational teaching paradigm in itself would be very useful for my edutainment model for it is common knowledge that raising awareness techniques (epignosagogy) play a big part, especially with edutainment techniques, in drawing young people into education per se and into particular areas of education (Chadwick et al 2016). I have in mind such products as 'popularising science' programmes by Prof. Brian Cox and the wildlife series of David Attenborough both of which are mild edutainment. In cyber security, the issue of raising awareness has become very important since the publication of the UK Government Cyber Security Strategy in 2011 (Clemente 2011). This was primarily about providing guidance for business and the public and resulted in public awareness campaigns such as (Get Safe Online 2015) for adults and 'Cyber Streetwise' for children (CyberStreetWise 2015). The knowledge presented in these two websites are relevant to those with limited or no prior knowledge in cyber security or those wishing to 'brush up'. This approach to teaching cyber security is evident in 'A Renewed Approach to Serious Games for Cyber Security' , the title of a paper by Le Compte et al (2015) who addresses the skills and competencies required for basic security. It is also the thinking behind the 'taster' sessions delivered by my colleagues mentioned in STEP 6 of the Data Collection and Analysis chapter who made use of the edutainment model herein. This notion of epignosagogical edutainment would extend the use of edutainment from the more formal to the more informal of educational needs and there appear to be three categories of person that the UK Government Cyber Security Strategy attempts to address: children, the adult public and practitioners (Clemente D 2011). It seems that education to raise awareness may be very useful for the first two categories. Children need to be made aware of grooming by paedophiles and cyber bullying and the adult public to be made aware of phishing, '419' frauds and dating frauds. The concept of epignosagogy cannot be ignored when discussing edutainment and cyber security as protecting children and adults by making them aware of threats is a valid form of education and so must be included in the edutainment model along with pedagogy, andragogy and heutagogy.

Returning to the model, the lecturer would presumably choose the mix of paradigms appropriate to the Learner Characteristics identified in the Presage stage. This approach is encouraged by Howard Gardner who said "For if the teacher is able to use different pedagogical approaches, there is the possibility of teaching more students in more effective ways" (Gardner 2009:107). Gardner, of course, was referring to his own concept of multiple-intelligences, that different students learn

in different ways, and that the more different the approaches taken in the teaching the more likely students were to find one that suits them. A good idea in principle but not practical in an individual sense, but nonetheless possibly useful in a cohort sense. The knowledge base for Teaching might be expanded to explicitly cover the psychological factors identified in the Literature review phase I as the mechanism behind 'synergy' between entertainment and education. The original model has taken the view that the psychological factors are attributes of the entertainment themes but, in time, it might be useful to bring them out as factors in their own right. However, this is all supposition – suffice it to say that more work could be done based upon the edutainment model created in this thesis.

In this thesis I have made much use of the work of two pioneers of the positive psychology movement especially the work on 'flow' of Professor Mihaly Csikszentmihalyi at Claremont Graduate University and the work of Professor Martin Seligman on 'positive emotions' at the Positive Psychology Center at the University of Pennsylvania. Martin Seligman is a pioneer of Positive Psychology, not simply because he has a systematic theory about what makes people happy, but because he uses the scientific method to explore it (positive psychologists pride themselves on being 'scientific').

R

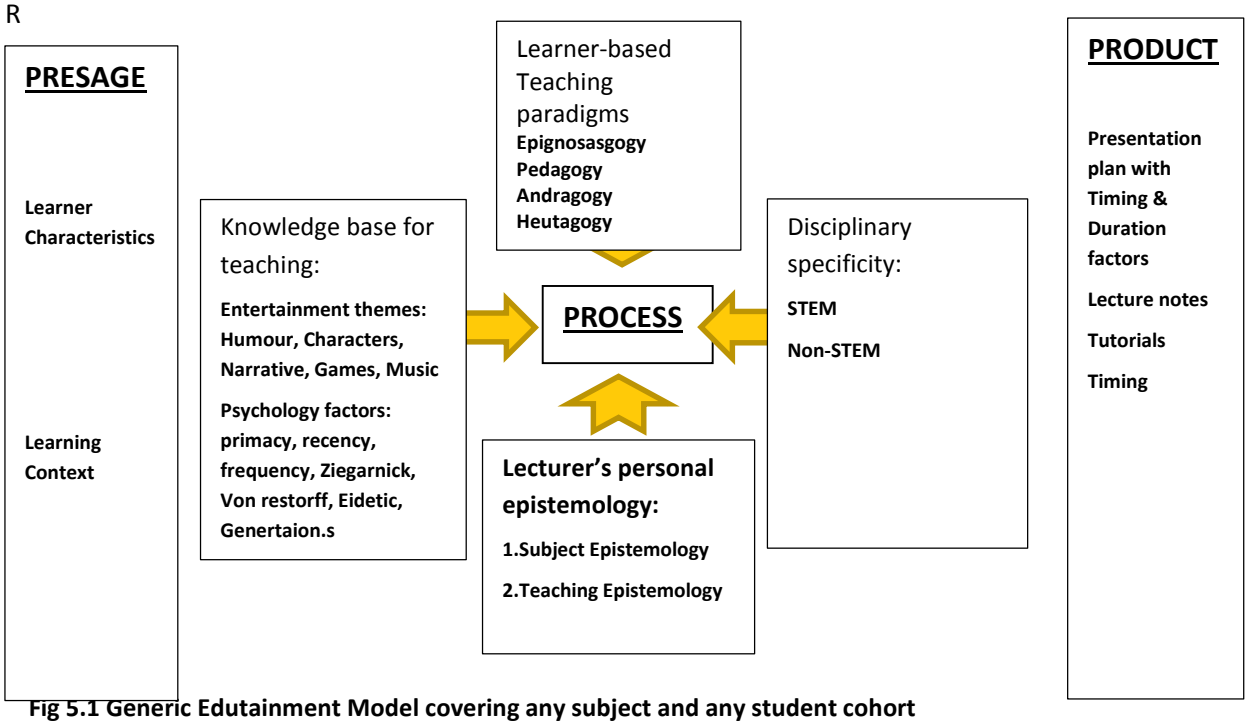


Fig 5.1 Generic Edutainment Model covering any subject and any student cohort

Coincidentally, there are many parallels between positive psychology and the work herein especially that they both shine a light on the benefits of positive emotions and it is possible that

more work on edutainment based around the first two of the three operational domains of attentive, affective and cognitive, might add significantly to the supporting literature of the positive psychology movement.

5.4.5 Research on Humour, Characterisation, Narrative, Music, Games

Lastly, I am sure each of the five edutainment elements of humour, narrative, characterisation, games and music has more depth than I have alluded to in this thesis There is no doubt that the humour element of edutainment for educational purposes has yet to be fully explored with a taxonomy of different types of humour and how they can be created for different learning situations. So, too, the narrative and characterisation elements; story-telling, role-playing and acting are possibly the oldest of the learning methods known to humans and there is no doubt that people respond to them as positively today as they have always done. Music, although not explored in depth in this thesis, may very well have further depths to its use in education. Lastly, the games element is a growing field especially in software-based so-called serious games and a taxonomy of different types of games such as single-user, multi-user, team-based and so forth as espoused by Buchanan et al (2011:3) and the different psychologies that accompany them might be worth further exploration. Serious software-based edutainment, especially incorporating more than one of the other edutainment elements of humour, narrative, characterisation, and music have much to offer the learning environment of the future.

6. CONCLUSION

> "Even though the action research may be about finding ways to improve a social situation, the research element is always about creating knowledge and generating theory*"* (McNiff 2014:55)

McNiff's statement above sets the scene for this chapter for we need to know if knowledge has been created and theory generated. Therefore, this Conclusion chapter addresses two pertinent areas: firstly, whether or not the research question and sub-questions have been satisfactorily answered and, secondly, whether this thesis is both original and a contribution to human knowledge.

6.1 Are the Research Questions Satisfactorily Answered?

The most important guides through the thesis were the three research questions posed at the outset, the main question and the two sub-questions. The main research question was :

'Is it possible to Define A Formal Model of Edutainment That Enhances Learning of Cyber Security Subjects by Higher education students?

And the two sub-questions were:

(i) What are the principles of successful edutainment?

(ii) How can the effect of these principles to enhance learning be assessed?

6.1.1 Sub-question 1: What are the principles of successful edutainment?

I attempted to answer this question by reviewing the literature on edutainment to identify the theoretical issues concerning edutainment and by analysing six selected case studies in the genre to identify the practical issues of delivery. My review of the literature involved searching for those theoretical principles that supported the formation of edutainment and would possibly form the components of a working model. The case study analyses were to ascertain if the theoretical issues identified actually occurred in reality and exactly how they were applied.

The relevance tree in appendix A shows the areas of theoretical concern that I identified as being of relevance and were subsequently addressed in the literature review. These topics were

considered to cover the entire research universe for the subject under review within the scope of this work applying , as it does, solely to postgraduate higher education, the teaching of a STEM related subject such as cyber security and within the UK educational system. I identified several principles.

Firstly, there were the five entertainment themes (Humour, Narrative, Characterisation, Gaming and Music) and although there might conceivably have been other areas the research was limited to these five. Secondly, the usefulness of an overall structuring model was identified and the timeline-process model of Presage-Process-Product described by (Prosser & Trigwell 2001) was adopted and adapted for use. Thirdly, the need for practitioner feedback during practical use was identified as a necessary feature as it would enhance the body of knowledge of edutainment over time, permit wider sharing of practical improvements amongst practitioners, and encourage staff practitioners to become more involved; the notion of PDS (Pedagogy as Design Science) described by (Laurillard 2012) and the notions of summative and formative feedback from the Sesame Street case study (Fisch & Truglio 2001: xvi) were recognised as main sources in this area. Fourthly, as the students were postgraduate, the peculiarities of mature student needs had to be addressed and the area of andragogy, based upon Michael Knowles' penetrating insights (Knowles 1980), was looked into. Lastly, the need for gaining 'blending and synergy' between educational material and entertainment was investigated through the DPK (Discipline-specific Pedagogic Knowledge) notion of Shulman and expanded upon by Berthiaume (Berthiaume 2007) (Shulman 1986). These five principles were identified as being necessary for the construction of a edutainment model that would be straightforward to follow.

The practical aspects of edutainment were explored through the six case studies analysed using coding techniques. This analysis established that the five factors identified through the literature review did, in fact, occur in reality. The methods of application were noted and were used later in the design of materials for trialling the drafted model. A further principle was recognised in that timing and duration (chunking) factors were of major importance in edutainment of all kinds.

It is believed that the use of these two methods, literature review and case study analysis, brought together both theoretical and practical principles which were later tested in the classroom experience and found to be beneficial. For teaching practitioners, I believe the model is sufficiently detailed to guide application but not too trivial to be dismissed. (De Bono 1976) paraphrased the teachers complaints *'...give us something simple we shall not be impressed ... because we shall claim to do it anyway. Give us something complicated we shall be impressed ... but unable to use*

it because it is complicated'. But perhaps the most useful thing is that the model is entirely composed of concepts that the average teaching practitioner is already aware of – they may not know the vocabulary, so may not recognise the term 'epistemology' nor the term 'andragogy', but they do recognise the practice in reality. Therefore the learning curve for teachers should not be too steep; this model should not be too difficult for practitioners to get to grips with (and this is important!).

6.1.2 Sub-question 2 : How can the effect of these principles to enhance learning be assessed?

This was perhaps the most difficult part of the thesis. I decided to use as many data sources as possible in order to benefit from tri-angulation and to have both quantitative and qualitative data sources. In the end six sources were used: official university surveys, assessment and attendance statistics, researcher's survey and interviews of students and researcher's own statement. Although the feedback from the students was highly pertinent in itself it only showed one aspect of enhancement; the students' personal feelings, however positive, only showed what they felt about the teaching process and not whether the learning was better this year relative to learning in the previous year. Hence, it was important for me to introduce the comparison of marks from one year 2012-13 to another 2013-14 as this, if anything, was the true pointer towards enhancement on the understanding that enhancement supposes improvement over an existing baseline of some kind. The marks do indeed show that student performance improved from one year to the next so, coupled with the favourable comments from the students themselves, one is justified in saying that enhancement can indeed be assessed.

Main research question: **Is it possible to Define A Formal Model of Edutainment That Enhances Learning of Cyber Security Subjects by Higher education students?**

I believe that the main research question has been satisfactorily answered in a positive light. There are two issues to be evaluated here: (i) *has it been possible to define an edutainment model?* and (ii) *does that model, when followed, enhance learning?*

With regards to the first issue of defining a formal model of edutainment, some problematic issues arose. Despite investigations in the literature review following the Relevance Tree shown in appendix A and the coding analyses of the six case studies shown in appendices C through to H, there was the question of which issues to consider for a possible model, or give a major role to,

and which to ignore, or give a minor role to. At first sight everything seemed relevant but the work of (Jung & Latchen 2011:7) discussed in the Methodology step 4, in their paper concerning the building of a model for e-education, stated that 'theoretical frameworks and models' should (i) create conceptual order, (ii) provide simple ways of describing complex phenomena and (iii) illuminate areas where further theoretical and empirical inquiries are needed. These three areas, order, simplicity and research, were adopted as criteria for prioritising what features should be included in the final model. It is considered that the final model created here is the most optimum construct that could have been derived. 'Conceptual order' was obtained through the Prosser & Trigwell (2001:7) PPP construct and the Berthiaume (2009) DPK construct. 'Further research' was accomplished through the notions of summative and formative feedback from the Sesame Street case study mentioned in Fisch and Truglio (2001: xvi) as well as the work of practitioner to practitioner feedback as envisaged by Laurillard (2012). And, lastly, 'simplicity' was accomplished by limiting all the salient factors to the most important and building in sufficient flexibility for practitioner improvisation. The inclusion of the entertainment themes within the model and the lecturer's epistemology were mandatory as entertainment was implied within edutainment anyway and epistemology was part of the chosen DPK model. Therefore it is believed that it was possible to define a model of edutainment that was a 'formal' model based upon sound factors derived from public domain data sources and case studies chosen using criteria from a previously successful model-building exercise (Jung & Latchem 2011:7).

The second issue was whether the formal model actually enhanced learning. This is different to sub-question 2 which concerned whether enhancement could be measured and not whether it actually occurred or not. In the end six data sources were used: university official end-of-year student survey, university official end-of-year assessment marks, university official attendance statistics, researcher's survey of students, researcher's interviews of students, and researcher's own statement. These sources all reported positively on edutainment as a teaching approach from three stakeholder positions: student, lecturer, university administration. They showed that the students had not only enjoyed the experience of an edutainment based teaching but had performed better in their assessments in the experimental year 2013-14 than in the previous control year 2012-13. The lecturer's statement overall was a positive indictment on how the teaching went, and the official statistics would be very acceptable to the university management. Whichever stakeholder perspective is chosen, the edutainment approach appeared positive and so it may be surmised that the edutainment model did deliver enhanced learning in comparison with learning that did not use the edutainment model.

6.2 The Final Model

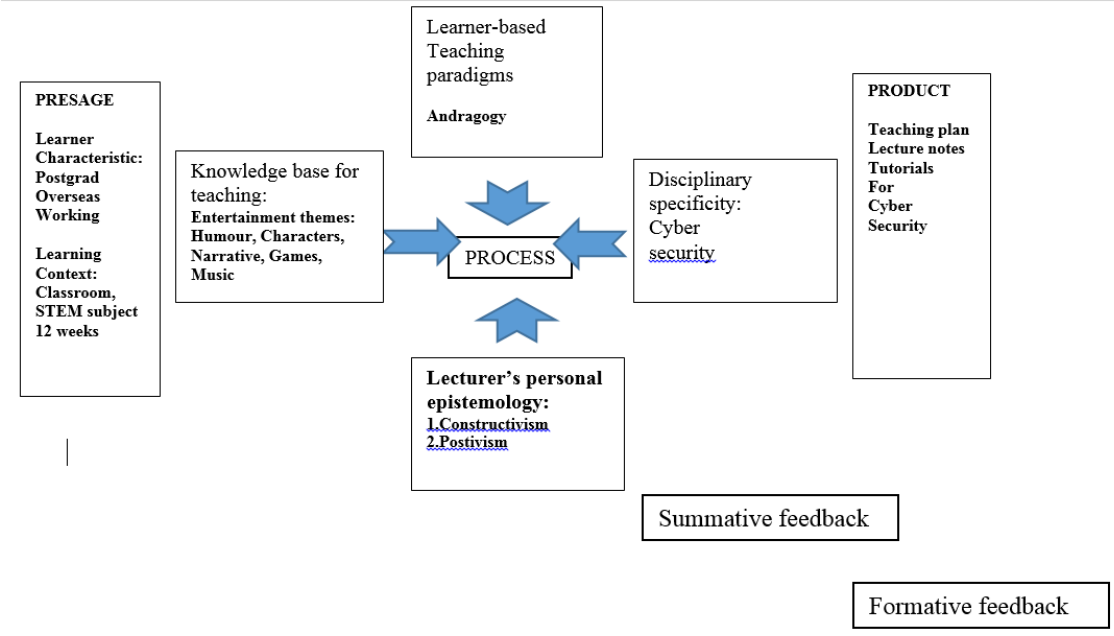


Fig. 6.1 Final Model for Edutainment for Teaching Cyber Security in HE

In my opinion the final model meets the two operational criteria that I defined throughout the thesis. The first operational criterion was that the model of edutainment had to produce an edutainment product that met the definition of edutainment determined during the Introduction chapter. The second operational criterion was that the final model had to operate in the three domains: attentive, affective and cognitive determined during the literature review phase II.

The first operational criterion was that edutainment produced by the final model should be consistent with the definition: "*Edutainment is a synergistic blend of education and entertainment that through the use of fun and play, supporting creativity and curiosity, can produce a deeper and lifelong learning experience*". I believe that the model produces artefacts consistent with the above definition. There is certainly an attempt to integrate education and entertainment through the DPK approach, there is certainly the application of entertainment themes involving play (humour and narrative) support for creativity and curiosity (games) and the assessment statistics seem to show that learning is deeper (through better marks) and the student interviews feedback

seems to suggest that students will adopt the edutainment techniques for their own learning after they have left the university course.

The second criterion involving the three posits of operation derived in the literature review phase II: attentive, affective, cognitive, seems also to have been met. The student feedback indicates that they certainly enjoyed the course, that emotionally they engaged with it, the course materials, the class contact and the assessments. The materials produced as part of the experimental classroom trial certainly had 'cognitive' effect being based around the curriculum content so that direct 'scaffolding' was produced in the Vygotskian sense. As for attention, it was somewhat problematical to measure this but a rudimentary statistic was uncovered in that attendance rose from an average of 78% attendance per lecture to an average 81% over the two years of measurement. Bearing in mind that most of the students were overseas and so had to attend regularly as per UKBA (United Kingdom Border Agency) and many had to provide proof of attendance for their own embassies and fee-paying bodies, it was a wonder that any improvement was noticeable at all but, at least, it was not negative which would have been harder to explain.

Not only do I believe the model met its two operational requirements as above but it did perform well in the classroom trial phase, and showed that its component parts were well chosen and integrated well in practice. I did rely on some of my previous experience of building a spreadsheet development model - a completely different application but nonetheless model-building (Chadwick et al 1997, 1999, 2000; Chadwick 2000, 2002; Chadwick and Rajalingham 1998). However, for this thesis the discovery of the PPP (Presage-Process-Product) approach through the writings of (Prosser and Trigwell 2001) was not just a piece of good luck, it was heaven sent. It adapted so well for structuring all stages of the thesis that I am not sure how I would have coped without it. The notion of Presage, or the starting situation, was particularly pertinent as every process must start with some pre-conditions some of which are helpful and some not so and these both needed to be explicitly identified. The Process stage with it's DPK (Discipline-specific Pedagogic Knowledge) model of Berthiaume (2007,2009) which was based upon the work of Shulman (1986), and which formed the heart of the Process phase, was highly useful – for it met the basic criteria for demonstrating a synergistic process combining education and entertainment. This was important as edutainment had to be more than just combining education with a bit of entertainment – the two had to work together. Although Shulman's original PCK model had only two inputs (Pedagogy + Content) and probably would have sufficed for my model, Berthiaume's extended model with three inputs (Pedagogy + Content + Lecturer Epistemology) seemed to be more thorough. I did worry about the inclusion of anything to do with epistemology as few of my

colleagues could actually spell the word never mind know what it meant but having myself looked into epistemology for this thesis research I realised the importance of including it; at postgraduate level, which this work is all about, students need an appreciation of how we know what we know and how truth can be proven or otherwise. Of course, having the lecturer as an input within the DPK model and not the student seemed too unbalanced – they are both the major stakeholders in edutainment and so, I reasoned, if one was included then so must the other. In fact, including the student and the student characteristics within the DPK model enabled the andragogy principles of Knowles (1980) to be more easily brought to the fore which was highly desirable. The Product stage enabled the detail of artefacts to be explored and gave some robustness to the whole thing. Lastly, the inclusion of summative and formative feedback flows, borrowed from the Sesame Street case study described in Morrow (2008:77) and which was successfully used within their programme production over 40 years, I believe, completed the model admirably by giving an element of flexibility and capability of change over time (which surely every model should have?). The feedback from the students indicated that the edutainment products were well received and it did seem that enhancement of learning could occur by adopting such an approach. I am therefore pleased with the outcome.

6.3 Thesis Originality and Contribution to Human Knowledge

Was this work both original and a contribution to human knowledge – or have models of this type, or something similar, been created already?' As Howard and Sharp (1983:6) put it, the thesis must "seek through methodical processes to add to one's own body of knowledge and … to that of others, by the discovery of non-trivial facts and insights", a definition which implies both originality and knowledge contribution. I believe that this thesis has attempted structured, well justified 'methodical processes' which can stand scrutiny and that it's outcome of an edutainment model is composed of 'non-trivial facts and insights' integrated in a robust fashion. In addition, I know for a fact that I have added to my 'own body of knowledge', which is what I set out to do using the individual-based action research paradigm, and that, as my model has been used by other lecturers independently of me, that I have added to the knowledge 'of others'.

6.3.1 Thesis Originality

I believe that this thesis does embody significantly original work. Of course, it is based upon data that already exists in the world, such as the case studies, the variety of psychological concepts that

have been used and the work of previous researchers in education but I feel that these features have been put together in a way not previously considered. As Einstein said (and I don't for one second compare myself with him) "If I have seen further than others it is because I have stood on the shoulders of giants" so I do acknowledge all those whose shoulders I have stood upon, which are quite a few. However, there are two instances of insight that I do consider most original and of which I am very proud. The first is that I managed to explain how education and entertainment could be synergistically linked through their shared goals of audience participation (attentive and affective) and their shared psychologies (primacy, recency, repetition,Von Restorff, Zeigarnick, Eidetic, Generation, Cognitive Load) – see 2.1.7. To my knowledge such a thing has never been done before and was immensely significant. If I had been unable to show how this synergy might have worked then the resultant model would have been built on shallow foundations. The second instance is that of creating the word epignosagogy – see 5.4.4. I felt that education needed another word in addition to pedagogy, andragogy and heutagogy to describe the process of teaching awareness raising. This thesis has already shown the use of the edutainment model in taster sessions for student applicants and demonstrations at student careers events yet more 'awareness raising' events will be forthcoming in the near future. There will be schools outreach where cybersecurity taster teams will visit secondary schools and public outreach where short (one day) courses will be presented for teaching local businesspeople how to keep their businesses secure online (Greenwich Connect 2016). It seems that such short events designed to create immediate impact, teach a simplified message and leave a strong memory, themselves require much consideration and planning. I believe that my edutainment model has much to offer such epignosagogic events as it contains all the ingredients necessary for creating products of quick appeal, strong attention-retention, positive feelings and quick understanding of sometimes highly complex concepts.

6.3.2 Thesis Contribution to Human Knowledge

Would this work be a contribution to human knowledge or as Rudestam & Newton (1992: 46) put it, "would it be both important and timely". I do believe that this has been accomplished. As McNiff (2014:24) put it 'First-person action research is about individual researchers enquiring into their own practices …'. On this basis, the first-person action research adopted herein has improved the practice of the researcher himself and, in this limited sense, the thesis has been a contribution to the human knowledge of one individual. But what of the wider community? Surely, any novel

teaching approach that can be demonstrated to enhance learning, and is feasible to use in a practical sense, must be worthy of some consideration. Experimenting with novel ways of learning and teaching is paramount for teachers today. Universities are continually under pressure from their funding bodies (usually the government) to improve learning amongst their student populations and they have only one way of officially showing such improvement in learning over time : the official annual statistics showing average pass marks (mean and median) and the numbers obtaining different classifications of degree. But there are two ways in which these statistics can show improvement: (i) there is a genuine attempt to improve learning by experimenting with new techniques of teaching and choosing the ones that are effective in practice or (ii) altering the acceptance ranges of marks so that more students appear in higher categories, a strategy known as 'dumbing down'. The Express (2015) news website reported that 70% of undergraduate students were achieving 2.1 or higher and questioned whether this was really acceptable. Whichever way the truth may lie, and I take no particular view on what this truth might be, this thesis does recognise that trying to improve the learning process itself has some merit (whereas 'dumbing-down' may be somewhat questionable!!). Formal learning in an institution of learning involves either the transference of knowledge or the facilitation of self-learning, both of which revolve around human to human interaction of some kind. This interaction can be direct (face-to-face i.e lecturer to student)) or indirect (lecturer provided materials to student i.e written notes, video etc). Either way the learning must involve psychological functions of some kind between how the lecturer expresses the learning artefacts and how the student interprets and accepts those artefacts.

An even more interesting conjecture is whether use of the edutainment approach and its emphasis on attentive, affective and cognitive learning outcomes not only changed how the students learned but also perhaps changed how the teacher taught. Could it be that the lecturer subconsciously became more attentive to the students (which is good), really did become more positive in their teaching approach and enjoyed it more themselves (which is good) and really did start learning (perhaps becoming more self-reflective) about their own teaching approach (which is good)? In Gunn & Fisk (2014:31), a paper from the HEA entitled 'Considering teaching Excellence in Higher Education: 2007-2013', a point is made about "excellent teachers' that they 'never stop thinking in detail about how to be better teachers, and listening and responding to their students". It may be that this model of edutainment hereto, especially it's process proscription of how edutainment should be created, itself forces teachers to be more aware of what they are doing and that this, in itself, improves the service they give. There is no reason why the Hawthorne Effect should not be

put to good use – after all, if paying attention to people improves their performance (which is essentially what Hawthorne was implying) then any teaching system that causes teachers to pay more attention to students and their own method of teaching might have something going for it.

6.4 Postscript

Fortunately, I have found a quotation that encapsulates this entire thesis; it is by Alan Pritchard of the University of Warwick Institute of Education, UK and goes: "Thanks to detailed brain research, largely undertaken by neuroscientists and related to teaching by psychologists … we have at our disposal a good deal of information about how the brain is likely to function to fulfil its full potential. Fun, excitement and positive relationships are almost prerequisite for learning to reach its full potential. Teachers are not charged with turning every classroom event into a comedy show but laughter and real enjoyment do lead to starting points for learning with great possibilities for effective learning" (Pritchard 2009: 103). Pritchard could very well have been speaking about the entire concept of edutainment described in this thesis. However, to sum up in my own words, I would like to refer to what Ernest Hemingway called his shortest novel. It was only six words long and read: '*For sale: baby shoes: never worn' (*McNiff 2014:94). Perhaps a similar six word novel, summing up this thesis, and covering the three operational goals of attentive, affective and cognitive, might be:

'They listened: they laughed: they learned'.

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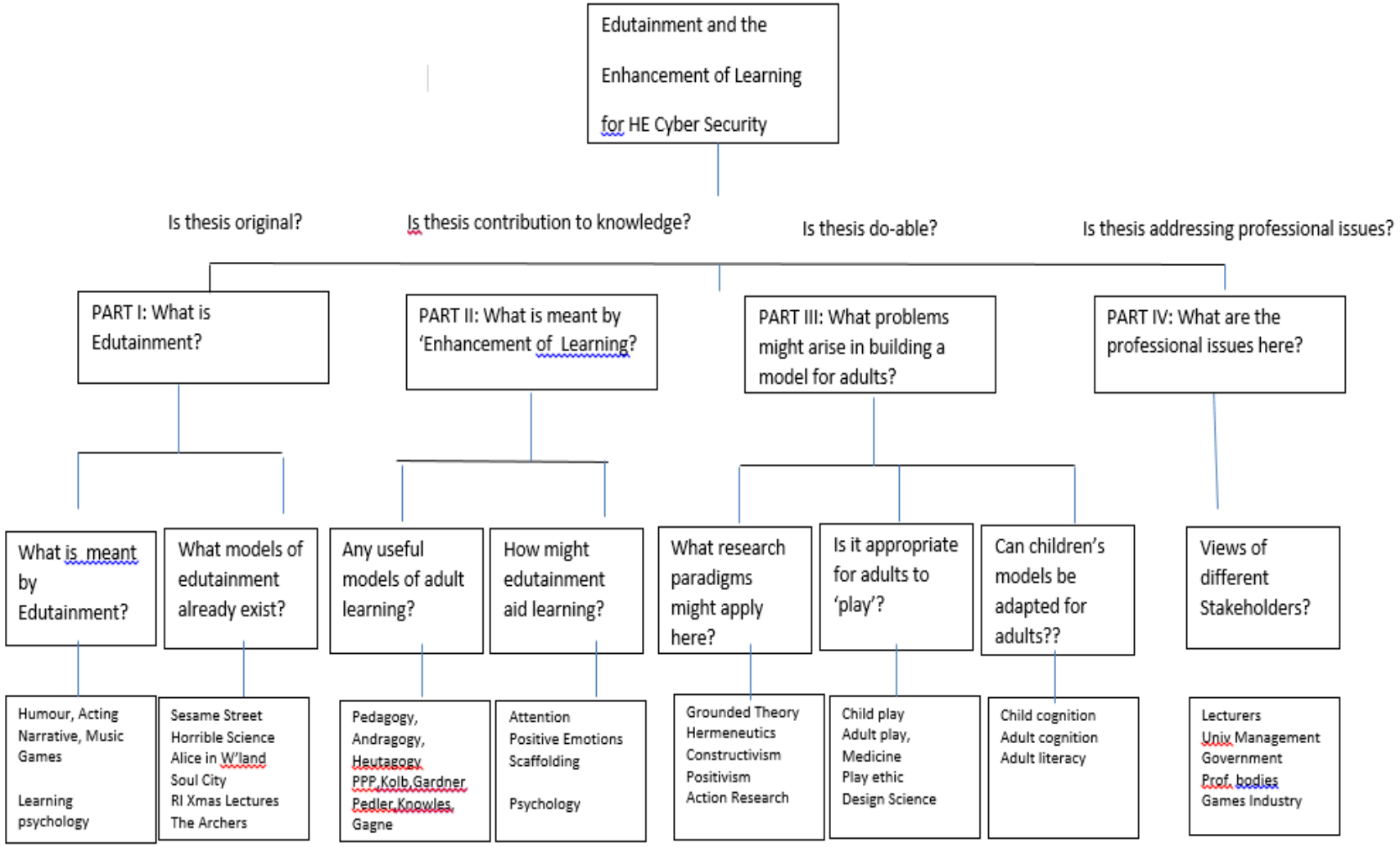
GLOSSARY OF TECHNICAL TERMS, PHRASES AND ACRONYMS

Action Research: McNiff (2014:62) : to actively engage in the action of understanding practice and generating theory from within.
BCS : British Computer Society
CEH : Certified Ethical Hacker
CISA: Certified Information Systems Auditor
CISM: Certified Information Security Manager
CISSP: Certified Information Systems Security Professional
Coding: ascription of a category label to a piece of data with the category label either decided in advance or in response to the data that have been collected
DPK: Discipline-specific Pedagogic Knowledge) as proposed by Shulman and Berthiaume.
Entertainment: Action of providing or being provided with amusement or enjoyment
ISACA : Information System Audit & Control Association
ISC^2 : International Information Systems Security Certification Consortium
Model: Smith (1999) : characterised by the use of analogies or metaphors to give a more visual or graphic representation with the task of simplifying as an aid to explanation and conceptualisation
Motivation: the process of being mentally stimulated to do or feel something, especially to do something creative – a hope or ambition of achieving something.
PERMA Model : stands for the five essential elements that should be in place for us to experience lasting well-being. These are: Positive Emotion, Engagement, Positive Relationships, Meaning Accomplishment/Achievement.
Personal questions: what the researcher must ask of their own stance and values
Research questions: those that that direct and form the major planks of the enquiry
Field questions: direct the collection of data to meet the research questions
PPP : timeline process model containing prerequisites (Presage), timeline functionalities (Process), and a resultant artefact(s) (Product).
PDS: Pedagogy as Design Science as proposed by D.Laurillard
Stress: A state of emotional strain or tension resulting from demanding circumstances
Triangulation: Cohen et al (2005:112): "the use of two or more methods of data collection in the study of some aspect of human behaviour"
Unitizing and Categorising: process of identifying relevant information units in the text and placing of such units into categories according to similarity in meaning
UREC: University Research Ethics Committee

APPENDICES

APPENDIX A: STRUCTURE OF LITERATURE REVIEW



Relevance Tree : Showing Questions for Planning the approach to Literature Reviews Based on (Sharp et al 2004:84)s

Appendix B: Laughter Therapy

Laughter therapy at Cancer Treatment Centres of America (CTCA)

What is laughter therapy? We were born with the gift of laughter. Laughter is a natural medicine. It lifts our spirits and makes us feel happy. Laughter is a contagious emotion. It can bring people together. It can help us feel more alive and empowered. Laughter therapy, also called humour therapy, is the use of humour to promote overall health and wellness. It aims to use the natural physiological process of laughter to help relieve physical or emotional stresses or discomfort.

Research supporting laughter therapy

A growing body of research supports the theory that laughter may have therapeutic value. For years, the use of humour has been used in medicine. Surgeons used humour to distract patients from pain as early as the 13th century. Later, in the 20th century, came the scientific study of the effect of humour on physical wellness. Many credit this to Norman Cousins. After years of prolonged pain from a serious illness, Cousins claims to have cured himself with a self-invented regimen of laughter and vitamins. In his 1979 book Anatomy of an Illness, Cousins describes how watching comedic movies helped him recover. Over the years, researchers have conducted studies to explore the impact of laughter on health. After evaluating participants before and after a humorous event (i.e., a comedy video), studies have revealed that episodes of laughter helped to reduce pain, decrease stress-related hormones and boost the immune system in participants. Today more than ever before, people are turning to humour for therapy and healing. Medical journals have acknowledged that laughter therapy can help improve quality of life for patients with chronic illnesses. Many hospitals now offer laughter therapy programs as a complementary treatment to illness.

The healing power of laughter

For people living with cancer, it may seem strange to find humour when facing such serious issues. Yet, laughter can be helpful in ways you might not have realized or imagined. Laughter can help you feel better about yourself and the world around you. Laughter can be a natural diversion. When you laugh, no other thought comes to mind. Laughing can also induce physical changes in the body. After laughing for only a few minutes, you may feel better for hours. When used in addition to conventional cancer treatments, laughter therapy may help in the overall healing process. According to some studies, laughter therapy may provide physical benefits, such as helping to:

- Boost the immune system and circulatory system
- Enhance oxygen intake
- Stimulate the heart and lungs
- Relax muscles throughout the body
- Trigger the release of endorphins (the body's natural painkillers)
- Ease digestion/soothes stomach aches
- Relieve pain
- Balance blood pressure
- Improve mental functions (i.e., alertness, memory, creativity)

Laughter therapy may also help to:

- Improve overall attitude
- Reduce stress/tension
- Promote relaxation
- Improve sleep
- Enhance quality of life
- Strengthen social bonds and relationships
- Produce a general sense of well-being

Laughter therapy at CTCA

At Cancer Treatment Centers of America (CTCA), we fight cancer using an integrative approach. Our Mind-Body Medicine Department offers supportive options, including laughter therapy, to help you cope as you receive conventional cancer treatments. Laughter therapy strives to help you use and enjoy laughter as a tool for healing. Dr. Katherine Puckett, National Director of Mind-Body Medicine at CTCA, first introduced laughter therapy to Midwestern Regional Medical Center upon a patient's request.

CTCA offers humour therapy sessions, also known as Laughter Clubs or humor groups, to help cancer patients and their families use and enjoy laughter as a tool for healing. These leader-led groups take patients through a number of laugh-related exercises including fake laughter and laughter greetings. Laughter Club is based not on humour or jokes, but rather on laughter as a physical exercise. One group laughter exercise involves patients standing in a circle, with the leader in the middle. Patients put their fingertips on their cheekbones, chest or lower abdomen and make “ha ha” or “hee hee” sounds until they felt vibrations through their bodies. Dr. Puckett says during these exercises, it is hard for people not to join in because laughter is so contagious. According to Dr. Puckett, at the end of a laughter therapy session, patients have said things like "I didn't even think about cancer during Laughter Club" and "That felt great! Things have been so hard that we hadn't laughed in months." Dr. Puckett adds that, just recently, the eight-year-old daughter of a CTCA patient who attended Laughter Club said afterwards: "I never thought about laughing everyday, but now I realize I can. Like even when I don't feel happy, I can still laugh and feel better."

http://www.cancercenter.com/treatments/laughter-therapy/

APPENDIX C: PPP ANALYSIS OF CASE STUDY 'ALICE IN WONDERLAND'

BACKGROUND

Lewis Carroll was the pen name of Charles Lutwidge Dodgson, a mathematics lecturer from Christchurch College, Oxford University. Dodgson taught the mathematics of the day but specialised in teaching logic and syllogisms. He was somewhat of a traditionalist and did not approve of the 'new' mathematics of imaginary numbers that were then being researched throughout the mathematics academia.

And Alice? In mid-Victorian times it was customary amongst the middle-classes for children to be taught by a governess from the age of 5 to the age of 8. From 8 onwards the boys would be sent to boarding school and the girls would continue at home with the governess. However, amongst academic communities, the girls would continue at home to be taught not by a governess but by the other academics i.e. the English lecturer would teach English to all the girl children and so forth. This is how Dodgson came to be teaching the elements of mathematics and logic to the three daughters, Edith, Alice and Lorina, of the Dean of Christchurch, Henry Liddell. It was to the middle daughter, Alice, to whom he directed his story one afternoon in July 1862 when he and his friend Robinson Duckworth took the three Liddell girls for a boat trip to Godstow. His first manuscript 'Alice's Adventures Underground' was accepted for publication in 1865 under the revised title 'Alice's Adventures in Wonderland'.

CRITERIA FOR CHOOSING AS A CASE STUDY

Applicability : The Alice books are a form of Edutainment – there is evidence they were designed by Carroll as a piece of edutainment for the Liddell sisters he was teaching at the time. One of his follow up books [Carroll L 1958] sought to explain some of the logical and mathematical problems in the Alice books. Also, Carroll's later book – *Sylvie and Bruno* [Carroll L 2001] – was very obviously designed as edutainment from the outset. Lewis Carroll's Alice books meet the test of applicability.

Longevity : The Alice stories have been in continuous print since Alice in Wonderland was first published in 1865 [Wilson R 2009, p109] and Through the Looking Glass in 1871. Despite the age of these texts, they are still part of children's reading even 150 years later. The style, content, language, characterisation and humour seem to be as relevant today as when first written. Clear evidence of this may be verified by the fact the high street based The Works bookshop retailer stocks copies of *The Complete Stories and Poems of Lewis Carroll* (Carroll L 2001). The books have certainly met the test of time.

Resilience : The Alice stories have also met the test of competition from other children's writers whether edutainment or just plain entertainment. Apart from all the children's texts that have come and disappeared in 150 years Alice has survived alongside 'Swallows and Amazons', the Enid Blyton books 'The Secret Five', the'Hobbit' and 'Lord of the Rings', and more recently the 'Harry Potter' series of books by J K Rowling. This is not to infer that these other texts do not have their merits either as edutainment or entertainment but it does seem remarkable that a text from so long

ago, written by an unmarried university lecturer in an obscure area of mathematics, should be still popular with children today. 'Alice' has certainly met the test of marketplace competition.

Universality : The Alice stories have been published and distributed to almost 50 countries in the world showing their world-wide acceptance in English-speaking countries [Gardner M 2001]. They have met the test of universal acceptance.

Academic Scrutiny : The Alice books have been subject to rigorous academic research over the last century and are still being researched even today. One of the most notable researchers recently was Melanie Bayley who was a DPhil candidate at the University of Oxford with her work being supported by the UK's Humanities and Arts Research Council (Bayley 2010).

PPP ANALYSIS

The following codes, derived in the Data Collection & Analysis chapter Table 4.4 were used in this analysis**.**

	Meaning in this context	**Analysis Code**
Presage	Learning Context and Learner Characteristics	Pe-Co, Pe-Ch
Process	DPK, Andragogy, Feedback	Ps-DPK, Ps-A, Ps-F
Product	Humour, Narrative, Games, Characterisation, Music	Pt-H,Pt-N,Pt-G,Pt-C,Pt-M
	Codes used for Case study analysis	

The data sources used for analysis in this case study are Carroll (2001), Wilson (2009), Gardner (2001), Bayley (2010). (Carroll 2001) is essentially the complete original works of Lewis Carroll whilst (Gardner 2001) is the famous 'the annotated Alice' which contains the original script of 'Alice in Wonderland' along with annotations to explain sayings, phrases, historical peculiarities and so forth. This thesis analysis relies heavily on Gardner's book. (Wilson 2009) and (Bayley 2010) are both mathematicians exploring the hidden logic, numeracy and syllogisms within the Alice book.

PPP-PRESAGE STAGE (code prefix Pe)

Learning Context Pe-Co

Robin Wilson, Professor of Mathematic at the Open University, seems to believe that Carroll really was deliberately writing edutainment: talking of Carroll's teaching tasks of the three Liddell sisters he says ' *[Carroll] varied his lessons with stories and puzzles and may have been the first to use recreational topics for conveying serious mathematical* ideas' [Wilson R 2009]. Also, as part of his lecturing work, and to earn some money, Carroll was obliged to teach mathematics to local schoolchildren and it was here that perhaps his 'edutainment' approach first developed.

Learner Characteristics Pe-Ch

Carroll's published materials do not throw much light onto his 'process' of creation except perhaps one – his last long book 'Sylvie and Bruno' – which, of course, few people have ever heard of. But in terms of why he wrote Sylvie and Bruno Carroll L 2001: 104) says '*It is written, not for money, and not for fame, but in the hope of supplying, for the children whom I love, some thoughts that may suit those hours of innocent merriment which are the very life of Childhood; and also in the hope of suggesting, to them and to others, some thoughts that may prove, I would fain hope, not wholly out of harmony with the graver cadences of life."* Clearly he wrote for children and their entertainment ("merriment" as he called it) and setting aside the meaning of the word 'love' (which could be variously interpreted in today's climate of child protection) he did intimate that he wanted them to learn something of the '*graver cadences of life*'; and not only the children but also '*and to others*'. What he meant by 'graver cadences of life' is not clear as the word 'cadence' appertains to rhythm and sound and who these 'others' were we do not know but we might guess that he was referring to adults who might also learn from his story. This thesis has identified three audiences that Carroll might have been writing for: children, middle-class adults with general education and professional mathematicians. Even today, – most people encounter Alice as children and on this level it reads as a long narrative interspersed with odd characters. What is not immediately obvious is that many of the included character-situations were vignettes that contained topical scientific issues of the day that most educated persons would have been aware of. But at a much deeper level were issues of significant mathematical debate in which Carroll questioned and sometimes ridiculed rival mathematicians.

PPP - PROCESS STAGE (code prefix Ps)

Carroll seems not to have said much about how he went about creating his stories. This thesis did not attempt a hermeneutics approach to dissecting Carroll's works – this was best left to the literature experts but review of Carroll's works was undertaken to ascertain his creation process. In his 'Tangled Tale', a serial published in the Monthly Packet in 1880 and consisting of a number of Knots or mathematical problems to be solved, Carroll (2001:270) says of himself '*the writer's intention was to embody in each Knot (like the medicine so dextrously but ineffectually, concealed in the jam of our early childhood) one or more mathematical questions – in arithmetic, algebra or geometry as the case may be –for the amusement and edification of the fair readers of that magazine*." So if we substitute 'education' for 'edification' and 'entertainment' for 'jam' we have edutainment; it seems to be clear that he wished to amuse and educate at the same time. The actual process of this edutainment creation was perhaps best summed up in the preface to 'Sylvie and Bruno' where Carroll (2001:103) gives perhaps the only published insight into his creative process; he says "*I jotted down at odd moments, all sorts of odd ideas, and fragments of dialogue, that occurred to me*" and "*such again, have been passages which occurred in dreams and which I cannot trace to any antecedent cause whatever*". He cites one particular case, that of the famous poem 'The Hunting of the Snark' "*which came into my head quite suddenly, during a solitary walk*" Carroll (2001:103). In fact, Carroll sums up his own process of creation with: "*the story had to grow out of these incidents, not the incidents out of the story*" . So it appears he assembled an

assortment of narrative ideas, snatches of dialogue, pieces of logic and mathematics that he wanted to put over and then welded them together with a long connecting narrative and a little bit of humour. Or as he says himself "*I found myself at last in possession of a huge unwieldy mass of litterature – if the reader will kindly excuse the spelling – which only needed stringing together, upon the thread of a consecutive story*". So that is how he did it.

Carroll's process, such as it was, did seem to demonstrate elements of what we now call DPK (code Ps-DPK). It did not exhibit any Andragogy (code Ps-A) as such but then this would not have been expected as his prime audience was children and young persons and not adults of working age. There was no evidence of Feedback of any kind (code Ps-F).

PPP - PRODUCT STAGE (code prefix Pt)

The book: Alice in Wonderland (hereafter known as AW) was analysed for themes that might be relevant to edutainment. Gardner's book [Gardner M 2001] was used as the main text and was composed of annotations explaining the historical, cultural and author's personal context. The process was one of reading the text and identifying and recording themes worthy of interest according to the appropriate codes.

Chap	Edutainment events : Alice in Wonderland (AW)	Theme Coding
1	Alice was beginning to get very tired … of having nothing to do …what is the use of a book [she thought] without pictures or conversations"	Pt-C
2	A: *Let me see: four times five is twelve, and four times six is thirteen, and four times seven is – oh dear! I shall never get to twenty at that rate!*	Pt-G of maths
2	"Oh I beg your pardon" cried Alice …afraid she had hurt the poor animal's [the mouse's] feelings. "I quite forgot you didn't like cats"	Pt-C
3	"William the Conqueror …was soon submitted to by the English …Edwin and Morcar, the earls of Mercia and Northumbria, declared for him; and even Stigand, the Archbishop of Canterbury, found it advisable	Data
3	"... Archbishop of Canterbury, found it advisable –" "Found what?" said the Duck. "Found *it*" the Mouse replied.."of course you know what 'it' means" "I know what 'it' means well enough, when I find a thing," said the Duck	Pt-H
3	Fury said to a mouse A mouse, That He met in the House, 'Let Us both go to law; I will prose -cute you Come, I'll	Pt-H

	Take no Denial:We Must have The trial *The mouse's tale is perhaps the best known example of emblematic, or figured, verse: poems printed in such a way that they resemble something related to the subject matter* [Garner M 2001]	
6	Alice: "…the Earth takes twenty four hours to turn on its axis" "Talking of axes" said the Duchess "off with her head"	Pt-H
6	".. which way ought I to go from here?" [asked Alice] "that depends on where you want to get to" said the [Cheshire] Cat "I don't much care where –" said Alice. "then it doesn't matter which way you go" said the Cat. "- so long as I get somewhere" Alice added. "Oh, you're sure to do that" said the Cat.	Pt-H Data Pt-C
7	MadH: "Then you should say what you mean" A:"I do .. at least I mean what I say – that's the same thing" MadH: "Not the same thing - you might just as well say that 'I see what I eat' is the same as 'I eat what I see'!"	Pt-G of logic
7	MarchH: "Take some more tea" A:"I've had nothing yet so I can't take more" MadH:"You mean you can't take less, it's very easy to take more than nothing"	Pt-H Pt-G of logic
7	D: once upon a time there were three little sisters and they lived at the bottom of a well.." A: "What did they live on?" D:"They lived on treacle" A:"Why did they live at the bottom of a well?" D: "It was a treacle well … and these , they were learning to draw" A: "What did they draw?" D: "Treacle" A: "But where did they draw the treacle from?" D: "You can draw water out of a water-well soI think you could draw treacle out of a treacle-well" A: "But they were in the well" D: "Of course they were – well in"	Pt-H Pt-N
8	Q: "Off with their heads" The unfortunate gardeners ran to Alice for protection and she put them into a large flowerpot. The soldiers wandered around looking for them and then marched off. Q: "Are their heads off!" shouted the Queen. S: "Their heads are gone, if it please your Majesty" .	Pt-H Pt-C
8	Q: "Off with his head" after the King requested the Cheshire Cat be removed. The executioner's argument was that you couldn't cut off a head unless there was a body to cut it off from. The King's argument was that anything that had a head could be beheaded.	Pt-G of logic
9	MT …`we went to school in the sea. The The master was an old Turtle--we used to call him Tortoise--' A: "Why did you call him Tortoise, if he wasn't one?' MT: "We called him Tortoise because he taught us"	Pt-H
9	A:"And how many hours a day did you do lessons?" MT: "ten hours the first day, nine the next and so on" A: "What a curious plan!"	Pt-H

	MT: “That’s the reason they’re called lessons .. because they lessen from day to day”	
10	G:”What are your shoes done with ..what makes them shiny?” A: “They’re done with blacking” G:”Under the sea boots and shoes are done with whiting” A: “And what are they made of?” G: “Soles and eels”	Pt-H
10	MT: “if a fish .. told me he was to go on a long journey, I should say ‘with what porpoise?; A: “Don’t you mean’purpose’?” MT: “I mean what I say”	Pt-H
11	Alice had never been in a court of justice before but she had read about them in books.	Pt-C
11	K:”Take off your hat” MadH: “It isn’t mine” K:”Stolen!”	Pt-H
11	MadH “And the twinkling of the tea..” K:”The twinkling of what?” MadH: “It began with the tea” K:”Of course twinkling begins with a T”	Pt-H
11	K “if that’s all you know about it , you may *stand* down” MadH “I can’t go no lower. I’m on the floor as it is” K : “Then you may *sit* down”	Pt-H
12	K: “What do you know about this business?” A:Nothing” K: “Nothing whatever?” A: “Nothing whatever” K: “That’s very important”	Pt-H Pt-G of logic
12	K: *Rule forty-two: all persons more than a mile high to leave the court* A:*I’m not a mile high* K: *You are* A: “Well I sha’n’t go ..besides that’s not a regular rule, you invented it just now” K:”It’s the oldest rule in the book” A: “Then it ought to be Number One”	Pt-H Pt-G of logic
12	Knave: “I didn’t write it, and they can’t prove that I did, there’s no name signed at the end” K:If you didn’t sign it then that makes the matter worse. You must have meant some mischief or else you’d have signed your name like an honest man”	Pt-G of logic
12	K Let the jury consider their verdict. Q:No, no – sentence first, verdict afterwards.	Pt-H
	[Bayley (2009)] : Alice’s Secrets in Wonderland: **At time of writing Melanie Bayley was a DPhil candidate at the University of Oxford with this work, published in New Scientist magazine, supported by UK Arts and Humanities Research Council**	
38	There’s hidden mathematical meaning behind Lewis Carroll’s classic tale	Pt-G
39	…one side of the mushroom stretches her neck, while another shrinks her torso. She must eat exactly the right balance to regain her proper size … While some have argued .. that this scene is about drugs, …[Bayley believes] it’s actually about … the absurdity of symbolic algebra which severed the link between algebra, arithmetic and … geometry.	Pt-G of logic

40	Alice has moved from a rational world to a land where even numbers behave erratically….she tried to remember her multiplication tables but they had slipped out the base-10 number system wea re used to.	Pt-G of logic
41	Alice …wanders into the Mad Hatters tea-party, which explores the work of …William Rowan Hamilton …[whose] discovery of quaternions was …hailed as an important milestone in abstract algebra … The member's of the Hatter's tea-party represent the three terms of a quaternion, in which the all-important fourth term, time, is missing. Without time … the characters are stuck …constantly moving round to find clean cups and saucers.	Pt-G of logic
41	The Hatter's nonsensical riddle …'Why is a raven like a writing desk?'	Pt-G of logic
41	When the hare tells her to say' what she means', she replies ' at least I mean what I say, that's the same thing''. 'Not the same thing' says the Hatter. 'Why, you might just as well say that'Isee what I eat' is the same as 'I eat what I see'.	Pt-G of logic

APPENDIX D: PPP ANALYSIS OF CASE STUDY 'HORRIBLE SCIENCE' BOOKS

BACKGROUND

This a very successful series of titles under the general title of Horrible 'somethings'. The somethings started off originally as topics in the Horrible Science series for instance Painful Poisons, Killer Energy, Deadly Diseases and so forth, later followed by similar series in Horrible Geography and Horrible Histories. They are designed as educational books presented in a highly visual jokey style with plenty of pictures and gruesome facts. They appear to teach topics to children corresponding to the areas of curriculum most likely met in school eg |Science, Geography, History. The different series have become immensely successful and all kinds of title are now available as well as a TV programme spin-off.

CRITERIA FOR CHOOSING AS A CASE STUDY

Applicability : The Horrible Science books are a form of Edutainment – there is evidence they were designed deliberately from the outset as easy to follow text books for children.

Longevity : They have been produced since the mid 1990's and are still in print with new titles coming out every year. The books have certainly met the test of time.

Resilience : The format holds its own in the highly competitive market of children's books. There is evidence that titles from other publishers try to emulate the same format. They have certainly met the test of marketplace competition.

Universality : It is not known how many other countries (apart from UK) sell these books but it would not be surprising if they turned up in every English-speaking country. They have met the test of universal acceptance.

Academic Scrutiny : The Horrible Science books have not been formally subjected to academic scrutiny but have won many prizes from industry for their model of popularising science including the ZSL Thomson Reuters Award, Junior Aventis Science Book Prize 2004 and the Rhône-Poulenc Junior Science Book Prize 1997.

PPP ANALYSIS

The three data sources used for analysis in this case study are Arnold (2009a), Arnold (2009b), Horrible Science (2014), Deary ((1997),Ganeri (2008). These are all the scripts of Horrible Science: Painful Poisons and Horrible Science: Killer Energy. The following codes, derived in the Data Collection & Analysis chapter Table 4.4 were used in this analysis**.**

	Meaning in this context	**Analysis Code**
Presage	Learning Context and Learner Characteristics	Pe-Co, Pe-Ch
Process	DPK, Andragogy, Feedback	Ps-DPK, Ps-A, Ps-F
Product	Humour, Narrative, Games, Characterisation, Music	Pt-H,Pt-N,Pt-G,Pt-C,Pt-M
	Codes used for Case study analysis	

PRESAGE STAGE (Code Prefix Pe)

Pe-L Learner Characteristics: this series of books was produced for older children and young adolescents approximately aged 10-15. The children were expected to have good literacy skills as the vocabulary used in most books is often technical; the Horrible Science books mention names of elements, famous scientists, technical procedures so one must presume that readers of these books have received a good literacy-based education for several years beforehand.

Pe-LC Learning Context: The subjects for titles seem chosen for their excitement and curiosity features.

PROCESS ANALYSIS (Coding Prefix Ps)

The process behind production of 'Horrible Science ' series of books is not available. It is clear however, that the different series in the same theme (Horrible Science, Horrible Histories, Horrible Geography) were all built to the same template (Product) and were possibly built by a similar process.

PRODUCT ANALYSIS (Coding Prefix Pt)

Chap	**Horrible Science Analysis: Killer Energy**	**Coding Suffix**
1	Ultimate Power: pp 8-13, contains 7 graphic vignettes Scientists: Aristotle, Anaxagoras, Stahl, Leibniz	N,H, C
2	Laying Down The Laws: pp 14-25, contains 12 vignettes, Experiment: build hand-heat driven propeller+questionnaire+answer Scientists: von Mayer, Joule,	N, H, C, G,
3	Horrible Heat pp26-36: contains 15 vignettes Experiment: building a Galileo thermoscope + questionnaire + answer	N,H,C

	Scientists: Prevost, Rumford, Galileo, Fahrenheit	G
4	The Dead Freezing Chapter:pp37-44: contains 5 vignettes Scientists: Lord Kelvin.	N,H,C,
5	Killer Cold: pp45-57 contains 15 graphic vignettes Quiz: could you be a surgeon+ question + answer Quiz: could you be polar explorer+ question + answers Explorers: Peary, Scott, Amundsen Fictional characters: Dr Grimgrave, Harvey Tucker	N,H,C, G
6	Horribly Powerful Fuel: pp58-78 contains 26 graphic vignettes Quiz: 'I'm a rhino-analyst' 1 questionnaire+answer Discoveres: Brandt/Krafft/Kunckel (disacovery of phosphorus), Murdock, Boulton, Watt, Lundstrom, Fictional Characters: Bernard Boyle,	N,H,C, G,
7	The Power To Move You: pp79-95 contains 17 graphic vignettes Experiment: practical exercise on movement energy+question+answer Quiz: 'Could you be a scientist?'+questions+answer Inventors: Newcomen, Watt, Parsons,, Carnot, da Vinci, Cardano, Offreyeus, Prof Frank Helper	N,H,C, G,
8	Hot Sweaty Body Bits: pp96-111: contains 17 graphic vignettes 7 Super-Energy quiz questions + answers 1 Teacher's Tea-break Teaser question+answer Scientists: Thayer,Lavoisier,, Lagrange, Liebig Fictional character: Harvey Tucker, Dr Grimgrave, Dr Jekyll & Mr Hyde,	N,H,C, G
9	Killer Heat: pp112-125 contains 16 vignettes Experiment; 'what a sock does to ice' + 1 questions+answer Quiz:'Could you be a scientist?; 2 questions +answers Scientists: Tyndall Fictional characters: Harvey Tucker, Dr Grimgrave	N,H,C, G,
10	Fearsome Fiery Furnaces: pp 126-139 contains 16 vignettes Quiz:'Could you be a scientist?' 2 questions+answers Experiment: 'How to Watch the Big Bang on TV' + question+answer Fictional characters: Harvey Tucker	N,H,C, G,
11	A Power For Good? pp 140-144 Contains 6 vignettes Scientists: Maxwell, Edison,	N,H,C,
12	Killer Energy Quiz pp145-154 contains 9 vignettes 8 questions for each of 5 sections = 40 questions in total + answers Sections: Energy in Everything, Fantastic Fuel, Horrible Heat & Killer Cold, Meet the Scientists, Confusing Renewable Energy	G,
	Vignettes 152	
Chap	**HORRIBLE SCIENCE ANALYSIS : PAINFUL POISON**	**Code**
1	Killer Chemicals: pp7-18 contains 16 vignettes Experiment: Teacher's Tea-break Teaser: Fictional characters: Mr Stinks, Count Vomito & Donna Venoma, MI Gutzache	N,H,C
2	Painful poison Gangs: pp19-30 contains 8 vignettes Explorer: Mawson Fictional characters: Count Vomito, MI Gutzache	N,H,C
3	The Gory Story of Poison: pp31-41 contains 13 vignettes Historical characters: Ovid, Socrates, Agothocles, , Capello, Sultan Hamid,Pare	N,H,C

4	Ghastly Gases: pp42-55 contains 17 vignettes Experiment: Teacher's Tea-break Teaser Researchers: Lavoisier, Campbell, Fictional characters: MI Gutzache	N,H,C,G
5	Metals, Murder & Madness:pp56-66 contains 11 vignettes Experiment: Teacher's Tea-break Teaser Researchers: Bunsen, Quiz: Could you be a scientist? 1 question + answer Quiz: The Lethal Lead Experience: 1 question + answer Fictional characters: None	N,H,C,G,
6	Invasion of the Metalloids: pp67-80 contains 10 vignettes Fictional characters: Count Vomito, MI Gutzache, Dr Grimgrave	N,H,C,
7	Painfully Poisonous Plants: pp81-93 contains 14 vignettes Quiz: An irritating irritating-plants quiz: question + answer Researchers: Col Robert Jonson, Stevenson, Fictional characters: MI Gutzache, Donna Venoma	N,H,C, G
8	Appallingly Poisonous Animals: pp94-123 contains 25 vignettes Quiz: the queasy poison quiz: 10 questions + answers 2 * Could you be a scientist? Question + answer Researchers: Allan Blair, Kevin Budden, Wade Davis Fictional characters: Count Vomito, MI Gutzache	N,H,C,G
9	How to be a Poison detective: pp124-140 contains 18 vignettes Experiment: how to Make Your Home a Poison Safety Zone Experiment: How to test for poisons using paper chromatography Quiz: 5 questions + answers Scientists: Orfila Fictional characters:MI Gutzache, Count Vomito	N,H,C,G
10	Epilogue-the Painful Truth: pp141-144 contains 5 vignettes Fictional characters: MI Gutzache Mithradates VI	N,H,C,
11	Painful poison Quiz: pp145-154 contains 3 vignettes All Clued Up, Murder file,Evil Effects of Poison,Powerfully Poisonous Plants, Angry Animals = 5 sections @ 8 questions each = 40 questions	G
	Pages (excl chap. 11 quiz) 144 Vignettes 137	

	Other titles investigated in the 'Horrible' series	
	Horrible Science: Evolve or Die	
	Horrible Science: Deadly Diseases	
	Horrible Geography: Raging Rivers	
	Horrible Histories: The Stormin' Normans	
	Horrible Histories: The Cut-Throat Celts	

APPENDIX E : PPP ANALYSIS OF ROYAL INSTITUTION XMAS LECTURES

BACKGROUND

The Royal Institution Christmas Lectures have been inspiring children and adults alike since 1825. The Christmas Lectures were initiated by Michael Faraday at a time when organised education for young people was scarce. He presented 19 series of Christmas Lectures himself, establishing an exciting new venture of teaching science to young people. The Christmas Lectures continued annually since the 1825 series, stopping only during World War II, and ending up being aired on television since 1966. During that time, many world-famous scientists have given the lectures supporting the Royal Institution's charitable mission to "connect people to the world of science".

CRITERIA FOR CHOOSING AS A CASE STUDY

Applicability : The lectures are a form of Edutainment – they are clearly designed deliberately to educate and raise awareness of scientific matters in accordance with the Royal Institution's charitable mission to "connect people to the world of science". The lectures are designed primarily to relate to children (and their teachers) although, curiously, they are sometimes broadcast at times when children should be in bed.

Longevity : The concept of producing lectures for public consumption has been alive since 1825 stopping only during World War II, and ending up being aired on television since 1966.

Resilience : The format holds its own in the crowded Christmas television schedules. Despite the plethora of films and entertainment the lectures receive reasonable audience figures. There appears to be little competition to rival these lectures so unique is their format and provenance so they have met the test of marketplace competition.

Universality : These lectures are broadcast wherever the BBC broadcasts and are sold even outside the English-speaking world. They have met the test of universal acceptance.

Academic Scrutiny : The lectures have not themselves been subject to academic scrutiny ; there are no academic papers written about them. However, the academic input is obviously there as the presenters are all academic ‘stars’ in their own right.

PPP ANALYSIS

The three data sources used for analysis in this case study are RICL (2012), RICL (2013), RICL (2014) which are transcripts made by the thesis author of the actual broadcast programmes of the Royal Institution. The following codes, derived in the Data Collection & Analysis chapter Table 4.4 were used in this analysis**.**

	Meaning in this context	Analysis Code
Presage	Learning Context and Learner Characteristics	Pe-Co, Pe-Ch
Process	DPK, Andragogy, Feedback	Ps-DPK, Ps-A, Ps-F
Product	Humour, Narrative, Games, Characterisation, Music	Pt-H,Pt-N,Pt-G,Pt-C,Pt-M
	Codes used for Case study analysis	

PRESAGE ANALYSIS (Coding prefix Pe)

Learner Characteristics (Pe-Ch): The lectures seem aimed at school children aged 11-16 although the childrens' teachers may also be included as they accompany the children to the venue and have much to gain from watching the lectures themselves in terms of their own teaching in the classroom. It is clear the children in the audience need a basic background knowledge in the broad area of the topic domain otherwise the subject matter could become **unintelligible.**

Learning Context (Pe-Co): The content of the lectures is usually a scientific topic, of current interest to the public, and being researched by the university academic delivering the lecture.

PROCESS ANALYSIS (Coding prefix Ps)

No definite data on process was found. However, it was clear that the lectures in any one year were based around content devised by the invited speaker who was usually a research professor at a UK university. Such persons may have been well versed in teaching undergraduates but delivering to children must have been a different matter so the speaker must have been guided by a production team from the Royal Institution and/or the broadcasting television network on how to present the material both to the child audience at the venue and those watching at home. Comparison of three years of broadcasts 2012, 2013 and 2014 show the product was much the same over the six years so it did appear that there was a well-established and consistent production process. According to the RI website the process of producing lectures was supported on an ongoing basis by a Scientific Advisory Group made up of leading figures from the world of science; so there did appear to be a great deal of input from different sources culminating in a broad team effort of academic + RI staff + TV production staff. This in itself met the criterion of DPK (code Ps-DPK) as there was a clear effort of integration of educational pedagogy with the content. There was little clear evidence that Andragogy (Ps-A) and feedback (Ps-F) played a role but DPK (Ps-DPK) was demonstrated in the production process.

PRODUCT ANALYSIS (Coding prefix Pt)

Vignette	**Royal Institution Xmas Lectures – 2014** **Danielle George –Professor of Engineering** **University of Manchester**	**Theme Coding**
	Lecture 1.Sparks Will Fly: How To Hack Your Home: Broadcast BBC4 29th Dec 2014	
1	Experiment with Fire Exit sign	G
2	Child sends picture of leaf from ipad	G
3	Discussed Victorian scientist Joseph Swann	C
4	Gets audience to clap its level of confidence that experiment will work	G,H
5	Child chosen to go to Shell Centre by taxi	C
6	Photos of children in audience shown on moving display in Piccadilly	C,H
7	Child helped with demo of 16 lights light matrix	G
8	Assistant Andy rides bike and wheel displays message	G
9	Assistant Andy uses Nitrogen to prevent filament bulb burning out	G
10	Talks about Matrix film	N
11	Children using Raspberry Pi computers to take photos	G
12	Child to send On-Off message to lamp	G
13	Child sends video between 2 computers using torch light	G
14	Demo of Zylobands	G
15	Bryony Scott from CBBC shows coding demo	C, G
16	Child audience vote on order of balloon popping using code	G, H
17	Child at Shell centre observes display on building front	G, H
18	Child plays keyboard with keys of jelly	H,G
19	Using front row of children to explain a controller	G
	Lecture 2. Making Contact: **Broadcast BBC4 30th Dec 2014**	
1	Danielle speaks to International Space Station crew Samantha Christoforetti	C
2	Child holds robot hand	C,G
3	Experiment to recreate original phone of Alexander Graham Bell	C,G,N
4	Child speaks into cup to recreate Bell's first [phone message	G,N
5	TV presenter Dallas Campbell – how to break down a problem	C,G
6	4 children pretend to be pixels	G
7	Child attaches lens to iphone to take close-up pictures	G
8	Experiment : paint balls fired at assistant Lucy	C,G
9	Child bends light down water from a bucket	G
10	Adults Rob and Steve from GongBit talk about stereo glasses	C,G
11	Child watches video wearing stereo glasses	G
12	Demo of 3D image of Dallas Campbell in fog screen, controls electronic hand	C,G
13	Child shakes Dallas electronic hand	C,G
14	Thelma Bailey (Bristol) shows haptic cow	C,G
15	Child feels air above haptic device – feels shapes in mid-air	G
16	Child tries out electric lollipop and can taste flavours	G
17	Dallas in fog screen also tries electric lollipop with child – agrees on flavours	C,G
	Lecture 3 : A New Revolution **Broadcast BBC4 31st Dec 2014**	
1	Demo of Robotic Acrobat spider	G,C,H
2	Demo of Faraday's mercury electric motor	G

3	Demo : 2 children with batteries and coils	G
4	Demo: washing machine with windblower to make electricity to light torches	G
5	Demo of Rubic Cube solving robot	G,H
6	Demo of robotic drummer	G,C,H
7	Demo of dot matrix printer playing a tune	G
8	Demo of robotic guitar playing	G
9	Child's head printed by 3d printer	G,C
10	Video link-ip with child with prosthetic robotic hand	C
11	Child playing Swanee whistles	C,H
12	Demo of wheeled robot following white line on floor	C
13	Demo of life-size clone of 'Bruno' rover sent to surface of Mars	C,G
14	Demo of H5W robot from Spain	C
15	Experiment showing how pixel-bots can make images	G
16	Child mixing up pixel-bots to watch them re-arranging themselves	G
17	Video of robots playing	H
18	Demo of quadcopter flying	G
19	Finale of robotic instruments playing 'Dr Who' theme	H

Vignette	**Royal Institution Xmas Lectures – 2013** **Dr Peter Wothers** **University of Cambridger** ***Lecture 3: The Modern Alchemist - Search for the Philosopher's Stone***	**Theme Coding**
1	Child audience holds up cards of periodic table	G
2	Museum of London shows Roman jewellery-gold does not tarnish	G
3	Child is weighed with real gold to determine 'weight in gold'	C
4	Sir Harry Kroto gives Nobel Prize to finish weighing of child	C
5	Demo: burns Hydrogen to produce Carbon Dioxide	G
6	Demo: Burns diamond borrowed from Mrs Kroto	G
7	Prof Kroto discusses atomic make-up of his discovery buckminsterfullerene	C,N
8	Demo: Tank of Carbon Dioxide puts out flaming torch	G
9	Demo: Burns magnesium in Carbon Dioxide to produce Carbon	G
10	Child cuts ice with slice of graphite	C,G
11	Seven children hold hands to show bond strengths	C
12	Hematite, meteorite, and meteorite slice discussed	G
13	Child: burns iron wool and weighs as gets heavier	G
14	Dr Caroline Smith shows Inuit knife and meteorites from Disko Island	C
15	Demo: Blast furnace demo burns through metal safe	G
16	Child: Napolean III's aluminium cutlery, Lithium spoon fizzes in water	C,N
17	Demo: heats silicon dioxide with Lithium to get pure silicon	G
18	Shows block of silicon for making computer processor chips	G
19	Demo: red and blue balls to show radioactive decay	G
20	Demo: Cloud chamber trails	G
21	Magnetic meteorite picks up paper-clips from child audience	C,G
22	Child cannot pull apart neodymium magnets: child suspended by magnets	C,G
23	Demo: Yttrium superconductors racing around Mobius strip	G,H

Vignette	**Royal Institution Xmas Lectures – 2012** **Prof. Alison Woollard** **Queen Mary College** ***Lecture 3: Could I Live Forever?*** Broadcast BBC4 Wed 26th December 2012	**Theme Coding**
1	Acrobatics by Alison Woollard stunt double	C,H
2	Children from audience – guessing ages of animals	G
3	Ageing children's faces	H,G
4	Photos of kids in the audience being aged by software	H,G
5	Projection of the vascular system	G
6	Piece of rope with coloured ends – demo of cellular senescence	G
7	Video of cells dying	G,N
8	2 boys cutting out shapes - one with webbed gloves	C,G
9	2 children, one with boxing gloves, moving balls between boxes	C,G
10	Animals – mole rats- that have no cancer	C,G
11	Projection of Nematode worms – how age changes them	G
12	Natalie Mount (visiting lecturer) – stem-cells cure for blindness	C
13	Peter Coffey – retina – demo using children and adults	C
14	Child with special glasses shows effects of retinal pigment damage in AMD	G
15	Demo of stem cells for treating AMD	G
16	Lord Robert Winston – when you're going to die	C,N
17	Question: Do you really want to live forever?	G

APPENDIX F: PPP ANALYSIS OF SESAME STREET CASE STUDY

BACKGROUND

Sesame Street is a television programme produced by a publicly-funded Children's Television Workshop (CTW) in the USA but broadcast around the world and in many languages. It was deliberately designed for the teaching of basic literacy, numeracy and social skills and , as Morrow (2008:111) states, to ' … help all unschooled prekindergarten children – particularly low-income, African-American, urban youngsters – prepare to enter school'.

CRITERIA FOR CHOOSING AS A CASE STUDY

Applicability: Sesame Street was deliberately designed from the outset by the Children's Television Workshop (CTW) as edutainment to prepare pre-school children from all ethnic backgrounds to be well prepared to enter the normal school system.

Longevity: Sesame Street first broadcast on TV in 1969 – it is therefore more than 40 years old – the reference herein [Fisch S & Truglio R (editors) 2001] is entitled '*G'is for Growing – Thirty Years of Research on Children and Sesame Street*.

Resilience: It has been resilient in that there have been many imitators and many creations have adopted similar methods to sesame Street particularly making programmes that had 'stickiness' [Gladwell M 2000 p89].

Universality: Nonetheless, despite its imitators, the programme continues to be broadcast today and is universally accepted as broadcast in more than 130 countries [Fisch S & Truglio R (editors) 2001 p147]

Academic Research has been extensive; it is said to be the most heavily researched series in the history of television with more than 1000 academic studies [Fisch S & Truglio R (editors) 2001 p.xvii]

PPP ANALYSIS

The data sources used for analysis in this case study are Fisch & Truglio (2001), Morrow (2006), Davis (2009), Gladwell (2001). The Fisch & Truglio (2001) book was chosen because the authors were active participants on the CTW team and this book is a look at the research done on children's learning and children's television production methods over 30 years from an insider viewpoint. It contained examples of formative research undertaken by CTW staff and used for informing production decisions as well as summative research performed by universities and other educational bodies on follow-up research to determine the long-lasting effects on children's more formal education (at school and college). Morrow (2006) is a history of Sesame Street written by

a professor of history at Morgan State University, USA.; this text was chosen as it represented an independent view on the Sesame Street development. The Gladwell (2001) book 'The Tipping Point' was chosen because it gave an unorthodox independent view from the perspective of human behaviour. The following codes, derived in the Data Collection & Analysis chapter Table 4.4 were used in this analysis**.**

	Meaning in this context	**Analysis Code**
Presage	Learning Context and Learner Characteristics	Pe-Co, Pe-Ch
Process	DPK, Andragogy, Feedback	Ps-DPK, Ps-A, Ps-F
Product	Humour, Narrative, Games, Characterisation, Music	Pt-H,Pt-N,Pt-G,Pt-C,Pt-M
	Codes used for Case study analysis	

PRESAGE (Coding Prefix Pe)

Learner Characteristics (code Pe-Ch):

Sesame Street was deliberately designed to provide education for pre-schoolers [Morrow R 2006 p30]. However, the CTW model suggested that the mother was assumed to sit with the child during watching of the programme; consequently, occasional jokes and references were made that only adults would really understand.

Learning Context (code Pe-Co):

Learning environment was entirely that of broadcast television during the hours when pre-school children were considered to be available. Curricular goals were defined as in Fig F.1.

1.Symbolic Representation
- A: Letters
- B: Numbers 1-10
- C: Geometric Forms

2.Cognitive Organisation
- A: Perceptual Discrimination and Orientation
- B: Relational Concepts
- C: Classification
- D: Ordering

3.Reasoning and problem Solving
- A: Problem Sensitivity ("What's wrong here?")
- B: Inferences and Causality
- C: Generating and Evaluating Explanations and Solutions

4.The Child and his World
- A: Self
- B: Social Units
- C: Social Interactions
- D: The Man-Made Environment
- E: The Natural Environment

Fig.F.1 CTW's curricular goals for the first season Morrow R (2008:78)

PROCESS AND PRODUCT ANALYSIS (Coding prefix Ps, Pt)

SOURCE : Fisch & Truglio (2001) *"G" is for Growing: Thirty Years of Research on Children and Sesame Street*	**Pages**	**Theme Coding**
SS was the first series to employ empirical research as an integral part of its production; formative research was - and continues to be - used on an ongoing basis to inform production decisions, whereas summative research has been used to assess SS's educational impact on its target audience. This …integration of curriculum development, formative and summative research …[is] known as the CTW model.	Xvi	Ps-F
SS is the most heavily researched series in the history of television. More than 1000 studies have examined …its power in areas such as literacy, number skills,…social behaviour …[and] issues such as children's attention.	Xvii	Ps-F
SS contains about 40 program segments (skits) in each of its…episodes.	8	Ps-DPK
…there was a need for an annotated document that would assist writers and producers … a Writer's Notebook was developed	10-11	
When humour, dramatic tension or other attractive features coincide with the educational message, this interaction could be used to enhance the effectiveness of the educational content…When the two did not coincide, children would recall the attractive material and not the educational message.	12	Ps-DPK
…repetition in SS involved, not only exact repetition of intact program segments, but also repetition of program segments with variation.	12	Ps-DPK
The schedule would include as much review as possible for the sake of the irregular viewer	13	Ps-DPK
Distractor technique. [Two televisions – one showing proposed SS episode, the other another programme. The technique recorded children's viewing activity every 7.5 secs. This gave data points in time and showed where SS was more interesting than the control programme]	15	Ps-DPK
One useful approach was to present a program to an audience of … children,…at predetermined points … "freeze the frame" …and ask viewers about events leading up to or likely to follow from the pictured situation.	16	Ps-DPK
Formative research …contribute[s] to the effectiveness of the product or procedure. … Based on [such] data, the researchers concluded that the educational point needed to be better integrated into the action.	17	Ps-F
…for SS to be considered a success, it would have to produce measurable outcomes in achieving its educational goals.	18	Ps-F

There were three motivations for establishing close relations with the academic community. One …to share the innovative research methods being developed…second ..to promote support for the educational aims … of the series, by publishing research results…finally, by stimulating interest, we hoped for …enticing other researchers…CTW obtained grants to bring academic researchers …to the Workshop for several months to work on research methods.	19	Ps-F
Five clusters of skills…1. Social, Moral and Affective Development 2.Language and Reading 3.Mathematical and Numerical skills 4.Reasoning and Problem-solving 5.Perception	26	Ps-DPK
…invited professionals with diverse backgrounds …preschool teachers, developmental psychologists, TV producers and film-makers, child psychiatrists, artists, musicians, children's books writers, performers, sociologists, puppeteers, and creative advertising designers.	27	Ps-DPK
Sources of change: One source is the changing (and increasingly diverse) makeup of the US population…curriculum also evolved in response to changes in professional understanding of children's growth, development and learning….third …original curriculum emphasised academic skills…More recently experts have recognised that …success in school Is also a function of …social behaviour such as …communicate with others and act cooperatively.	35	Ps-DPK
Success of basic [summative] research is …[to] inform our understanding of children. …formative research…[is to] inform the production of effective educational materials.	41	Ps-F
…whereas behavioural methods provide how appealing some given material might be, verbal measures allow children to express the reasons why.	48	Ps-DPK
It is not surprising that two potential factors pertained to repetition and reinforcement …	67	Ps-DPK
CTW arranged for the Educational Testing Service (ETS) of Princeton, New Jersey, to design and conduct the summative evaluation…	85	Ps-F
Early childhood education can give...cognitive advantage at…mastering…first grade….this helps the child successfully complete upper grades, and so on.	91	Ps-DPK
The Recontact Study Summary: Adolescents who often watched SS as pre-schoolers, compared with those who rarely watched the program, had higher grades in English,, mathematics, and science; spent more time reading books outside of school; perceived themselves as more competent at school, placed higher value on achievement in mathematics and science…; and expressed lower levels of aggressive attitudes. Many of these relations between SS viewing and teen behaviour were stronger and more consistent for boys than girls. There .was little relation between SS viewing and creativity but there was no evidence for a negative effect …All these patterns occurred when groups were statistically equated for parents' level of education, birth order, site, and sex.	140	Ps-F

SOURCE : Morrow R (2008) *Sesame Street and the Reform of Children's Television*	**Pages**	**Coding**
Combined stylish, popular elements of televisual art with an educational apparatus of goals and testing … a show to demonstrate a new, better way to make educational programs for children.	1	Ps-DPK
Children had an innate desire to explore …Sociologist Martha Wolfenstein called this …"fun morality"..	3	Pt-G
It made sense to teach … through advertising –style cartoons to poor children in the hopes that later academic success would lift them out of poverty.	5	Pt-N
CTW brought together producers and writers from commercial TV with child psychologists and educators	5	Ps-DPK
[Cooney said] Program had to be "highly visual. Slickly and expensively produced … it should utilize "frequent repetition, clever visual presentation, brevity and clarity".	51	Ps-DPK
In the studio they could provide immediate information to improve production [formative research]. Outside they could perform tests of …effectiveness at holding children's attention, motivating them and teaching them [summative research].	58	Ps-F
CTW's head researcher had invented it [the distractor] to test how much children liked a TV program by showing them competing images on a second TV to distract them.	67	Ps-DPK
The Model had four parts: interaction of .. television producers and childe science experts, creation of specific and age-appropriate curriculum, research to shape the program directly [formative research], and independent of viewer' learning [summative research]	68	Ps-DPK
What White had done was imagine a character [Big Bird] whose bumbling gave chi8ldren the opportunity to think, respond and learn.	74	Pt-C
The Model developed from two competing ideas about testing …"formative research" and "summative research" …to meet two needs … provide information on in shaping skits, films, cartoons to teach effectively…. Second, evaluation because backers needed credible proof that SS actually educated children.	77	Ps-F

Jean Piaget postulated abstract mental processes … inferred from observing learning behaviour. ..SS's researchers were relentlessly practical and had no use for such abstractions. Years later, it would fall to academic researchers to create theories that explained why children watched and learned from television as they did.	82	Ps-DPK
… researchers found that repetition within a single episode imparted familiarity better than single iterations on consecutive days.	89	Pt-N
Grown-ups also enjoyed the Muppet's humour … keeping older viewers watching alongside the pre-schoolers could prompt educational conversations at home.	95	Pt-C
Big Bird was like a child , a bumbling three year old struggling to learn … he stood for the learner whom children could emulate or surpass.	99	Pt-C
The Workshop intended musical segments like [Stevie] Wonder's to hold the interest of older siblings and parents.	100	Pt-C
Cooney wrote in her 1966 feasibility study …"children receive pleasure from achievement and mastery and do not differentiate between work and play …the line dividing 'work' from 'play' may well be a barrier erected by the adult mind". When the show made it to the air, it erased this adult boundary.	103	Pt-G
And the research department established early on that repetition did not bother young viewers. Repeatedly watching the same segment … made it possible …to become thoroughly familiar with it.	104	Pt-N
… to help all unschooled prekindergarten children – particularly low-income, African-American, urban youngsters – prepare to enter school.	111	Pe-Ch
The press release called the show an 'experiment primarily designed to establish whether entertainment techniques that preschool children are known to enjoy on television can be put to meaningful educational purpose".	113	Ps-DPK

APPENDIX G: PPP ANALYSIS OF CASE STUDY 'SOUL CITY'

BACKGROUND

Begun in 1994 'Soul City Its Real' is a television show which has become one of South Africa's most loved. Set in the fictional Soul City Township, the Soul City mirrors the social and development challenges faced by poor communities everywhere. It weaves health and social issues into real-life stories for the millions of people who have grown to trust the powerful messages of this very popular programme. The Soul City television drama series is part of a multimedia health promotion and social change project by the Soul City Institute for Health and Development Communication (SC IHDC). An offshoot programme for children, Soul Buddyz, follows a similar path.

health
Department:
Health
REPUBLIC OF SOUTH AFRICA

CRITERIA FOR CHOOSING AS A CASE STUDY

Applicability: Soul City was deliberately designed from the outset to be edutainment and expressly states this on its website with the very word 'edutainment' – see fig. G1. Soul City is an example of edutainment used in a developing country with low levels of adult literacy but a great need to educate the populace on health matters such as HIV, contraception and sanitation. For this reason it represents many of the models used throughout the non-western non-developed world.

Longevity: Soul City has been in existence for more than 20 years so has passed the test of time.

Resilience: There have been many imitators in other African countries and many creations have adopted similar methods but it is still broadcast in South Africa.

Universality: It has limited broadcast outside South Africa.

Academic Research: Soul City has been academically critiqued in several papers for example Singhal et al (2002).

PPP ANALYSIS

The data sources used for analysis in this case study were Soul City(2014), Singhal et al (2002). The following codes, derived in the Data Collection & Analysis chapter Table 4.4 were used in this analysis**.**

	Meaning in this context	**Analysis Code**
Presage	Learning Context and Learner Characteristics	Pe-Co, Pe-Ch
Process	DPK, Andragogy, Feedback	Ps-DPK, Ps-A, Ps-F
Product	Humour, Narrative, Games, Characterisation, Music	Pt-H,Pt-N,Pt-G,Pt-C,Pt-M
	Codes used for Case study analysis	

PRESAGE (Coding prefix Pe)

Thirteen half- hour prime time TV episodes carrying riveting drama air on the national broadcasters SABC 1 channel. The Drama has also been broadcast in many other countries

Learner Characteristics (code Pe-Ch)

Soul Buddyz , an offshoot programme from Soul City, is a multi media "edutainment" vehicle for children aged 8-12 years old designed to promote their health and well-being. Because attitudes are often formed during this critical time, the programme was developed specifically with this age group in mind. In the context of a rapidly transforming society with technological and social changes, the needs and aspirations of disadvantaged children between the ages of 8-12 years old are often neglected. Emotional and health problems often originate or become embedded in this age group, with social problems such as physical and sexual abuse severely retarding the potential of many children.

Told through Television, Radio and print learner material, it closely reflects the lives, struggles and joys of 8 -12 year olds in South African society. It is reported that 90% of parents said that Soul Buddyz made it easier fro them to discuss difficult and sensitive health issues with their children.

Soul Buddyz embraces the principles of the International Convention on the Rights of the Child, which the South Africa Government has ratified and signed. All the issues dealt with in the series are framed within the South African Constitution. According to the Convention:

"The child has the right to the highest standard of health and medical care attainable. States shall place special emphasis on the provision of primary and preventive health care, public health education and the reduction of infant mortality." Utilising multiple media platforms including

television, radio, lifeskills and parenting publications as well as Soul Buddyz clubs, a number of social issues are highlighted to showcase:

- children's rights and responsibilities
- valuing and respecting other children
- advocating respect and sensitivity for culture
- creating a sense of history
- role modelling good behaviour towards older people
- promoting alternate values to the dominant individualist, consumerist set of values
- encouraging exploration and interaction with the environment
- encouraging a positive view of science and technology
- viewing children as proactive, valuable and productive members of the community

Learning Context (code Pe-Co)

Through its multi-media and advocacy strategies Soul City aims to create an enabling environment empowering audiences to make healthy choices, both as individuals and as communities. Popular and important topics highlighted in the respective radio series' are further debated in depth on community and commercial radio stations across the nine provinces, where target audience participation is ensured

Around 1 million full colour easy to read booklets covering health and development l topics raised by the TV series are distributed for each series. The booklets deal with the topics carried by the series in greater detail and can be kept by readers for future reference. The rationale behind the Soul City Institute's programmes is that through drama, the series changes social norms, attitudes and practice, and gives power to individuals and communities to make informed healthy choices.

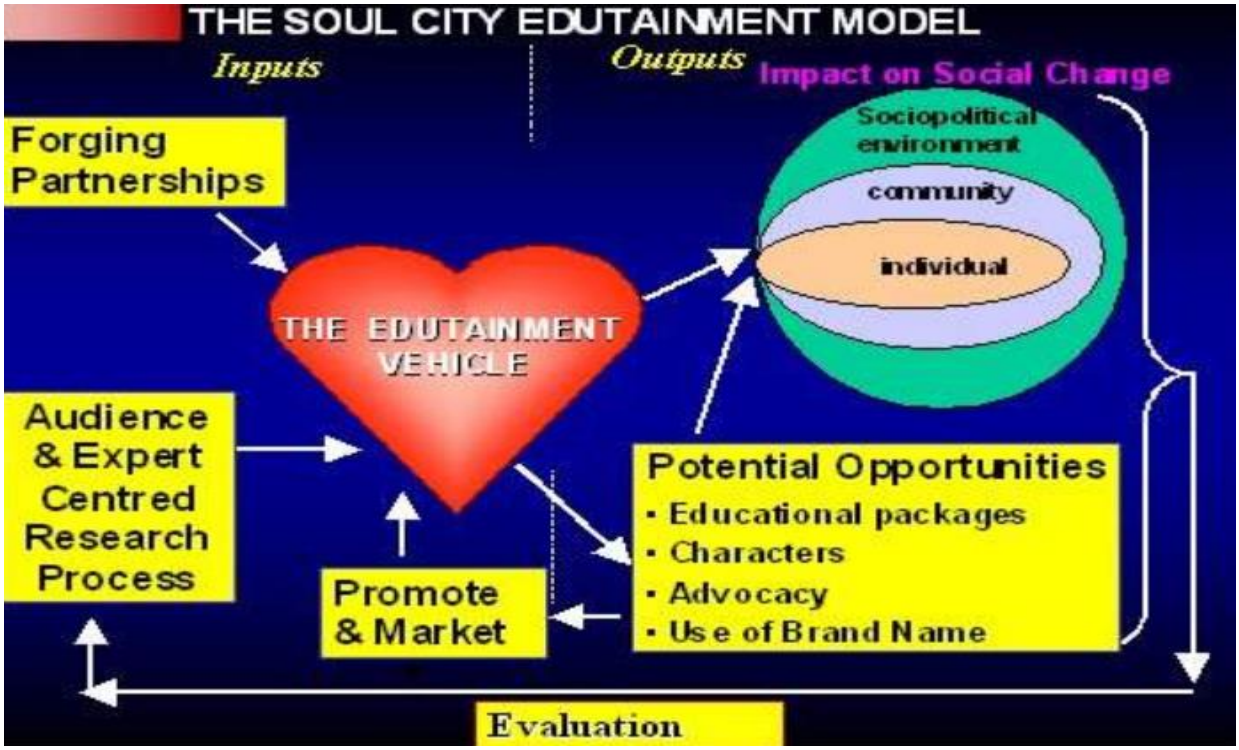


Fig. G.1 Soul City Edutainment Model www.soulcity.org.za

PROCESS (Coding prefix Ps)

Although it was not possible to gain access to production secrets nor local sources of information it was possible to obtain some insight, from the Soul City website itself, of their modus operandi. As can be seen, the Soul City website explicitly uses the term 'edutainment' in it's process model description – see fig G.1

All Soul City seasons are developed through a rigorous formative research process. The word 'formative' means 'Serving to form something, especially having a profound influence on a person's development' www.oxforddictionaries.com/definition/english/formative. In the diagram G.1 the formative feedback is evidenced by the box 'Evaluation' and box 'Audience and Expert Centred Research Process' and is a clear indication of feedback (code Ps-F). Effectively, this involves consulting both audiences and experts. All materials are thoroughly tested with audiences to ensure that the materials are effective – a process very similar to the children's focus groups used in Sesame Street. Through formative research the actual experiences and voices of the communities are captured, giving the materials a certain real-world credibility.

Each series, and a series seemingly comprises up to ten programmes, covers various themes and each programme is produced according with the ten steps shown in fig. G2.

Step 1: Consulting widely with experts and key stakeholders on the topic issues. This includes government as well as civil society including non-governmental and community based organisations/activists/academics).
Step 2: Consulting audience members about what they know, their concerns, their attitudes to the issue and the barriers that exist to positive change.
Step 3: Role players and experts are brought together. They are presented with the findings from the first two steps. They then help define the issues to be included in the edutainment product and the way in which these issues will be dealt with.
Step 4: A message brief that defines these messages is produced. This forms the blueprint for the creative team (producers, directors and scriptwriters) to work off in developing the TV and radio dramas.
Step 5: The creative team use the message brief to integrate the issues into the entertainment vehicle. This is done in a creative workshop where the creative team is briefed and brainstorms how best to do this.
Step 6: A draft outline is produced. This is tested with the experts, role players and audience members. After this, full scripts are produced.
Step 7: The scripts go through a writing and testing process until the issues are have been well integrated while ensuring the product maintains its entertainment value.
Step 8: The material is produced, broadcast, printed and distributed.
Step 9: The materials are evaluated. Lessons learned are integrated into future productions. Evaluation is an essential part of the Soul City strategy. It helps determine impact and is important for accountability to the public as well as to funders
Step10: Lessons learned are fed back into the development of future projects. All Soul City projects are independently evaluated.

Table G.2 Soul City Edutainment Process from www.soulcity.org.za

PRODUCT (Coding prefix Pt)

It seems clear from Table G.3 that in each series, a number of topics are selected and programmes built around these. The programmes use the same set of characters each week, members of the fictitious Soul City township, and these characters' lives touch upon the relevant themes in some way with all the trauma, mixed emotions and decision-making that arises. These themes form the strong narratives running through each programme and are interspersed with smaller s based upon individuals' personal circumstances.

Soul Buddyz Series	Year	Key theme
Series 1	2000	• Disability • AIDS and sexuality • Trauma (unintentional and intentional) • children's rights
Series 2	2004	• Racism and Xenophobia • Substance Abuse (cigarette, drugs and alcohol) • HIV and AIDS (awareness, prevention, stigma, support and care) • Disability- specifically learning disorders • Environment • Children and justice
Series 3 and 3B	2005	• Financial Literacy and Management; • Nutrition and lifestyle • HIV and AIDS: Education, Educators and Learners; • Gender, Sexuality and Masculinity (also within the context of disability)
Series 4	2007	• Trauma as a result of exposure to violence as a victim or witness as experienced by children • HIV and AIDS prevention with a focus on gender • Road Safety
Series 5	2011	• Violence prevention, specifically the role of alcohol as a catalyst for violence
		G3: Different Series of Soul City showing how themes change

APPENDIX H: PPP CASE STUDY : THE ARCHERS

BACKGROUND

The Archers, brainchild of Godfrey Basely, programming assistant on BBC Midlands radio in the 1950's, was to combine the attributes of an adventure thriller with the need to teach farmers how to modernise their practices at a time when the UK was short of food Smethurst (2000:12). The Archers used work-related language, work- based scenarios and narratives based around farming issues suggested by the programme's farming consultants, the Ministry of Agriculture and the National Farmers Union. It used speech for narrative, music for atmosphere and strong characters to impart the farming information with authority Smethurst (2000), Whitburn (1996).

CRITERIA FOR CHOOSING AS A CASE STUDY

Applicability: It has excellent provenance as being perhaps the first model of edutainment deliberately designed to put over an educational message for adults, with a programme template (a product) and also a process by which the 'products' were created. Being one of the first accepted models makes it a good contender for this thesis study.

Longevity: The Archers first hit the British radio in 1954 and is still being broadcast today.

Resilience: The Archers was an excellent model of edutainment for adults which was widely considered the first example of modern broadcast edutainment. It is mentioned on the website for Soul City (see case study) as having been a great influence upon Soul City itself.

Universality: The Archers format has had many copiers. It might even be said that, in the UK, the television 'soaps' such as Coronation Street, Emmerdale and Eastenders all copied the original format of the Archers. They were all less involved in education and training but nonetheless did attempt to discuss social issues of the day through the characters.

Academic Research: Programme story lines have been the subject of several academic papers.

PPP ANALYSIS

The data sources used for analysis in this case study were Whitburn (1997), Smethurst (2000) and Dillon (2011). Both Whitburn and Smethurst were members of the production team and give insider perspectives whereas Dillon was an avid listener who collected the minutiae of programme features over the years. It was felt this gave an evenly balanced overview of the Archers production processes.The following codes, derived in the Data Collection & Analysis chapter Table 4.4 were used in this analysis**.**

	Meaning in this context	**Analysis Code**
Presage	Learning Context and Learner Characteristics	Pe-Co, Pe-Ch
Process	DPK, Andragogy, Feedback	Ps-DPK, Ps-A, Ps-F
Product	Humour, Narrative, Games, Characterisation, Music	Pt-H,Pt-N,Pt-G,Pt-C,Pt-M
	Codes used for Case study analysis	

PRESAGE (prefix code Pe), PROCESS (prefix code Ps), PRODUCT (prefix code Pt)

SOURCE : (Smethurst)2000): The Archers – The History of Radio's Most Famous programme – 50th Anniversary edition	Page	Code
He started to think up the characters …the target audience would be small farmers ... the principal characters would be small farmers…if the farmer's wives started to listen then the husbands would have to listen…'	13	Pe-Ch
To reflect every aspect of farming in a Midland village.	14	Pe-Ch
Walter Gabriel was to be an old fashioned stubborn farmer The sort of chap who cared nothing for new herbicides and pesticides, or for Ministry advisors…his farm implements were old-fashioned, his buildings falling down. Phil [Archer] was to be a representative of the bright young generation.	23	Pt-C
Should Boxer, the old shire horse, be sold off so that Dan [Archer]could buy a Massey Ferguson tractor?	26	Pt-C Ps-DPK
Would Dan get the Brookfield dairy herd attested, which would give him an extra 4d a gallon for his milk?	26	Ps-DPK
There was drama when first the sugar-beet factory complained that Brookfield milk was lowon butterfat content.	28	Ps-DPK
The meeting decided the amount of agricultural information should be 15 per cent of the script …the microphone should spend 30 per cent of its time at Brookfield, natural history and folk lore should vary between 10 and 15 per cent.	29	Pe-Co Pt-F

Local 'yokels' accused the programme of making a mistake about the age at which a heifer could give birth to a calf. Baseley responded [that] it was regular practice for heifers to mate at 15-18 months old. Musing on the first 250 episodes [Baseley] admitted to having made mistakes… a heifer had given birth to a calf much earlier than nature permitted (had the 'yokels' been right all along?)	29, 32	Ps-F
Chrysanthemums at the summer show when really they should have waited until autumn and.. sugar beet yield at Brookfield – forty tons to the acre instead of forty tons for the whole farm.	34	PS-F
The secret of the Archers …was the fascination and important facts of farming, that help make it the vital economic factor in modern life. Chunks of advice for farmers were produced by the Ministry [of Agriculture] and were dutifully inserted into the scripts Christine Archer was overheard lecturing her mother on Milk Marketing Board hygiene regulations Phil [Archer] shared with the nation the morsels of information he gleaned from the Pigbreeders weekly.	37	Ps-DPK
Phil overturned his tractor and was nearly crushed There were interludes in the kitchen at Brookfield farm.. people telling them about the milk yields possible from Friesian cows fed on high-protein concentrates. Stories of passion, betrayal, and sabotage were mixed up with dramas about dirt tare on sugarbeet, and problems with cows' milk butterfat content…	38	Pt-C Pt-N Pt-N
The characters were becoming stars …they had become real in the imagination of their listeners. At a flower show …Norman Painting [Phil Archer] made his appearance wearing dark glasses (Phil was recovering from an eye operation). The producer of a radio programme wanted Dan Archer –Farmer Dan not actor Harry Oakes [who played Dan Archer]. When Gwen [Gwen Berryman who played Doris Archer] went to open a fete, everybody sang 'Happy Birthday' as she walked in, much to her surprise as it wasn't her birthday at all –but, of course, it was Doris's.	39	Pt-C Pt-N Pt-C Pt-C

Accuracy of characterisation, consistency of factual detail – these were the elements that were clearly making the programme work.	42	Pt-C
The false cliff-hangers never did lose credibility..: the ability of people to be kept in suspense over the fate of a character they know is going to survive intact and unharmed, is one of the most curious aspects of mankind's response to drama.	46	Pt-Z
…the public would quickly adapt to new voices …Attempts to find good actors who could subtly re-invent the characters, than poor actors who could only produce pale shadows of the past	47	Pt-C
Pigs, meant bacon and pork chops. Although Britain had emerged from the long years of rationing, memories of enforced vegetarianism were still sharp, and supplies of fresh meat were a topic of national interest.	48	Ps-DPK
Dan transferred his pullets from free range to deep litter and Phil got is pig-breeding scheme under way.	53	Ps-DPK
Things got even worse when foot-and-mouth disease was confirmed at Brookfield.	63	Ps-DPK
That a way of bringing in an industrial element would be for Fairbrother to open a factory in Ambridge.	65	Ps-DPK Pt-C
He had started a story about Dan Archer wanting o sell his shorthorn cows and buy Friesians to get a higher milk yield. The British Shorthorn Society was so horrified it appealed to the Director-General [of the BBC]	65	Ps-DPK Ps-F
That a way of bringing in an industrial element would be for Fairbrother to open a factory in Ambridge.	65	Ps-DPK Pt-C
The Department of Agriculture in Washington wanted to know the secret of the Archers success… and asked to see scripts. Scripts were sent to Washington … a trade-off perhaps for US nuclear know-how that was flowing the other way across the Atlantic.	67	Ps-DPK Pe-Co
Dan Archer is …on the brink of a gigantic gamble. Comment on a proposed £3000 bank overdraft.	73	Pt-C, Pt-N
The Fifties had been the decade of the Archers; no other programme had come close to equalling its success.	75	Pe-Co

The Ministry of Agriculture was keen to show small farmers that they must amalgamate to increase efficiency…	85	Pe-Co
One writer wrote for a month, twenty scripts, then handed over to the other writer. Scripts were checked for continuity problems …	90	Ps-DPK
Jack Woolley …planned to turn Grey Gables into an exclusive holiday centre for tired businessmen…	92	Pt-C, Pt-N
Dan was signing a sugarbeet contract…and planning to buy a precision drill and down-the-row thinner.	92	Pt-C, Pt-N
BBC audience research… revealed …listeners said they enjoyed learning facts about the countryside, human interest stories, farming matters, comedy and Walter Gabriel.	96	Ps-PDS
Elsewhere cattle were rustled and Brookfield was burgled.	98	Pt-N
Jack Woolley was overheard announcing plans to turn Ambridge into an urban overspill area [of Birmingham]	102	Pt-C, Pt-N
'Always run three stories …one of a week's duration, one of a month's duration and one for a longer period say up to three months. It is through these longer stories that you are able to maintain the attention of your audience …	106	Ps-DPK
End every scene with a situation that needs further explanation. End every night on an upward questioning inflection.	107	Ps-DPK
Mollie Harris was cast to play Martha Lily …Mollie had worked on farms singling sugarbeet and sorting potatoes. [Mollie Harris, George Hart and Bob Arnold were actors specially chosen because of their own countryside roots]	110	Pt-C
Was the balance of 60% entertainment, 30% information and 10% education the best? It concluded that the percentages were just about right, although perhaps there could be a documentary flavour that would explore 'a range of issues from the social and political to economic and administrative – but without reducing the programme's entertainment value.'	120	Ps-DPK
I have always felt the Archers could handle almost any subject if the tone is right and in keeping with the times. He [Godfrey Baseley] wrote about the acceleration of the pace of change in farming, the increasing dominance of large-scale farms over the small, the rise of convenience foods, the increased leisure and	167 167	Pe-Ch Pe-Ch

recreational use of the countryside and the development of dormitory villages.		
SOURCE [Dillon (2011) ' The Archers – an unofficial companion'	**Page**	**Code**
Organic farming, Organic v GM	10, 23	Ps-DPK
Agricultural diseases: Foot & Mouth, Bovine TB, Johne's, Myxomatosis, BSE	36, 43, 31,79, 92	Ps-DPK
Agricultural qualifications; Nat.Dip. In Farming, HND Food Technology,	82,73,29	Ps-DPK
Farming-related Accidents: Tractors, Guns, Iced ponds, Fireworks, Eye injuries	82, 69, 46, 32, 26	Ps-DPK
Farm Business Problems: Recession, Bankruptcy, Failure,	51, 43, 40	Ps-DPK
Farm Business Opportunities: diversification, housing developments, allotments, chees-making, beef to milk, development-grants	62, 39, 7,14, 59, 43, 43, 126	Ps-DPK
Farming Community issues: loss of village shops (Plunkett Foundation) , Homophobia & civil partnerships, racism,	59, 104, 125	Ps-DPK
Personal issues: mastectomy, IVF (guest: Robert Winston)	93, 102	Ps-DPK
Animal issues: dogs, horses, llamas, peacocks, snakes	48,63,64,65	Ps-DPK
Celebrity appearances: R.Winston, M Gatting, A Gormley, C Dexter, Duchess of Cornwall, A Titchmarsh, R Trehane (Milk Marketing Board)	102,8	Pt-C
[Whitburn (1997)] 'the official Inside Story – the Archers'		
Heavily dependent on the writers to blend factual farming material, so crucial to the programme in the fifties, into the emotional and dramatic life of the village.	160	Ps-DPK
…used a mixture of professional actors and 'real' people [for] authenticity and understanding of country life ..	160	Pt-C
…for a potential storyline..[a landowner edging out tenant farmers who he thought were not pulling their weight] Godfrey [Baseley] checked out the landowner's position with Country Landowner's Association, the legal position with the Land Agents Association,; the viability of the plan with the Government Agricultural Land service	162	Ps-DPK Pt-C

and the National Agricultural Advisory Service and the tenant's positions with National Farmers union.		
The decision we make now [1996] is to tell the story from the point of view of how it affects the characters and not to disseminate information for its own sake.	164	Pt-C
Godfrey … worked 5 years ahead on nutrition, biology and genetics; a year ahead on broadstrokes; and thirteen weeks ahead on detail.	165	Ps-DPK
Heavily dependent on the writers to blend factual farming material, so crucial to the programme in the fifties, into the emotional and dramatic life of the village.	160	Ps-DPK

APPENDIX I: GAGNE'S NINE INSTRUCTIONAL PHASES

Gagne's 9 Instructional Phases seemed a possible choice of learning model on which to base the edutainment model designed hereto. It is a simple process model going through stages involved in straightforward learning. It does suggest that learning psychologies might play a role, however, it does lack a concept of what kind of learning could be attained, and where things might go wrong within a phase apart from the missing of a whole phase. It has no obvious concept of different learners bringing problems to the learning environment, such as overseas students or older students, although this may be implied in phases 3 and 5. Although this model was not accepted as a platform for the edutainment model it did provide some support for the final model as phases 1,3, 4 and 5 do appear in some sense in that final model.

Instructional Event	Internal Mental Process
1. Gain attention	Stimuli activates receptors
2. Inform learners of objectives	Creates level of expectation for learning
3. Stimulate recall of prior learning	Retrieval and activation of short-term memory
4. Present the content	Selective perception of content
5. Provide "learning guidance"	Semantic encoding for storage long-term memory
6. Elicit performance (practice)	Responds to questions to enhance encoding and verification
7. Provide feedback	Reinforcement and assessment of correct performance
8. Assess performance	Retrieval and reinforcement of content as final evaluation
9. Enhance retention and transfer to the job	Retrieval and generalization of learned skill to new situation

Appendix J : BLOOM'S TAXONOMY

A description of Bloom's Taxonomy is required for this thesis since it is mentioned on two occasions: in the literature review part II where a selection of learning models was being reviewed in order to find a platform on which to model the edutainment process, and , also, in a description of some forms of 'serious games' which have attempted to follow the taxonomy to classify the various levels of learning and skills required within the game – this may be reviewed under literature review part IV in the section Software-based Serious Games Industry. Bloom identified six levels within the cognitive domain, from the simple recall or recognition of facts, as the lowest level, through increasingly more complex and abstract mental levels, to the highest order which is classified as evaluation. A description of the six levels as well as verb examples that represent intellectual activity are listed here.

Knowledge is the lowest level of learning outcomes in the cognitive domain and is defined as the remembering of previously learned material. This may involve the recall of a wide range of material, from specific facts to complete theories, but all that is required is the bringing to mind of the appropriate information.

Comprehension is defined as the ability to grasp the meaning of material. This may be shown by translating material from one form to another (words to numbers), by interpreting material (explaining or summarizing), and by estimating future trends (predicting consequences or effects). These learning outcomes go one step beyond the simple remembering of material, and represent the lowest level of understanding.

Application refers to the ability to use learned material in new and concrete situations such as the application of rules, methods, concepts, principles, laws, and theories. Learning outcomes in this area require a higher level of understanding than those under comprehension.

Analysis refers to the ability to break down material into its component parts so that its organizational structure may be understood. This may include the identification of the parts, analysis of the relationships between parts, and recognition of the organizational principles involved. Learning outcomes here represent a higher intellectual level than comprehension and application because they require an understanding of both content and structural form of material.

Synthesis refers to the ability to put parts together to form a new whole. This may involve the production of a unique communication (theme or speech), a plan of operations (research proposal), or a set of abstract relations (scheme for classifying information). Learning outcomes in this area stress creative behaviours, with major emphasis on the formulation of new patterns or structures.

Evaluation is concerned with the ability to judge the value of material (statement, novel, poem, research report) for a given purpose. The judgements are to be based on definite criteria. These may be internal criteria (organization) or external criteria (relevance to the purpose) and the student may determine the criteria or be given them. Learning outcomes in this area are highest in the cognitive hierarchy because they contain elements of all the other categories, plus conscious value judgements based on clearly defined criteria. **Reference***: Major categories in the cognitive domain of the taxonomy of educational objectives* (Bloom, 1956).

APPENDIX K: PIAGET

JEAN PIAGET - INTELLECTUAL DEVELOPMENT

Piaget has been called one of the first adherents of constructivism. His interest in cognitive development came from his training in the natural sciences and his interest in epistemology and his abiding interest in how children come to know their world. Piaget believed that children's spontaneous comments provided valuable clues to understanding their thinking. He was not interested in a right or wrong answer, but rather what forms of logic and reasoning the child used. After many years of observation, Piaget concluded that intellectual development is the result of the interaction of hereditary and environmental factors. As the child develops and constantly interacts with the world around him, knowledge is invented and reinvented. His theory of intellectual development is strongly grounded in the biological sciences. He saw cognitive growth as an extension of biological growth and as being governed by the same laws and principles. He argued that intellectual development controlled every other aspect of development - emotional, social, and moral.

STAGES OF INTELLECTUAL DEVELOPMENT

Piaget discovered that children think and reason differently at different periods in their lives. He believed that everyone passed through an invariant sequence of four qualitatively distinct stages. Invariant means that a person cannot skip stages or reorder them. Although every normal child passes through the stages in exactly the same order, there is some variability in the ages at which children attain each stage. The four stages are: sensorimotor - birth to 2 years; preoperational - 2 years to 7 years; concrete operational - 7 years to 11 years; and formal operational (abstract thinking) - 11 years and up. Each stage has major cognitive tasks which must be accomplished. In the sensorimotor stage, the mental structures are mainly concerned with the mastery of concrete objects. The mastery of symbols takes place in the preoperational stage. In the concrete stage, children learn mastery of classes, relations, and numbers and how to reason. The last stage deals with the mastery of thought.

HOW CHILDREN LEARN

A central component of Piaget's developmental theory of learning and thinking is that both involve the participation of the learner. Knowledge is not merely transmitted verbally but must be constructed and reconstructed by the learner. Piaget asserted that for a child to know and construct knowledge of the world, the child must act on objects and it is this action which provides knowledge of those objects; the mind organizes reality and acts upon it. The learner must be active; he is not a vessel to be filled with facts. Piaget's approach to learning is a readiness approach. Readiness approaches in developmental psychology emphasize that children cannot learn something until maturation gives them certain prerequisites. The ability to learn any cognitive content is always related to their stage of intellectual development. Children who are at a certain stage cannot be taught the concepts of a higher stage.

Intellectual growth involves three fundamental processes: assimilation, accommodation, and equilibration. Assimilation involves the incorporation of new events into pre-existing cognitive structures. Accommodation means existing structures change to accommodate to the new information. This dual process, assimilation-accommodation, enables the child to form schema. Equilibration involves the person striking a balance between himself and the environment, between assimilation and accommodation. When a child experiences a new event, disequilibrium

sets in until he is able to assimilate and accommodate the new information and thus attain equilibrium. There are many types of equilibrium between assimilation and accommodation that vary with the levels of development and the problems to be solved. For Piaget, equilibration is the major factor in explaining why some children advance more quickly in the development of logical intelligence than do others.

IMPLICATIONS FOR EDUCATION

A Piagetian-inspired curricula emphasizes a learner-centred educational philosophy. The teaching methods which most American school children are familiar with - teacher lectures, demonstrations, audio-visual presentations, teaching machines, and programmed instruction - do not fit in with Piaget's ideas on the acquisition of knowledge. Piaget espoused *active* discovery learning environments in our schools. Intelligence grows through the twin processes of assimilation and accommodation; therefore, experiences should be planned to allow opportunities for assimilation and accommodation. Children need to explore, to manipulate, to experiment, to question, and to search out answers for themselves - activity is essential. However, this does not mean that children should be allowed to do whatever they want. So what is the role of the teacher? Teachers should be able to assess the child's present cognitive level; their strengths and weaknesses. Instruction should be individualized as much as possible and children should have opportunities to communicate with one another, to argue and debate issues. He saw teachers as facilitators of knowledge - they are there to guide and stimulate the students. Allow children to make mistakes and learn from them. Learning is much more meaningful if the child is allowed to experiment on his own rather than listening to the teacher lecture. The teacher should present students with materials and situations and occasions that allow them to discover new learning. In his book *To Understand Is to Invent* Piaget said the basic principle of active methods can be expressed as follows: "to understand is to discover, or reconstruct by rediscovery, and such conditions must be complied with if in the future individuals are to be formed who are capable of production and creativity and not simply repetition". In active learning, the teacher must have confidence in the child's ability to learn on his own.

IMPLICATIONS FOR INSTRUCTIONAL TECHNOLOGY

Laboratories, workshops and technologies that encourage interactivity such as multimedia, hypermedia and virtual reality fit in with Piagetian thought. Computer software that is strictly drill and practice does not fit in with an active discovery environment. Drill and memorization practice, often used in language schools, do not encourage creativity or discovery.

Students not only can use multimedia to learn, but they can also use it to communicate their understanding of the subject to those around them. They can create what they learn by using an authoring tool such as Hypercard. Peer teaching is used as the students work together in the making of their projects. Students become active participants instead of passive sponges and the teacher truly takes on the role of facilitator as she gives them guidance in their creations. Hypermedia also allows the students to manipulate their environment as they follow the path(s) of their choice. Virtual reality has the potential to move education from its reliance on books to experential learning in naturalistic settings. For example, rather than reading about an event, the children can participate in the event with simulated persons and/or objects. These technologies supply the students with a learning environment that encourages children to initiate and complete their own activities.

APPENDIX L: JOHN HATTIE'S 'EFFECTS'

Professor John Hattie's Table of Effect Sizes

Hattie says 'effect sizes' are the best way of answering the question 'what has the greatest influence on student learning?'. An effect-size of 1.0 is typically associated with

- advancing learners' achievement by one year, or improving the rate of learning by 50%
- a correlation between some variable (e.g., amount of homework) and achievement of approximately .50
- A two grade leap in GCSE, e.g. from a C to an A grade

An effect size of 1.0 is clearly enormous (It is defined as an increase of one standard deviation)

Below is Hattie's table of effect sizes.

Influence	Effect Size	Source of Influence
Feedback	1.13	Teacher
Student's prior cognitive ability	1.04	Student
Instructional quality	1.00	Teacher
Direct instruction	.82	Teacher
Acceleration	.72	Student
Remediation/feedback	.65	Teacher
Student's disposition to learn	.61	Student
Class environment	.56	Teacher
Challenge of Goals	.52	Teacher
Peer tutoring	.50	Teacher
Mastery learning	.50	Teacher
Homework	.43	Teacher
Teacher Style	.42	Teacher
Questioning	.41	Teacher
Peer effects	.38	Peers
Advance organisers	.37	Teacher
Simulation & games	.34	Teacher
Computer-assisted instruction	.31	Teacher
Testing	.30	Teacher
Instructional media	.30	Teacher

Affective attributes of students	.24	Student
Physical attributes of students	.21	Student
Programmed instruction	.18	Teacher
Audio-visual aids	.16	Teacher
Individualisation	.14	Teacher
Finances/money	.12	School
Behavioural objectives	.12	Teacher
Team teaching	.06	Teacher
Physical attributes (e.g., class size)	-.05	School

Terms used in the table
An effect size of 0.5 is equivalent to a one grade leap at GCSE
An effect size of 1.0 is equivalent to a two grade leap at GCSE
Number of effects is the number of effect sizes from well designed studies that have been averaged to produce the average effect size.
An effect size above 0.4 is above average for educational research
The effect sizes are averaged, and are a synthesis of research studies thought to be well designed and implemented by research reviewers. Hence they are the best guess we have about what has the greatest effect on student achievement.
Some effect sizes are 'Russian Dolls' containing more than one strategy e.g. 'Direct instruction' is a strategy that includes active learning, structured reviews after one hour, five hours and 20 hours study. There is also immediate feedback for the learners, and some corrective work if this is necessary.

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APPENDIX M: Berthiaume's Model of DPK

This is the outline model of Berthiaume's own DPK model.

THREE DOMAINS	**Berthiaume 2009**
1.KNOWLEDGE BASE FOR TEACHING	
Goals Related to Teaching	Course-level goals,
	Class-level goals,
	Ordering of goals,
	Accomplishment of goals
	New/future goals
Knowledge related to Teaching	Knowledge of the Content
	Pedagogical Content Knowledge
	Knowledge of Self
	Knowledge of Teaching and Teachers
	Knowledge of Learning and Learners
	Knowledge of Assessment of Learning
	Knowledge of Curricular Issues
	Knowledge of Human Behaviour
	Knowledge of the Physical Environment
	Knowledge of Logistical Issues
Beliefs Related to Teaching	Beliefs about the Purpose of Instrction
	Beliefs about the conditions of Instruction
	Beliefs about teaching and Teachers
	Beliefs about Learning and Learners
2.DISCIPLINARY SPECIFICITY	
Socio-cultural characteristics	Teaching in the discipline
	Learning in the discipline
	Knowing in the discipline
	Practising in the discipline
Epistemological Structure	Description of the discipline
	Organisation of the discipline
	Relation to other disciplines
3.PERSONAL EPISTEMOLOGY	
Beliefs re. Knowledge and Knowing	Beliefs about the nature of knowledge
	Beliefs about the act of knowing
Beliefs re. Knowledge Construction	
	Beliefs about how people learn in general
	Beliefs about how one learns specifically
Beliefs about Knowledge Evaluation	
	Beliefs about the relative value of knowledge

APPENDIX N: Morgan & Tweh: 'Ebola in Town' song

This song has warnings against touching friends, kissing, hugging and being careful about what you eat especially monkey meat (the scientific consensus was that eating of simian meat might have caused transfer of the disease from animals to humans). This emphasis on behaviour change is good advice and is giving listeners advice on how to keep safe as well as simply warning them. It warns that it is difficult to go anywhere to avoid it, even to a neighbouring country like Guinea where it is also endemic and that it is probably better to stay at home. This is good advice as, in the absence of organised public social welfare facilities, staying near to one's extended family may be the only way to get fed during a period of imposed isolation or illness. Also, imploring people to stay put may hinder the spread of the disease. It warns that the disease is worse than HIV/AIDS which is also endemic in many African countries; Most people would have heard of HIV/AIDS and seen its effect on families, the reduced ability to continue working, and difficulty of affording medications. This gives a dimension to the problem that ordinary people can probably relate to. Note the lack of mention of any doctors, hospitals, medications or any medical interventions of any kind. The only mention of medicine is the warning to change behaviour to 'distant' ,i.e without physical contact, kissing, hugging and shaking [of hands]. It reflects the reality of many of the listeners of this song that they probably couldn't afford much in the way of medical facilities anyway besides the fact that any that existed were almost powerless to help victims. The only appeal to a higher authority is to Jehovah which seems very final indeed but this only occurs once so a desperate Armageddon feel, which might promote panic, is avoided. This kind of edutainment involves the power of music, short narratives about ordinary life (eating, travelling, hugging, kissing) and characterisation (it talks of friends and is sung in the first person throughout). Overall a powerful warning comes through with lots of 'don'ts' and a few 'do's' which is simple but straightforward advice for locations where little else is available**.**

Something happen
Something in town
Oh yeah the news
I said something in town
Ebola
Ebola in town
Don't touch your friend!
No touching
No eating something
It's dangerous!
Ebola
Ebola in town
Don't touch your friend!
No kissing!
No eating something
It's dangerous!

I woke up in the morning
I started hearing people dem yelling

"Da what thing happen? What thing happen? Ma peekin' what thing?"
They sit down grab me
They say something in town
Frisky!
That thing that in town it quick to kill
That me scary-o
E-B-O-L-A
Ebola. Ebola in town.
I started yelling.
I started running.
What place I will go?

I go to Guinea.
I went everywhere.
Ebola. Ebola there.
I'm not going anywhere.
I'm right here.
I'm not going nowhere-o.
I'm right here.
I know the medicine.
That distant hugging
I said distant shaking
Distant kissing
Don't touch me!

Something in town-oh
Something in town-eh

Ebola.
Ebola in town.
It's dangerous-o.
Ebola is very wicked.
It can kill you quick quick.
Be careful how you shaking hands-o.
Be careful who you touch.
Ebola is more than HIV/AIDS.

It can kill you quick quick.
It can kill you fast fast.
Don't touch your friend.
Don't touch your friend.
I say it will kill you-o.

My pa Jehovah
Please save us from Ebola
Nowhere to go
Nowhere to hide
And I ain't come in town
My people, ya'll please take time
Take time before you get that disease
Don't overlook it
That thing it quick to kill

Na na na na. Ebola - o.
It's dangerous.
Don't take it for joke
My people, I saw it before
It coming too fast
Be on the safe side, you hear me?
Ebola.

If you like the monkey
Don't eat the meat
If you like the baboon
I said don't eat the meat
If you like the bat-o
Don't eat the meat
Ebola in town.

APPENDIX P: INTERVIEW TRANSCRIPTS

RESPONDENT 1

Response to the Question

1. 1) In what way did you find the use of humour in lectures helped you in your studies?
It helped me to remember things and understand things more clearly, and it still does, I can vividly play back instances where he used humour to explain very vital points in lectures. Till date any time I meet for instance asymmetric and symmetric encryption I recall the hilarious posture, facial expression and tone he used to explain Joe and Sue's exchange of messages that involved their public key and private key.

2. 2) In what way did you find the use of story-telling (anecdotes etc) in lectures to be useful?
Coming from a background where folk tales is a part of our culture, [the lecturer's] dexterity in using funny stories to teach made it so easy for me to relate to the topic being taught and I could easily imbibe the explanation and concept.

3. 3) Do you think you might use such techniques yourself in the future to prepare for professional exams etc?
Yes

4. 4) Is there anything else you might like to say about the edutainment teaching style you were exposed to by the lecturer?
Edutainment made it simple to relate to what was being taught, it made me love his lectures, it never made his class boring it was always active and engaging, as a former programme's leader I could confirm how exciting my colleagues were attending his class, and how we all referred to one of such funny instances or hilarious stories he told anytime we wanted to recall or explain a topic he treated. Personally I said this in a programmes meeting and I will reiterate it, he made things simple for us, I would wish Edutainment comes to stay.
I am more than happy to be a part of your research project-which by the way I find to be quite interesting. I am still very much around, and preparing to take CISA next month.

Synopsis:
Qu1: helped to remember,
Qu2: I come from a culture of folk tales [so reacted well to this approach]]
Qu3: will use techniques myself in future
Qu4: simple to relate to teaching, furthering professional studies (CISA), referred to funny stories when recalling topics

RESPONDENT 2

I have provided answers to your questions below.

1) In what way did you find the use of humour in lectures helped you in your studies?
A: The use of humour provided a more interactive environment, and also helped to memorize things easily. For instance, in the audit & security lectures, the use of humour, incorporated as well into the slides, made a lasting impression. I still recall a joke about dos and don'ts of being an auditor-but it drove home the point about ethics in audit, andnot getting too close to auditees.

2) In what way did you find the use of story-telling (anecdotes etc) in lectures to be useful?
A: The use of story telling offered a different perspective, and I mustsay aided my understanding of topics during lectures, and also while reading for the course exams.

3) Do you think you might use such techniques yourself in the future to prepare for professional exams etc?
A: I can say that I have used a small part of the technique, whilstpreparing for my ITIL exam in November, and will do the same for my CISA exam in December.

4) Is there anything else you might like to say about the edutainment teaching style you were exposed to by the lecturer?
A: I would like to say, that the lecturer's teaching style stood out for me, as I always looked forward to every class, with the knowledge that there would be no boring moments. I can also say that, his classes were more interactive as students felt more relaxed and participated more-than I had seen in other course lectures. Lastly, his use of humour clearly is a benefit. For me, I found out that I could approach him easily with issues, beyond the classroom. I should also point out that although the lecturer uses jokes, comments and stories, it is his manner of teaching and communicating that really stands out.

Synopsis:
Qu1: helped to memorise
Qu2: story-telling offered a different perspective
Qu3: I have used same techniques for ITI and CISA exams
Qu4: looked forward to classes, no boring moments

RESPONDENT 3

I will try.. I am not very good at writing this so please fix my English as much as you want.. Now it will try to bring back memories of the old time (like 3 years ago :D) Obviously, you have done an excellent job in all of these topics:

1) In what way did you find the use of humour in lectures helped you in your studies? Did it help you to remember things, understand things more clearly?
Everyone likes to smile. Having humour in teaching makes learning much more enjoyable. The more interesting the lectures are, the more students are more engaging, which sparks ideas and questions. Learning can be more boring because acquiring new knowledge can be challenging, or sometime the topic itself is boring. Humour would ease that away. Especially, some of us are not having English as the first language, listening to a flat lecture can be daunting time. Humour keeps us up and helps to more alerts and ,consequently, to remember and understand things better. It is the lecturer's talents not have any dull moments. He knows when/where to inject humour to keep the class alive.

2) In what way did you find the use of story-telling (anecdotes etc) in lectures to be useful? Did it help you to remember things, understand things more clearly?
Human have been transferring knowledge from generation to generation through story-telling. It put hard-concept into a context where everyone can paint his/her own picture. Once the hard-facts are in context, it is naturally easier for us/human, to understand and memorize. With the clear sequences of events, different steps are put into an logical order for us to comprehend. The lecturer is equipped with different stories and fact in his pocket and relates his teaching concepts as practical as possible.

3) Do you think you might use such techniques yourself in the future to prepare for professional exams etc?
Yes, it will definitely try to learn and apply this techniques.

4) Is there anything else you might like to say about the edutainment teaching style you were exposed to by the lecturer?
I believe the lecturer successful masters this teaching style because he is well prepared before every class like a great performer. He always came to class early with all materials ready. He announced the class the "show" was about to start by reminding students to turn off their phone. Once he starts, he always is engaged with the class and keep students alive by asking questions, telling us related stories. His humours keeps the class productive and fun. At the result, students attend more and learn more from his classes.

Synopsis:
Qu1: humour makes learning more enjoyable, especially, some of us are not having English as the first language, listening to a flat lecture can be daunting time. Humour keeps us up and helps to more alerts and ,consequently, to remember and understand things better.
Qu2: Human have been transferring knowledge from generation to generation through story-telling. It put hard-concept into a context where everyone can paint his/her own picture.
Qu3: Yes
Qu4: At the result, students attend more and learn more from his classes

RESPONDENT 4

I would be happy to help with your project.
I found the entertainment factor that you used in the lectures was very helpful for me as I realised that I took the content in better when I was concentrating but relaxed.

1) In what way did you find the use of humour in lectures helped you in your studies? Did it help you to remember things, understand things more clearly?

The use of humour helped me to remember the stories you told us about case studies. I remember very well your example of your previous work situation when you explained how everyone should know their role (BCP,DRP) where you rushed to work at night to sort out a computer fault. I definitely found that the humour helped me remember the content and the entertainment aspect helped me understand the emphasis of the importance of the topic you were teaching.

2) In what way did you find the use of story-telling (anecdotes etc) in lectures to be useful? Did it help you to remember things, understand things more clearly?

Absolutely, the story telling which combined humour and entertainment was very helpful, it made it easier to recall case studies such as the Data Stream Cowboy and Kuji, Colin Blanchard and so on. Ordinarily with normal lecture styles I would not be able to recall such information so long after the lectures.

3) Do you think you might use such techniques yourself in the future to prepare for professional exams etc?

If I was planning on delivering a lecture or talk I would definitely try to employ these techniques as the results of doing so stand out very strongly against traditional speaking.

4) Is there anything else you might like to say about the edutainment teaching style you were exposed to by the lecturer?

The effort you put in was much appreciated. It was the combination of humour, entertainment, story telling, graphical display (projector notes) as well as detail that made the delivery very effective.

Synopsis
Qu1: I found the entertainment factor that you used in the lectures was very helpful for me as I realised that I took the content in better when I was concentrating but relaxed, helped me to remember the stories you told us about case studies
Qu2: Ordinarily with normal lecture styles I would not be able to recall such information so long after the lectures.
Qu3: If I was planning on delivering a lecture or talk I would definitely try to employ these techniques as the results of doing so stand out very strongly against traditional speaking.
Qu4: It was the combination of humour, entertainment, story telling, graphical display (projector notes) as well as detail that made the delivery very effective.

APPENDIX Q: Data from Researchers Questionnaire

QUESTION 1 : SOME THINGS ABOUT YOU Please circle answer that applies**:**

a)	My GENDER is:	Male	Female
b)	ENGLISH is my first language:	Yes	No

QUESTION 2: SOME THINGS ABOUT THE USE OF HUMOUR DURING TEACHING

In teaching it is often the case that a lecturer uses humour during his/her lectures. An example of this in this course was the 'Mary Had A Little Lamb' poem for frequency analysis in crypto-analysis...

2(a) How important was it for you to have humour as part of the teaching process? **Please place a cross X in the appropriate position:** **1----------2----------3----------4----------5** **Not useful I didn't mind Very useful**	
1. I don't like this – humour is inappropriate in a learning environment.	
2. I don't like this – humour is distracting from the actual learning I have to do.	
3. I like this - humour helps me pay attention during the lecture.	
4. I like this – humour helps me remember the real things I have to learn.	

QUESTION 3 : SOME THINGS ABOUT THE USE OF CHARACTERS IN THE TEACHING

In teaching a lecturer may uses characters, so that students can more easily identify with the material. An example of this in this course was Chadwick the Hacker Man-in-the Middle Attacks with Joe and Sue..

3(a) : Was the use of characters e.g Chadwick the Hacker, a feature that helped you learn? **Please place a cross X in the appropriate position:** **1----------2----------3----------4----------5** **Not useful I didn't mind Very useful**	
3(b) Place a X against the one answer that most closely fits the way you feel	
1. I don't like use of characters – it seems childish.	
2. I don't like use of characters – it is better to just learn the facts.	
3. I like use of characters - it helps me pay attention during the lecture.	
4. I like use of characters - I remember them afterwards and this helps my memory.	

	Sex Qu1(a)	English First Language? Qu1(b)	Like use of Humour (Likert) Qu2(a)	Like use of Humour (Options) Qu2(b)	Like use of characters (Likert) Qu3(a)	Like use of characters (Options) Qu3(b)
1	F	N	5	3	4.5	4
2	M	Y	5	4	4	3
3	F	N	5	3	5	3
4	M	N	5	4	5	4
5	M	Y	4.8	3	4.5	3
6	F	Y	3.5	1	3.5	1
7	M	N	4.5	3	4.5	3
8	M	Y	4.5	3	4.5	3
9	F	Y	4.5	3	4.5	3
10	M	Y	4	3	4	3
11	M	N	4.5	3	4.5	3
12	M	N	5	3	5	3
13	F	Y	4.8	3	4.5	3
14	M	N	4	4	4	4
15	M	Y	4.5	3	4.5	3
16	M	Y	4.7	3	4.5	3
17	M	N	4.5	3	4.5	3
18	F	N	5	3	5	3
19	M	Y	3.7	3	3.5	3
20	M	N	3.9	3	3.5	3
21	M	N	4	3	4	3
22	M	N	5	3	5	3
23	F	Y	4.5	3	4.5	3
24	M	N	3.5	3	3.5	3
25	M	N	3.6	1	3.5	1
26	M	N	5	4	5	4

27	M	N	4.8	3	4.5	3
28	M	N	3.5	1	3.5	1
29	M	N	5	3	5	3
30	M	N	4.9	3	4	3
31	F	N	4.8	4	4.5	4
32	F	N	4.6	4	4.6	4
33	M	N	5	3	5	3
34	F	Y	4	4	4	4
35	M	N	4.5	3	4.5	3
36	F	Y	4.8	3	4.5	3
37	M	N	5	4	5	4
38	M	N	5	4	4	4
39	M	N	4.8	3	4.8	3
40	M	N	4.5	3	4.6	3
41	M	N	4.6	3	4.4	4
42	M	N	5	4	5	3
43	M	N	5	4	5	4
44	M	N	4.7	3	4.2	4
45	M	N	4.4	3	4.5	4
46	M	N	4.6	3	4.5	4
47	M	N	4.4	3	4.5	4
48	M	N	5	4	4	4
49	F	Y	4.5	3	4.5	3
50	M	N	3.9	3	3.5	3
51	M	N	4.9	3	4	3
52	M	Y	3.7	3	3.5	3
53	F	Y	4.8	3	4.5	3
54	M	Y	4.8	3	4.5	3

	Likes Humour	Likes Humour	Likes Characters	Likes Characters
	Qu2a Likert	Qu2b Options	Qu3a Likert	Qu3b Options
Total Likert scale average	4.55		4.37	
Average Likert Female scores	4.6		4.47	
Average Likert Male scores	4.53		4.34	
Options Count 3,4		51		51
Options Count 1,2		3		3

APPENDIX R: UNIVERSITY STATISTICS

DATA SOURCE D2 in Data Collection and Analysis Chapter

Course Monitoring Report 2012/13
Status: Approved by Coordinator | Approved by HoD

COMP1427: Cyber Security
Course Coordinator: XXXXXXXX
Level: 7
Department: Smart Systems Technologies
Examination Time: January 2013
Exam: 50% Coursework: 50%
Number of courseworks: 1

Extenuating Circumstances Affecting Assessment
There were none

Comments on the running of the course
There were no problems with the running of the course

Comments on the running of the course at Partner Colleges (if appropriate)
n/a

Comments on results
The results were better overall than the previous year. We gave the students a mock class test, which better prepared them for the class test.

Comments on Key Performance Indicators (KPIs)
The course pass rate is 88.9% overall. This includes five students who did not make the 50% pass mark overall and two students did not attend the exam.

Median courses marks are 60 overall, with 64 for the coursework and 55 for the exam.

Action Taken in response to External Examiner comments
There were none

Action taken in response to Student Feedback, including CMS student survey
There is no survey to comment on for this year yet.

Last year's Action Plan

For January:
The coursework may be a contributing factor for the low percentage of students who passed the course, compared to previous years. This will be addressed next year by the following. The length of time for the test will be extended to give the students more time to complete the coursework. We currently spend a lot of time preparing the students for the coursework. For next year we have a plan to give the students the scenario in advance to give them more time to read the instructions, which is where some students run into difficulty.

Comment on Action Plan for last year

As a number of students failed the coursework test last year mainly due to not following the instructions. This may have been because this was a new concept to them. This year we decided to give the students a mock class test which we then went through in a tutorial. This enabled them to understand what was required to prepare them for the real test and gave them an insight into the types of questions that would be asked. The format and layout were the same but the numbers and the details were changed for the actual test. We also gave them more time, which clearly helped.

Action Plan for next session

As things went well this year, the action plan will remain the same for next year with the exception of updating the teaching material in line with the changes in technologies.

Results Analysis

	Total	Exam	Coursework
Mean	60	57	63
Stnd Dev	12	16	14

Total number registered students: 54
Number registered with no marks: 0
Number of passes (regardless of profile): 48
Number of Failures with complete profiles 5
Number of Failures with incomplete profiles: 1

Marks Distribution (include students with complete profiles only)

Course Mark (%)	0-19	20-29	30-39	40-49	50-59	60-69	70-79	80-100	TOTAL
No of Students	0	1	1	3	20	15	9	4	53

Course Monitoring Report 2013/14
Status: Approved by Coordinator | Approved by HoD

COMP1427: Cyber Security
Course Coordinator: XXXXXXXX

Level: 7
Department: Smart Systems Technologies
Examination Time: January 2014
Exam: 50% Coursework: 50%
Number of courseworks: 1

Extenuating Circumstances Affecting Assessment
None

Comments on the running of the course
The course ran smoothly without any problems. The students engaged with the subject. We had an invited speaker from industry, which went down well with the students.

Comments on the running of the course at Partner Colleges (if appropriate)
N/a

Comments on results
The students completed the coursework very successfully. Only 7 students failed the coursework . The MSc computer Forensics and the Law students have all passed the coursework, some with exceptional marks. 58 students handed in course work and also took the exam. The exam marks average was 59 and for the course as a whole was 65. Top mark in the coursework (class test) was 99% and the average mark was 70.

Comments on Key Performance Indicators (KPIs)
The course has met its KPIs. The mean was 65% and the median was 66%. There were 10 students who had marks in the 80 -100 range. Nine students have failed in both coursework and exam, which is 15% of the class, so the course has met the KPIs as the pass rate was 84.5%.

Action Taken in response to External Examiner comments
A very minor change to the wording of one part of one question, which was done.

Action taken in response to Student Feedback, including CMS student survey
The overall satisfaction with the course was 91%. In almost all categories the feedback was "strongly agree" and in two the

feedback was 50-50 with "strongly agree" and "agree". I am very pleased with the results overall. There were a couple of negative comments which were in the nature of a personal attack by disgruntled students.

Last year's Action Plan

For January:
As things went well this year, the action plan will remain the same for next year with the exception of updating the teaching material in line with the changes in technologies.

Comment on Action Plan for last year

Last years action plan has worked well. We will update the material in line with current security threats. The class test has been successful and we will continue with this.

Action Plan for next session

The coursework has been very successful. There were no instances of plagiarism. We will continue with this style of coursework for the next year.

The lecturers will update the course material to reflect current trends and a new class test will be written.

Results Analysis

	Total	Exam	Coursework
Mean	65	60	70
Stnd Dev	13.9	14.5	18.2

Total number registered students: 58
Number registered with no marks: 0
Number of passes (regardless of profile): 49
Number of Failures with complete profiles 9
Number of Failures with incomplete profiles:0

Marks Distribution (include students with complete profiles only)

Course Mark (%)	0-19	20-29	30-39	40-49	50-59	60-69	70-79	80-100	TOTAL
No of Students	2	7	5	12	13	9			58

Official Student Survey Results 2013

Data Source 1 in Data Collection and Analysis Chapter

A total of 15 (Current Enrolment: 54) Course forms have been completed for course **COMP1427 Cyber Security**

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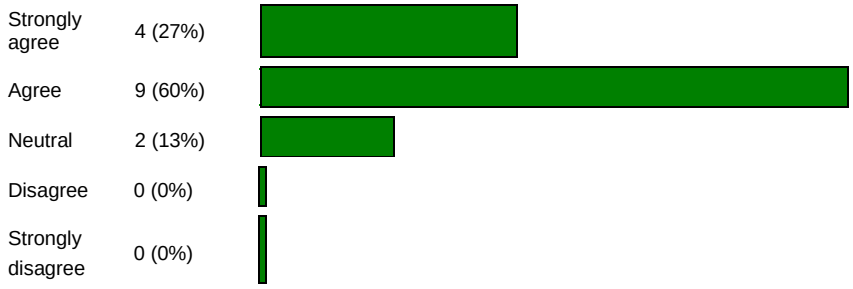
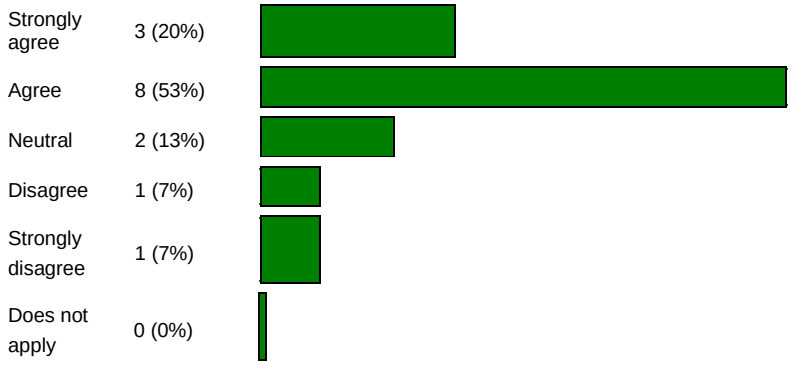
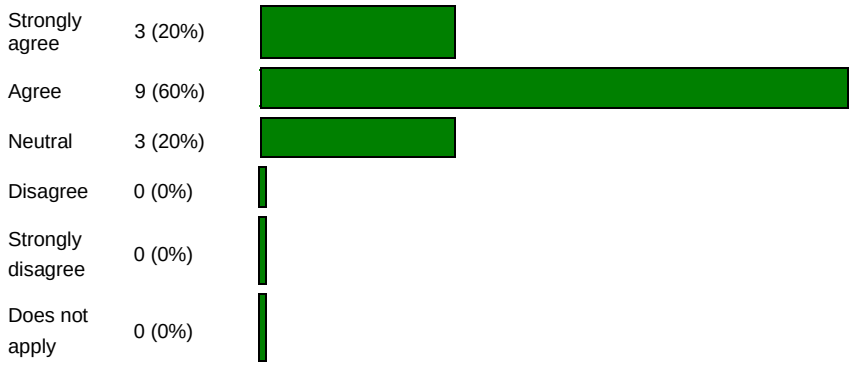
1. The course was intellectually stimulating



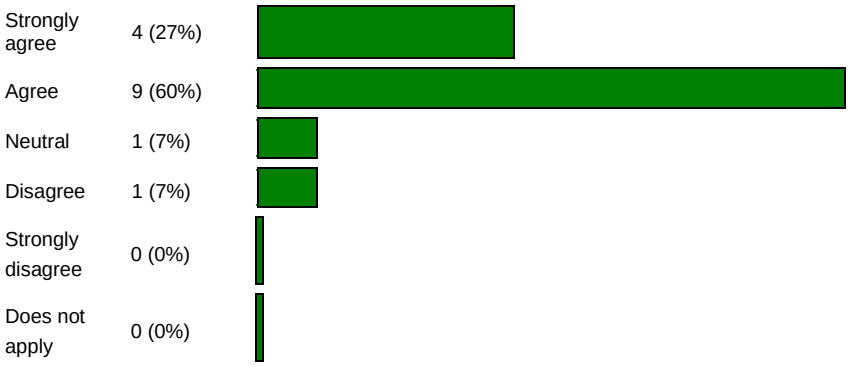
2. The course was well organised and ran smoothly



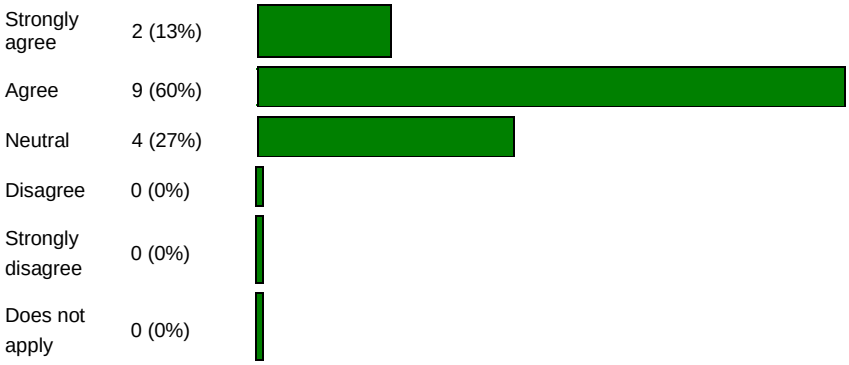
3. The criteria used in marking were made clear in advance



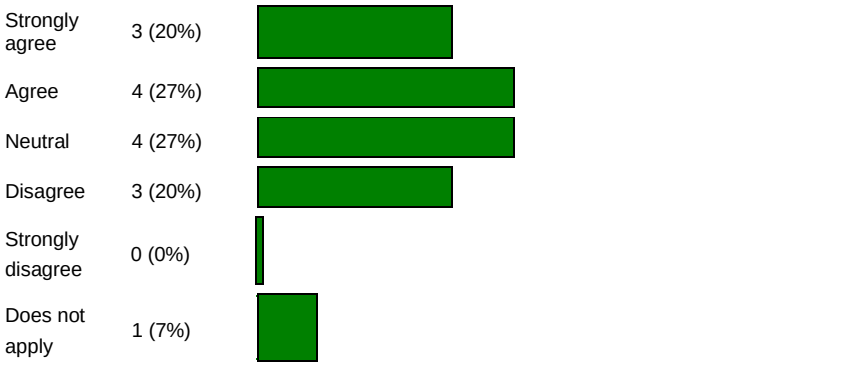
4. Assessment arrangements and marking have been fair



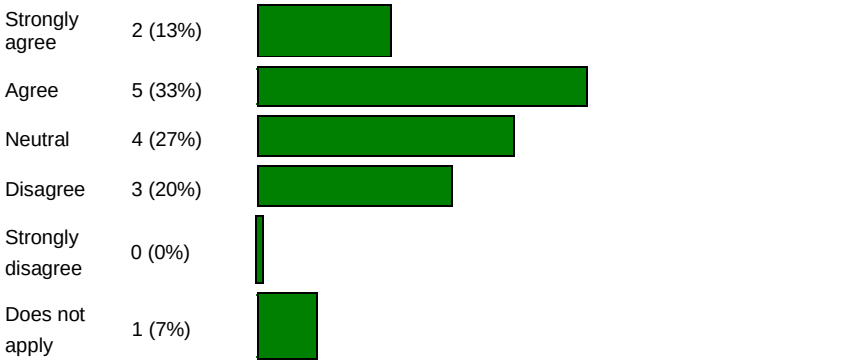
5. Feedback on my work has been prompt



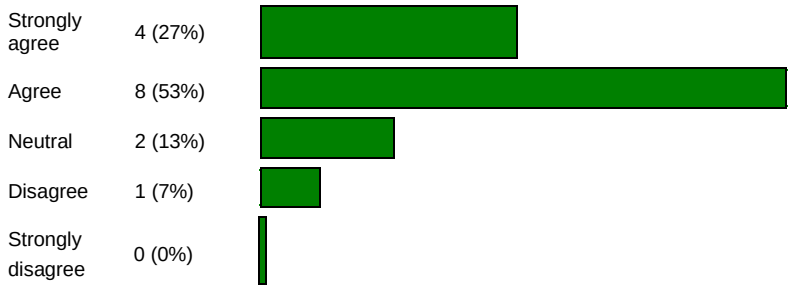
6. I have received detailed comments on my work



7. Feedback on my work has helped me clarify things I did not understand



8. The teaching, including lectures, was generally of a good standard



9. Overall, I am satisfied with the quality of the course

Official Student Survey Results 2014

A total of 35 (Current Enrolment: 58) Course forms have been completed for course **COMP1427 Cyber Security**

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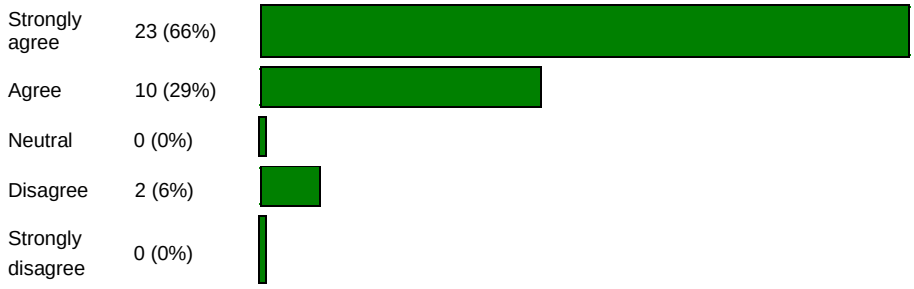
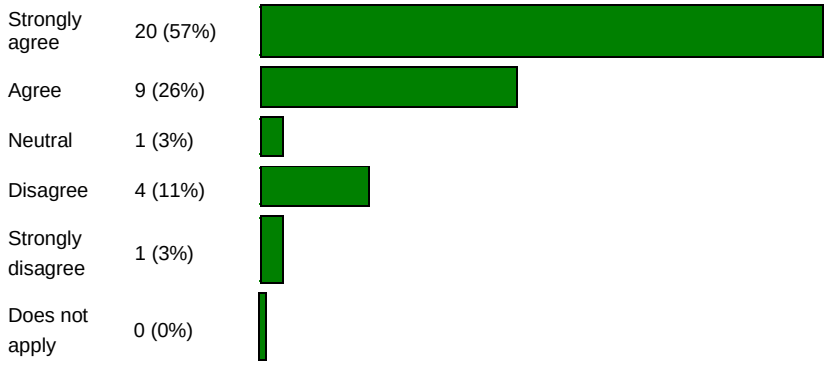
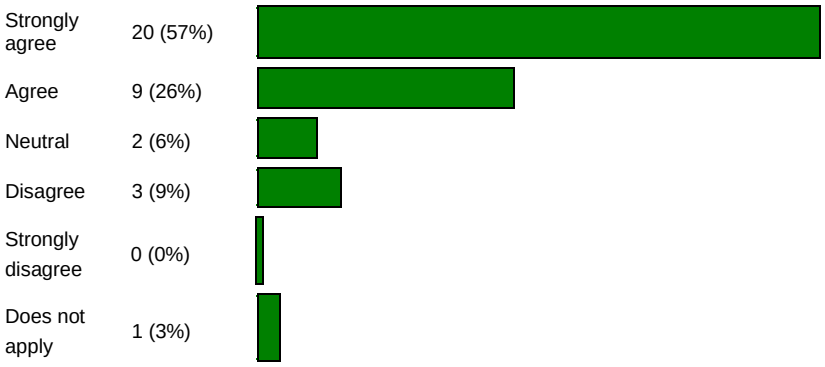
1. The course was intellectually stimulating



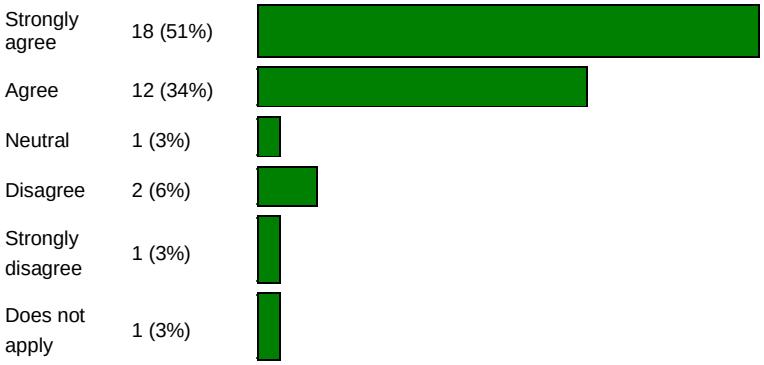
2. The course was well organised and ran smoothly



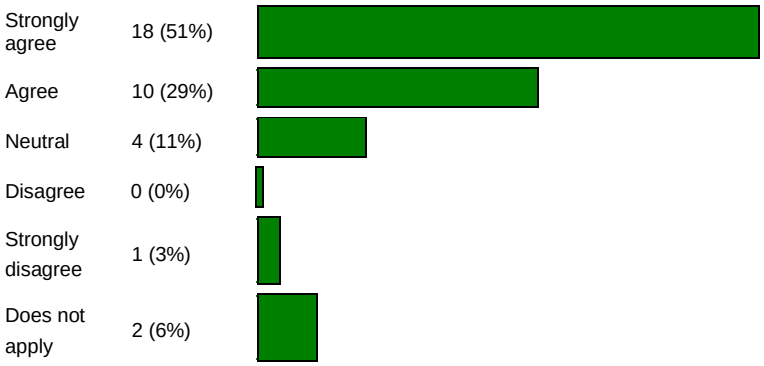
3. The criteria used in marking were made clear in advance



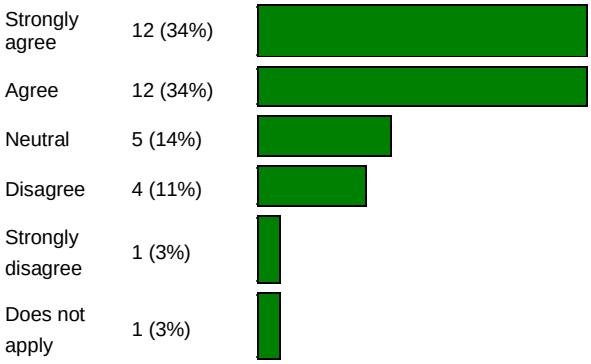
4. Assessment arrangements and marking have been fair



5. Feedback on my work has been prompt



6. I have received detailed comments on my work



7. Feedback on my work has helped me clarify things I did not understand

Strongly agree	12 (34%)	
Agree	12 (34%)	
Neutral	5 (14%)	
Disagree	3 (9%)	
Strongly disagree	2 (6%)	
Does not apply	1 (3%)	

8. The teaching, including lectures, was generally of a good standard

Strongly agree	22 (63%)	
Agree	9 (26%)	
Neutral	2 (6%)	
Disagree	2 (6%)	
Strongly disagree	0 (0%)	

9. Overall, I am satisfied with the quality of the course

Yes	32 (91%)	
No	3 (9%)	

APPENDIX S : RESEARCHER'S PERSONAL STATEMENT

Jean McNiff, Professor of Educational Research at York St John University, UK, and a supporter of the Action Research methodology undertaken in this thesis said '*In action research people should speak for themselves … You* [the researcher] *are the main actor*' McNiff J (2014:74) and '*[cultivate] the habit of writing as you speak not as you think academic texts should be written'* McNiff J (2014:51). This personal statement has accepted these statements as good advice and has been written in the first person in the writer's own language. It is a self-interview to address the concerns brought into the open by the following paragraph concerning a quotation from Cohen in the Methodology step6:

'Cohen et al caution that there may be conscious or unconscious tendency on the part of the researcher to (i) fall back on his own attitudes, opinions & expectations, (ii) see research subjects in his own image, (iii) seek answers that support his preconceived notions or (iv) be a victim of his own misperceptions in analysing and interpreting the data.' Cohen et al (2005: 121)

Issue (i) own attitudes, opinions & expectations

I hope I do not come to this work with a particular perspective – I am certainly not aware of one. Of course, I have an academic interest in this research in that I think the area of edutainment needs exploring but I am not aware of any desire of mine to make edutainment the focus of an educational revolution or whatever (heaven forbid!). And I am not consciously out to prove that edutainment works – I believe that that is already proved by the case studies many of which have existed in their own right for many years and one, the Alice books of Lewis Carroll, long before I was even born. My own opinion is that with all the different approaches to edutainment in the world in might be useful to take the very successful models and collect their good habits and discard their bad bits – all in all to give some kind of guidance to others who might want to use edutainment but are not sure how to get started. In order to place my own mark too firmly upon the resultant model I have resolved to make the model as flexible and adaptable as possible so that others, who might care to use it, can adapt to meet their own needs. Therefore I have deliberately incorporated such features as a loose Presage-Process-Product timeline process model incorporating, at its heart, the DPK model based upon Berthiaume's model (itself based upon Shuman's model). The DPK model has four inputs all of which can be adapted to a lecturer's personal perceptions.

Issue (ii) see research subjects in his own image,

I am white, British, male, over 60, able-bodied and I am educated to masters level at a British university. I was born in a working class family but I guess most people would consider me middle-class now. I suppose that all of these attributes must have some effect on my perception of the world and of other people. I am aware that there must be a power-relationship of lecturer-student but I believe the provisions of the University Resear4ch Ethics Committee have minimised any misuse of that relationship in this work. The questions in the researcher survey I believe to be

straightforward and it is the students who have anonymously to give a numerical assessment to their own feelings about things. I do not make any assessments or interpretations – all the data collected is provided by the respondents themselves. This is true, too, of the Official Statistics which are, independently of me, collected by the university. There are, however, two areas in which my perceptions may have some influence: (i) with the researcher interviews there is clearly interpretation by me of what the respondents have said, and (ii) there may be bias introduced by me in the class-based materials and in the survey questions vis-à-vis the overseas students in the class. Questions of national values, language, history, culture and so forth may unconsciously be introduced by me in the teaching. However, I do not see this as a concerning issue. I believe that the overseas students not only ACCEPT that the education they are receiving will have a slight Anglophilic bias but they actually EXPECT it. And by 'expect' I mean they actually DESIRE it for that is why they have come to this country for an education. In fact, it baffles me why English-speaking Asian students come to the UK at all when they could just as easily go to Australia, New Zealand or the USA.

Issue (iii) seek answers that support his preconceived notions

I actually do not have any pre-conceived notions about whether edutainment will be useful in educating adults generally – it may, it may not. Of course this entire thesis is based upon the premise that it might have an effect in enhancing learning and I do feel, from all the evidence collected, that it might have a positive effect on the adult students taught by me but I do not know for sure. One of the purposes of this research was to get some evidence either way. I was however always cognizant of the Hawthorne Effect and that somehow, because I was deeply involved in doing this research, my enthusiasm might somehow infect the students and, even though they did not know I was engaged in research, making them more susceptible to my teaching and to giving me positive feedback.

Issue (iv)) be a victim of his own misperceptions in analysing and interpreting the data

This was a genuine fear. I was very worried that the results and eventual findings would be artefacts of my own thinking and that I fooled myself into seeing things a particular way.

Could I be misled by own analytical methods and misinterpretations? This is always possible, no one is above making errors, but this problem is inherent in all research. The research findings are to be open to inspection by any concerned parties. Of course, in the end, there is always the prospect that this research could be duplicated by another lecturer with another cohort of students in another university in another country. If the model created by this current work is sufficiently robust then it will give structured guidance to replicators so they can truly try it out for themselves (of course, they will have to remove their own bias).

My main concern during the actual teaching was obtaining formative feedback quickly after each lecture session so that mistakes and errors in edutainment creation could be remedied for the

following lecture. In this I was attempting to emulate the formative+summative feedback approach of Sesame Street. The draft model of fig. 4.5 that I was working to through the trial period showed two types of feedback: summative and formative and I attempted to execute both during the experimental trial of the draft edutainment model. Formative feedback occurred between lessons so that edutainment products could be improved upon on an ongoing basis; I basically sat down after each lecture session and gave feedback to myself on how well things had gone and how things might be improved in the future. As an illustration of this at work, I give an example of a mistake that occurred when I delivered a short narrative about the use of acronyms with passwords was delivered to the class – see below. At first sight it seemed the perfect edutainment scenario: it has narrative, it has humour, it has a game element in that everyone tries to think what the acronyms might stand for. But, most of all, it actually teaches important points about password policy: that passwords should be a reasonable length, should contain other characters as well as alphabetic characters, should appear meaningless but be easy to remember, should never be written down, should be changed frequently and that there should be layers of password control (here there are two layers individual + team). On the face of it, it was a perfect edutainment scenario.

At XXXX plc I was a member of a systems development team. In addition to their own personal password, each member of the team was given the same password for entry to an area of shared data for that team. This password was changed every week for security purposes.

One week the password was given as RRWATR?. This was somewhat difficult to remember and we were banned from writing down passwords so we asked the security administrators how to remember it. They replies it was an acronym of : Romeo, Romeo, Wherefore Art Thou Romeo ?. This was easy to remember.

The following week the team password was changed to PYIKHWH. We racked our brains as to what this could be an acronym for taking into account there might be a Shakespearean theme but we couldn't figure it out. Eventually we went back to system administrators and they told us : Poor Yorick I Knew Him Well Horatio.

The next week the password changed to SWAT7D. Again we racked our brains for what this could mean, some thought it was a quote from Richard III, some thought it was from A Midsummer's Nights Dream. Eventually we gave up and asked the security administrators. They told us: Snow White And The Seven Dwarves.

The Password Acronym Scenario

However, the problem with the scenario above became evident as soon as I verbally told it to the class. The class, being predominantly composed of overseas students, turned out to have little knowledge of Shakespeare and his plays and so the humour of the acronyms was lost upon them. Even worse, coming from non-western cultures, they did not know who Snow White was. On top of all that was the possible charge that speaking of 'dwarves' was politically incorrect and it should have been 'vertically challenged persons'. The scenario completely failed as a piece of

edutainment although the students accepted it as an anecdote from which they could learn something. However, it did give immediate useful feedback to the lecturer on how important it was to ensure the edutainment was a good fit to the characteristics of the student cohort. A list of student characteristic domains for edutainment framing were immediately drawn up – see table 3.2 and this table was fed forward to the edutainment process for the next lecture. In this way, the mistakes and failures of one lecture were learned from and the lessons applied immediately in time for forming the next lecture. Formative feedback really did work for me during this trial as I learned a great deal very quickly about how to create and deliver materials, what worked and what did not work.

APPENDIX T: TASTER SESSION QUESTIONNAIRE AND RESULTS

Centre for Cyber - Security, Audit, Forensics Education

The C-SAFE Centre

Thank you for coming along today to our 'taster' session – we hope that you enjoyed it. We are always trying to improve what the C-SAFE Centre does and would like your comments on today's session. No need to give your name – everything is anonymous – and, fortunately, there are only THREE questions!

1.Did you find today's session was entertaining (please write a cross at the point that most represents your feelings)?

Boring OK Enthralling

1_____2_____3 _____4 _____5

2.Did you learn anything today (please write a cross at the point that most represents your feelings)?

Nothing Some good stuff All good stuff

1_____2_____3 _____4 _____5

3. Having now done this taster session do you think you are now more likely to choose this university to apply to (please write a cross at the point that most represents your feelings)?

Less likely No change More likely

1_____2_____3 _____4 _____5

Any other comments you would like to make (write on back if necessary)?

TASTER SESSION COHORT1: Secondary School A				
Respondent	**Qu1**	**Qu2**	**Qu3**	**Comments**
1	**4.8**	**4.4**	**4.4**	
2	**3**	**3**	**3**	Something good.
3	**5**	**5**	**5**	
4	**4.5**	**3.5**	**4.5**	
5	**4.5**	**5**	**5**	
6	**4.2**	**4**	**4.2**	
7	**4.5**	**3.5**	**3.5**	
8	**4**	**3**	**3**	
9	**4**	**5**	**4**	
10	**4**	**4.3**	**5**	
11	**5**	**5**	**5**	
Averages	**4.3**	**4.2**	**4.2**	

TASTER SESSION COHORT2: Secondary School B				
Respondent	**Qu1**	**Qu2**	**Qu3**	**Comments**
1	**4**	**4**	**3**	**I enjoyed the taster session today**
2	**5**	**5**	**5**	
3	**5**	**5**	**5**	
4	**4.5**	**4.5**	**4.5**	
5	**3.8**	**3.8**	**4.2**	
6	**4.9**	**4.9**	**4.9**	
7	**4.2**	**4.3**	**4.8**	
8	**4**	**5**	**4**	**Helpful and interesting tuition.**
9	**4**	**3**	**4**	
10	**4.5**	**5**	**5**	
Averages	**4.4**	**4.5**	**4.4**	

APPENDIX U: Forensics Coursework & Student Feedback Questionnaire

Appendix U(a) shows Forensics Coursework Specification showing student teams acting in both criminal and investigator roles. Appendix U(b) shows student feedback on this same coursework.

Appendix U(a) Forensics Coursework Specification

Detailed Specification

Topics for scenario selection: each team select one topic, all teams have different topics.

Terrorism
Bank robbery
Industrial espionage
Drug dealing
Paedophile ring
Murder
Running a prostitution ring
People smuggling
Stalking someone famous
Money Laundering

Create a case around your given topic. Write a brief synopsis of the crime. This should include names of gang members, how they were arrested, what they are suspected of (without giving too much away). You should also include a step by step guide as to what you have hidden, where it is and how it has been hidden.

This coursework is in two parts and is to be completed in teams (the same team for both parts). All activities carried out MUST be written up IN YOUR OWN WORDS.

PART 1 : Interim Report and artefact (deadline 07/12/2014)

- Each team member must include their own conclusion/evaluation at the end of each report (individual element).
- Using your allocated "crime" you will document the methods and techniques used to hide the relevant evidence within the forensic evidence file, so that someone could repeat what you have done.
- You must produce an artefact which has your evidence hidden within a number of files and folders.
- Write a brief synopsis of the crime and how this person/ these persons were arrested. You should also include the details of all equipment seized for the forensics investigators. It should also include the names of any criminals. These names **MUST** be present in the evidence to facilitate a search using the forensics tools. This could be in emails, pictures, letters or address books, etc.
- Create your given "crime" using any tools as appropriate and thoroughly document this activity, so that someone could repeat what you have done. You do **NOT** need to include things such as "I plugged in the dongle" or "I clicked on the Hide button".
- There **MUST** be some easy, medium and hard to find evidence. If you use passwords then they must be present within the evidence or someone's name within the case. You will need to include red herrings and padding files to disguise criminal activities.

- You will need to demo your case. There will be a viva where your team will demonstrate your evidence to the lecturers.
- It might be useful to have something encrypted using EFS. In which case you will need to include the SAM, SECURITY, NTUSER.DAT registry files
- Try to include some registry files (e.g. NTUSER.DAT)
- Document your activities thoroughly in such a way that someone could reproduce exactly what you have done.
- You are also expected to leave clues in your evidence.
- You must include the hashes in your report
- Each member must also include a personal evaluation and reflection

PART 2 : Final Report (deadline 29/03/2015)

- In the same group you will be allocated a random case from a different group from Part 1. You will perform a forensics investigation and write a report on your findings.
- Using any tools, as appropriate, perform a thorough forensics investigation using the ACPO guidelines (found on Teachmat) on your allocated case.
- Thoroughly document this activity (step by step).
- In your report explain the significance of each piece of evidence found and how it contributes to the case.
- Each member must include a personal evaluation and reflection (individual element)
- The report should be structured logically and clearly explain:-
  - the tools that you have used
  - the evidence that you have found
  - the significance of the evidence found to the case
- A professional and polished report is expected that could be presented in court.
- There will be a viva where your team will demonstrate your evidence in the lab.
- 10% of the coursework mark relates your previous work in Part 1. If the other team cannot uncover all of your evidence then 10 marks (or a portion of this) will be added to your coursework.

Appendix U(b) Forensics Coursework Student Feedback Questionnaire

Questionnaire given to student cohort who undertook the above coursework.

QU No	QU Descriptor
1: Part 1	Was Part 1 challenging? Did you have to think deeply and use most of the taught skills?
2: Part 1	Did Part 1, which put you into the criminal's mind, give you insight into the criminal mind?
3: Part 2	Was Part 2 challenging? Did you have to think deeply and use most of your taught skills to accomplish it?
4: Part 2	In Part 2, was your 'crime' to be investigated particularly interesting to you?
6: All parts	Did you like the course approach of having FOUR experts as lecturers?
7: All parts	Did you like the order in which the topics were delivered?