

EFFECTIVE EDUCATIONAL METHODS IN EDUCATIONAL VIDEO GAMES

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ABSTRACT

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Effective educational methods in educational video games

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This thesis examines the teaching methods used in three successful educational video games with the goal to provide a concise, practical guide for the proper implementation of educational learning into video games.

The main source for analysing the teaching methods of educational games in this thesis is James Paul Gee's book *What Video Games Have To Teach Us About Learning And Literacy* (2004). Gee expresses 36 learning principles existing in good games (chapter 4.2). This ideology serves as the comparative foundation of examining educational methods in the selected educational games.

The three selected educational video games in question are The Oregon Trail, Wolf Quest and Portal 2. The choices for these games are based on sales, awards and overall popularity.

The result of this thesis is a concise guide consisting of 7 guidelines for the proper implementation of educational learning into video games.

Key words: educational video games, game development, teaching methods

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1 INTRODUCTION

The purpose of this thesis is to provide a better understanding of the teaching methods present in successful educational video games and to serve as a general basis and practical guide for the proper implementation of educational concepts into video games.

The research subjects for this study are three selected examples of different types of popular educational video games, which are analysed and compared with one another throughout the main course of this research. The focus of the study is on the teaching methods of each game and to find similarities between these games in order to establish a set of general principles, which can be implemented in order to create other successful educational games of varying educational fields.

The main source for analysing the teaching methods of educational games in this thesis is James Paul Gee's book *What Video Games Have To Teach Us About Learning And Literacy* (2004). Gee expresses 36 learning principles existing in good games. This ideology serves as the comparative foundation of examining teaching methods in educational games.

The findings presented in this thesis are aimed to benefit anyone interested in the proper implementation of learning into video games. Personally this research paper is meant to be of use to me during the creation of my latest video game, which will include many educational elements. It will undoubtedly be of value to me as a game designer in general.

2 DEFINING CENTRAL TERMS

In order to study and analyse educational video games and their methods of teaching, it is important to understand their definitions, especially in the context of this thesis. In this section, the central terms “video game” and “educational game” are defined.

2.1 The definition of a video game

A video game is first and foremost a game. The word “game” means something different to every individual and there are countless definitions attempting to describe its meaning.

Salen & Zimmerman (2004, p.71-83) defines a game as “a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome.” This definition can be argued against on all of its points and attempting to define the word “game” can result in an endless philosophical discourse. If Salen & Zimmerman’s definition is considered to be more of a guideline rather than a rule carved in stone, it is satisfactory and true for most video games, especially in the context of this thesis.

So what is a video game? A video game is a game in an electronic, interactive world that requires a person to interact with a user interface to generate feedback on a display screen. Input devices can range from game controllers, keyboards, touch screens and voice and movement recognition systems. The electronic devices hosting these games, known as platforms, can range from personal computers, game consoles, mobile devices such as phones and tablets as well as any electronic device with the required capabilities. To limit the scope of this thesis, platforms and input devices are disregarded. The main focus is on the digital content of the selected games themselves.

2.2 The definition of an educational game

Educational games fall under the umbrella term of Serious Games. Abt. C. (1987, p.9) defines serious games as having “an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement.” His definition for serious games perfectly describes educational games and therefore the two terms appear to be synonymous, but in today’s gaming world this does not seem to be the case.

There are a number of terms under the game category of serious games, which would not qualify as educational. One example is advergaming; a classification of games used primarily for advertising. Serious Games Classification is a website dedicated to the classification of serious games, consisting of a whole range of sub categories, removing the parallels between the term “educational game” and “serious game”, effectively placing educational games in its own sub category (serious.gameclassification.com, 2014).

Michael & Chen (2006, p.111) briefly describes educational games as effective tools of training and teaching. Even though there might be some confusion regarding the term “serious games”, it seems that the term “educational game” is understood quite well. To prevent this section from becoming a tedious affair over terminology, I provide my personal description of what I believe an educational game to be in context of this thesis:

An educational game is a game designed with the primary or secondary purpose of conveying to participants new knowledge or skills about one or more predetermined subjects.

3 METHODS OF SELECTION AND ANALYSIS

Producing a practical guideline for properly implementing education into a video game by analysing a selected number of educational video games requires the selection of games that have been proven to be successful. A proper means of analysis is also needed to draw accurate conclusions. In this section, the criteria for determining the measure of success for the selected research subjects are explained, as well as the means by which these subjects are analysed.

3.1 Determining the successfulness of educational video games

Collecting information on the game's popularity, financial success and educational value as well as awards earned can determine the overall success of an educational video game. The Fun And Serious Game Festival, among other benefactors like the Serious Play Conference, gives awards to the best new serious games on an annual basis (funandseriousgamefestival.com, 2013).

Determining the financial success of a game is difficult. Financial information and sales data are not usually freely given out to the public, but it can be determined through third party sources such as articles from reliable sources. The educational value of a game is just as hard to determine without conducting extensive surveys, and that is beyond the scope of this thesis. Luckily information on the educational value of a game can be acquired through existing data such as surveys and acknowledgements. Awards earned from the decisions of a panel of judges who are experts in the field of serious games provide a certain confidence that the games in question are in fact appropriate samples.

Popularity can be determined from ratings charts and top game lists from reliable sources such as *Steam* and *Gog.com* as well as hobbyist sites. Online communities discussing a certain game can easily show how many active users a game has and the amount of articles and user made videos can help determine the popularity and success of a game.

3.2 Focus of the analysis

Video games in general need to teach players the rules, goals and game mechanics of the game as well as convey other information such as story and background information. While this is important and requires critical teaching methods, it is not the main focus of this study. The focus of this thesis is to examine the means by which successful educational games teach their predetermined educational subjects to the player.

3.3 Basis of the analysis

The main source for analysing the teaching methods of educational games in this thesis is James Paul Gee's book *What Video Games Have To Teach Us About Learning And Literacy* (2004). Gee expresses 36 learning principles existing in successful games (explained in chapter 4.2). This ideology serves as the comparative foundation of examining teaching methods in educational games.

Gee focuses on successful, commercial games created for the sole purpose of entertainment without the added element of teaching an educational subject, however, these games can include an enormous amount of information such as lore and sophisticated game mechanics that players need to learn. One example is *The Elder Scrolls III: Morrowind*, which contains a wealth of fictitious knowledge within the game as well as an online collection of all the game content collected and documented with the help of the player community since 1995 up until this day (The Unofficial Elder Scrolls Pages, 2014).

The fact that successful commercial video games contain effective methods of conveying vast amounts of information to players supports the idea of using the 36 learning principles articulated by Gee as a basis for analysing the teaching methods in educational games.

3.4 Method of the analysis

In this thesis I use a qualitative method of research where I gather my information through observation, participation and comparison. My main sources are written books, articles, videos and video games. I use these sources to gather information and through self-reflection and comparison of existing data, I make my own conclusions.

Before conceiving a basic guide on how to incorporate learning into video games, the selected games are first examined separately. Using Gee's 36 principles (chapter 4.2) as a comparative basis for study, each game is analysed, focusing on the teaching methods involved to convey the information or skills in relation to the game's predetermined educational subject(s).

Each game has its own chapter, which is divided into three different categories focusing on introduction, user interface and gameplay. The introduction section examines the first initial moments of the game when the player is introduced to the game concept and core mechanics. The user interface examines feedback information delivered by the game as a result of the player's actions mainly concerning the heads-up display. Finally, the gameplay section examines the main gameplay part of the game as well as other relevant elements concerning the incorporation of teaching methods into games that are not covered by the first two sections. Each section consists of two parts. The first part is an overall explanation and the second part is an analysis of the explanation based on James Paul Gee's 36 principles of learning (chapter 4.2).

Observations are done by playing through the games myself and by watching numerous gameplay videos uploaded by users onto YouTube. References to these videos and explanations about them are provided in later chapters.

The findings derived from each game are later compared in this thesis. The list of principles derived from all selected games are analysed once more with the goal of finding similarities between these principles with the purpose of producing a basic, more concise and more practical guide for integrating learning into video games.

To limit the scope of this thesis, only recurring methods of teaching are listed and examined. In other words, the main teaching methods that spread across the entire game

and the ones that stand out are seen as relevant to this study. Teaching methods extending beyond the games themselves, such as social and cultural aspects being used to spread teaching between users of the games are not analysed and are regarded as elements for further study. These elements include features like multiplayer, level editors, discussion groups and other outside sources, therefore some of Gee's principles such as the Dispersed Principle and the Insider Principle are ignored.

Not all of Gee's other principles apply in the context of this study either, for example his Psychosocial Moratorium Principle which states that real world consequences do not necessarily apply, allowing learners to take greater risks. This is a useful element for learning, but it is existent in all current video games by definition and therefore does not constitute as a direct principle for incorporating learning into educational video games.

There are a few of Gee's principles that appear to be more akin to the results of teaching methods rather than being teaching methods themselves. For example his Committed Learning Principle, which states that the learner feels a commitment to continue their effort and practice. This principle does not indicate a method employed or a cause for the person's commitment to learn and therefore does not qualify as a comparative basis for analysis.

Gee's list of principles is a useful basis by which I can compare my own analysis and later derive personal conclusions, but it remains a mere guideline and does not represent the strictness of a rule. It is entirely possible that some teaching methods found during the analysis of these games might not be comparative to anything on Gee's list. New terms are created for them.

4 JAMES PAUL GEE AND HIS 36 LEARNING PRINCIPLES

4.1 About James Paul Gee

James Gee is currently the Mary Lou Fulton Presidential Professor of Literacy Studies at Arizona State University. He is devoted to studying language, learning and literacy in an integrated way. Gee has written numerous books on communication and learning methods and has been published widely in journals in linguistics, psychology, the social sciences, and education. One of his most recent books *What Video Games Have To Teach Us About Learning and Literacy* (2004) deals with video games, language and learning. In this book he argues that good video games are designed to enhance learning through effective learning principles supported by research in the Learning Sciences. (Arizona State University Faculty Directory Profile.)

As explained in the previous chapter, Gee's book *What Video Games Have To Teach Us About Learning and Literacy* (2004) focuses on successful, commercial games created for the sole purpose of entertainment without the added element of teaching an educational subject. These games can include an enormous amount of information that players need to learn. The fact that successful commercial video games contain effective methods of conveying vast amounts of information to players supports the idea of using the 36 learning principles articulated by Gee as a basis for analysing the teaching methods in educational games.

4.2 Gee's 36 learning principles

Below is the full list of James Paul Gee's 36 learning principles with brief explanations (Gee, J. 2004, p.207-212):

1. Active, Critical Learning Principle: All aspects of the learning environment (including the ways in which the semiotic domain is designed and presented) are set up to encourage active and critical, not passive, learning.

2. Design Principle: Learning about and coming to appreciate design and design principles is core to the learning experience.
3. Semiotic Principle: Learning about and coming to appreciate interrelations within and across multiple sign systems (images, words, actions, symbols, artifacts, etc.) as a complex system is core to the learning experience.
4. Semiotic Domains Principle: Learning involves mastering, at some level, semiotic domains, and being able to participate, at some level, in the affinity group or groups connected to them.
5. Metalevel Thinking about Semiotic Domains Principle: Learning involves active and critical thinking about the relationships of the semiotic domain being learned to other semiotic domains.
6. “Psychosocial Moratorium” Principle: Learners can take risks in a space where real-world consequences are lowered.
7. Committed Learning Principle: Learners participate in an extended engagement (lots of effort and practice) as extensions of their real-world identities in relation to a virtual identity to which they feel some commitment and a virtual world that they find compelling.
8. Identity Principle: Learning involves taking on and playing with identities in such a way that the learner has real choices (in developing the virtual identity) and ample opportunity to meditate on the relationship between new identities and old ones. There is a tripartite play of identities as learners relate, and reflect on, their multiple real-world identities, a virtual identity, and a projective identity.
9. Self-Knowledge Principle: The virtual world is constructed in such a way that learners learn not only about the domain but about themselves and their current and potential capacities.
10. Amplification of Input Principle: For a little input, learners get a lot of output.

11. Achievement Principle: For learners of all levels of skill there are intrinsic rewards from the beginning, customized to each learner's level, effort, and growing mastery and signaling the learner's ongoing achievements.

12. Practice Principle: Learners get lots and lots of practice in a context where the practice is not boring (i.e., in a virtual world that is compelling to learners on their own terms and where the learners experience ongoing success). They spend lots of time on task.

13. Ongoing Learning Principle: The distinction between learner and master is vague, since learners, thanks to the operation of the "regime of competence" principle listed next, must, at higher and higher levels, undo their routinized mastery to adapt to new or changed conditions. There are cycles of new learning, automatization, undoing automatization, and new reorganized automatization.

14. "Regime of Competence" Principle: The learner gets ample opportunity to operate within, but at the outer edge of, his or her resources, so that at those points things are felt as challenging but not "undoable."

15. Probing Principle: Learning is a cycle of probing the world (doing something); reflecting in and on this action and, on this basis, forming a hypothesis; reprobating the world to test this hypothesis; and then accepting or rethinking the hypothesis.

16. Multiple Routes Principle: There are multiple ways to make progress or move ahead. This allows learners to make choices, rely on their own strengths and styles of learning and problem solving, while also exploring alternative styles.

17. Situated Meaning Principle: The meanings of signs (words, actions, objects, artifacts, symbols, texts, etc.) are situated in embodied experience. Meanings are not general or decontextualized. Whatever generality meanings come to have is discovered bottom up via embodied experiences.

18. Text Principle: Texts are not understood purely verbally (i.e., only in terms of the definitions of the words in the text and their text-internal relationships to each other) but are understood in terms of embodied experiences. Learners move back and forth

between texts and embodied experiences. More purely verbal understanding (reading texts apart from embodied action) comes only when learners have had enough embodied experience in the domain and ample experiences with similar texts.

19. Intertextual Principle: The learner understands texts as a family (“genre”) of related texts and understands any one such text in relation to others in the family, but only after having achieved embodied understandings of some texts. Understanding a group of texts as a family (genre) of texts is a large part of what helps the learner make

20. Multimodal Principle: Meaning and knowledge are built up through various modalities (images, texts, symbols, interactions, abstract design, sound, etc.), not just words.

21. “Material Intelligence” Principle: Thinking, problem solving, and knowledge are “stored” in material objects and the environment. This frees learners to engage their minds with other things while combining the results of their own thinking with the knowledge stored in material objects and the environment to achieve yet more powerful effects.

22. Intuitive Knowledge Principle: Intuitive or tacit knowledge built up in repeated practice and experience, often in association with an affinity group, counts a great deal and is honored. Not just verbal and conscious knowledge is rewarded.

23. Subset Principle: Learning even at its start takes place in a (simplified) subset of the real domain.

24. Incremental Principle: Learning situations are ordered in the early stages so that earlier cases lead to generalizations that are fruitful for later cases. When learners face more complex cases later, the learning space (the number and type of guesses the learner can make) is constrained by the sorts of fruitful patterns or generalizations the learner has found earlier.

25. Concentrated Sample Principle: The learner sees, especially early on, many more instances of fundamental signs and actions than would be the case in a less controlled

sample. Fundamental signs and actions are concentrated in the early stages so that learners get to practice them often and learn them well.

26. Bottom-up Basic Skills Principle: Basic skills are not learned in isolation or out of context; rather, what counts as a basic skill is discovered bottom up by engaging in more and more of the game/domain or game/domains like it. Basic skills are genre elements of a given type of game/domain.

27. Explicit Information On-Demand and Just-in-Time Principle: The learner is given explicit information both on-demand and just-in-time, when the learner needs it or just at the point where the information can best be understood and used in practice.

28. Discovery Principle: Overt telling is kept to a well-thought-out minimum, allowing ample opportunity for the learner to experiment and make discoveries.

29. Transfer Principle: Learners are given ample opportunity to practice, and support for, transferring what they have learned earlier to later problems, including problems that require adapting and transforming that earlier learning.

30. Cultural Models about the World Principle: Learning is set up in such a way that learners come to think consciously and reflectively about some of their cultural models regarding the world, without denigration of their identities, abilities, or social affiliations, and juxtapose them to new models that may conflict with or otherwise relate to them in various ways.

31. Cultural Models about Learning Principle: Learning is set up in such a way that learners come to think consciously and reflectively about their cultural models of learning and themselves as learners, without denigration of their identities, abilities, or social affiliations, and juxtapose them to new models of learning and themselves as learners.

32. Cultural Models about Semiotic Domains Principle: Learning is set up in such a way that learners come to think consciously and reflectively about their cultural models about a particular semiotic domain they are learning, without denigration of their

identities, abilities, or social affiliations, and juxtapose them to new models about this domain.

33. Distributed Principle: Meaning/knowledge is distributed across the learner, objects, tools, symbols, technologies, and the environment.

34. Dispersed Principle: Meaning/knowledge is dispersed in the sense that the learner shares it with others outside the domain/game, some of whom the learner may rarely or never see face-to-face.

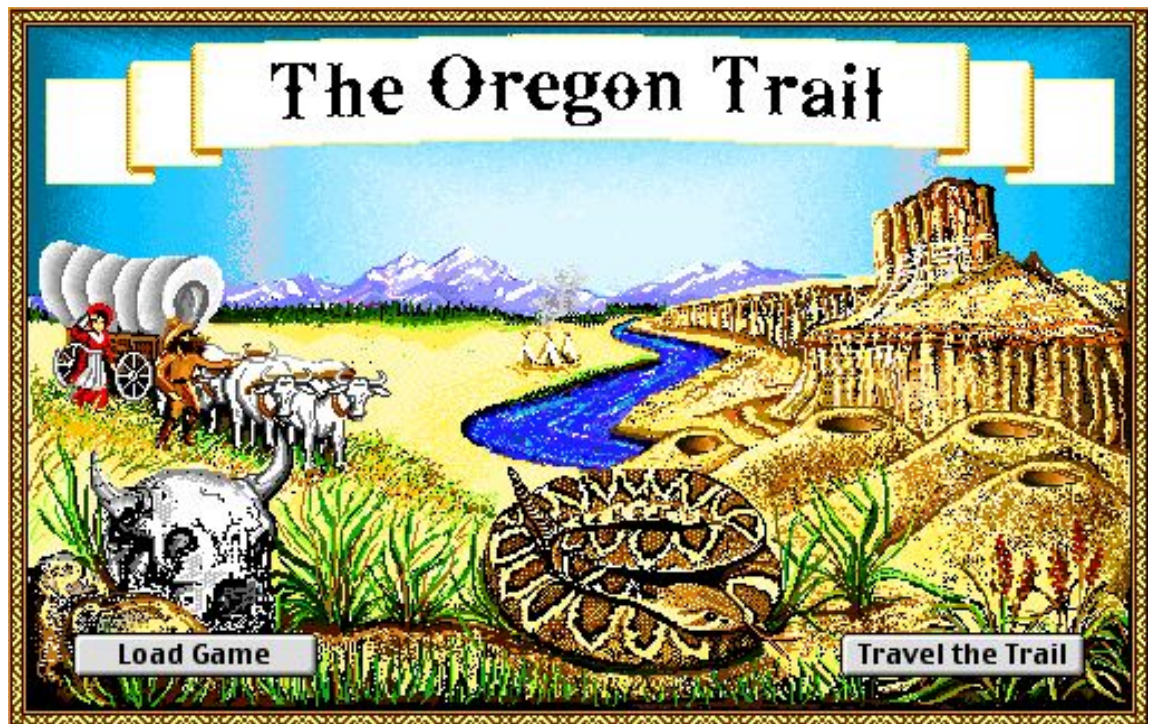
35. Affinity Group Principle: Learners constitute an “affinity group,” that is, a group that is bonded primarily through shared endeavors, goals, and practices and not shared race, gender, nation, ethnicity, or culture.

36. Insider Principle: The learner is an “insider,” “teacher,” and “producer” (not just a “consumer”) able to customize the learning experience and domain/game from the beginning and throughout the experience.

5 OVERVIEW OF SELECTED GAMES

In this section the educational games selected for analysis are presented along with brief descriptions. Reasons for their selection are explained.

5.1 Overview of The Oregon Trail



PICTURE 1. A screenshot of The Oregon Trail title screen.

The Oregon Trail is an educational video game designed to teach people about the hardships and realities of pioneer life on the trail between Independence, Missouri and Oregon's Willamette Valley. The player takes the role of a wagon leader and is tasked with the job of leading his or her party of settlers across the Oregon Trail.

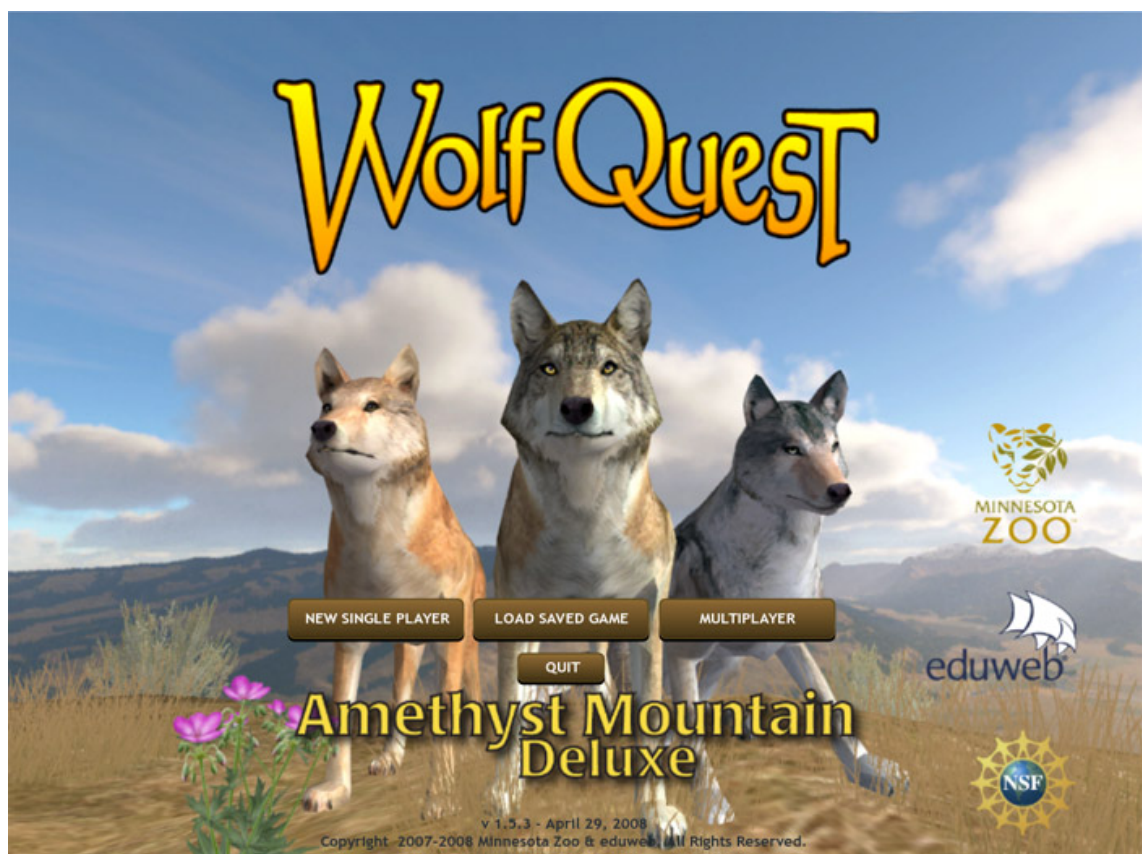
Different publishers and developers have released this game in many editions and it is arguably the most popular educational video game of all time with more than 65 million copies sold. (Lussenhop, J. 2011.) The great financial success and popularity of this game makes The Oregon Trail a very good candidate for study and analysis.

I chose to analyse the 1992 deluxe edition, because of its upgraded graphics and improved gameplay mechanics while still staying true to the original, as opposed to the

latest version that came out on the Wii game console in 2011, which has received bad ratings and reviews from respected sources like Gamespot (Oregon Trail review, 2011).

I did not play through this game myself, because it is very hard to obtain the 1992 version of the game that can run on my current computer. In order to observe and analyse the educational methods in The Oregon Trail, I watched numerous full playthrough videos of the game uploaded by users on Youtube.com. The main video I chose to focus on is by a YouTube user called Icrangirl. The video consists of two parts of a full playthrough of The Oregon Trail with commentary (Lets Play Oregon Trail Part 1 ZOMG!!! =D. YouTube. 2009).

5.2 Overview of Wolf Quest



PICTURE 2. A screenshot of the Wolf Quest title screen.

Wolf Quest is a third-person perspective educational video game designed to educate people about wolves and the part they play in nature. Players take the role of a grey wolf in Yellowstone National Park where they learn about wolf ecology by exploring

the wilderness, hunting for food and searching for a mate. Players can also establish a territory, find a den and raise pups while defending them from predators.

Wolf Quest has received numerous awards for its educational value and over 500,000 people have downloaded the game across the globe. It has an online community of 300,000 registered users and it is supported by a grant from the National Science Foundation. A comprehensive evaluation by the Institute Of Learning Innovation shows that players' knowledge about wolves increase significantly after playing Wolf Quest. (Wolf Quest Overview, 2014.) Considering the game's popularity, educational value and all the numerous awards it has received, Wolf Quest stands out as a perfect example of a successful educational video game.

Wolf Quest is a free game and can be downloaded from the game's official website. It is possible to play online with other users, but I decided to follow the single player experience, because of the scope and limitations of this thesis as well as time constraints. I downloaded the game and played through it on my computer. I also watched numerous playthrough videos on YouTube, but my personal gameplay experience was the main focus of observation.

5.3 Overview of Portal 2

Portal 2 is not a game that is widely considered to be an educational game. It is a big budget, commercial game geared towards entertainment with its dark humour and compelling storyline. Portal 2 is a first-person perspective puzzle game. Players find themselves in a science laboratory full of maze-like test chambers in which they have to solve puzzles with the help of a *portal gun*. This hand-held device can create two portals on certain flat surfaces, effectively creating a wormhole through which players can move themselves and other objects in order to solve certain puzzles.

Valve, the company that created Portal 2, has sold millions of copies of the game and it is remarkably popular (Newell: Portal 2 has hit 3 million sales, 2011). Math and science teachers have used this game as an educational tool in classrooms and after Valve was informed of this, they released a free version of the game with a built-in level editor for

teachers to create their own lesson plans and to teach a wide variety of subjects including physics and mathematics. (Wilde, T. 2011.)



PICTURE 3. A screenshot of the Portal 2 title screen.

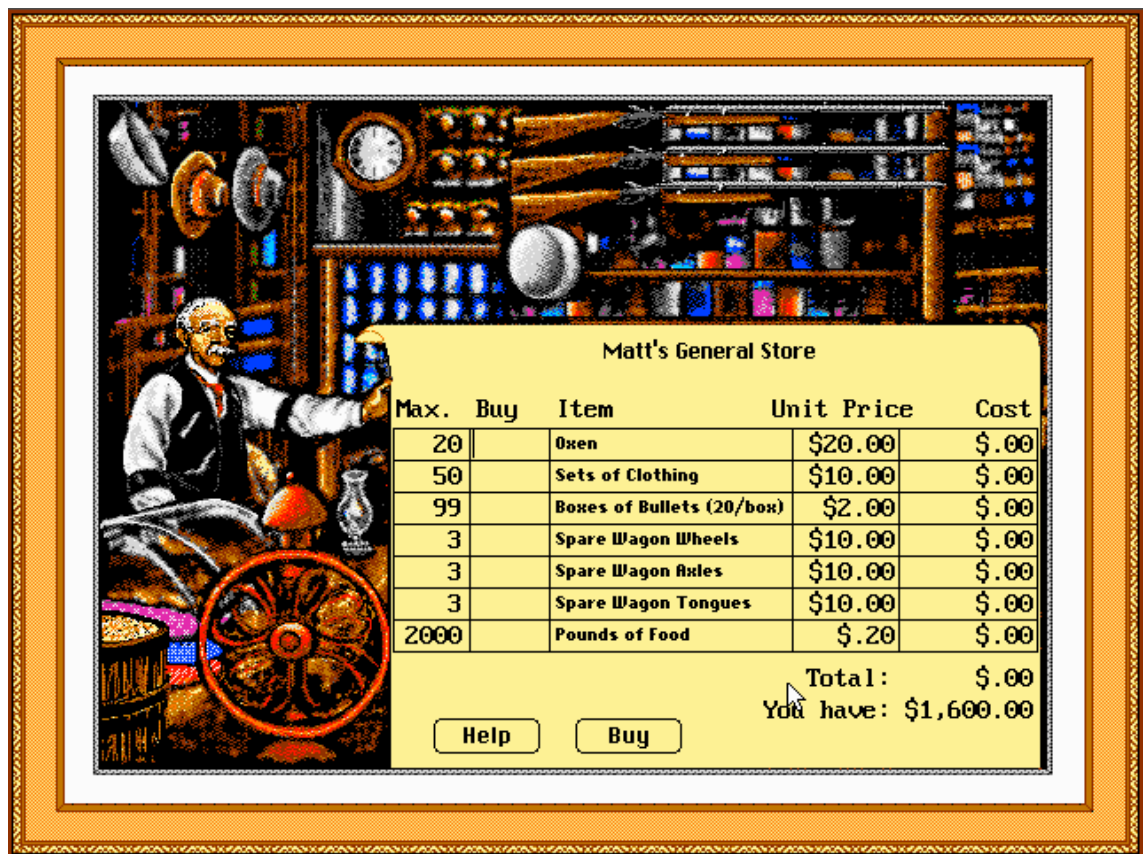
Considering the commercial success of this game along with its educational value, even though it is mostly designed for entertainment purposes, Portal 2 is a good example of a successful educational game under my own restrictions of the term and worth analysing.

I own the Xbox 360 version of Portal 2 and played through it on my own. It is possible to play co-operatively in a 2-player mode and even though I have done this before, I decided to focus on the single player experience, because of the scope and limitations of this thesis as well as time constraints. I also watched numerous playthrough videos on YouTube. The main video I chose to focus on is by a YouTube user called PlayingWithMahWii. The video consists of many parts of a full playthrough of the single player campaign of Portal 2 with commentary (Portal 2 Playthrough - Part 1. YouTube. 2012).

6 ANALYSING THE OREGON TRAIL

6.1 The Oregon Trail introduction

Apart from a passive introduction screen at the start of the game that briefly explains what it is about, The Oregon Trail places the player straight into the world of mid 19th century America where your active input is immediately required. The first task is to give yourself (the wagon leader) a name as well as the characters in your pioneering group.



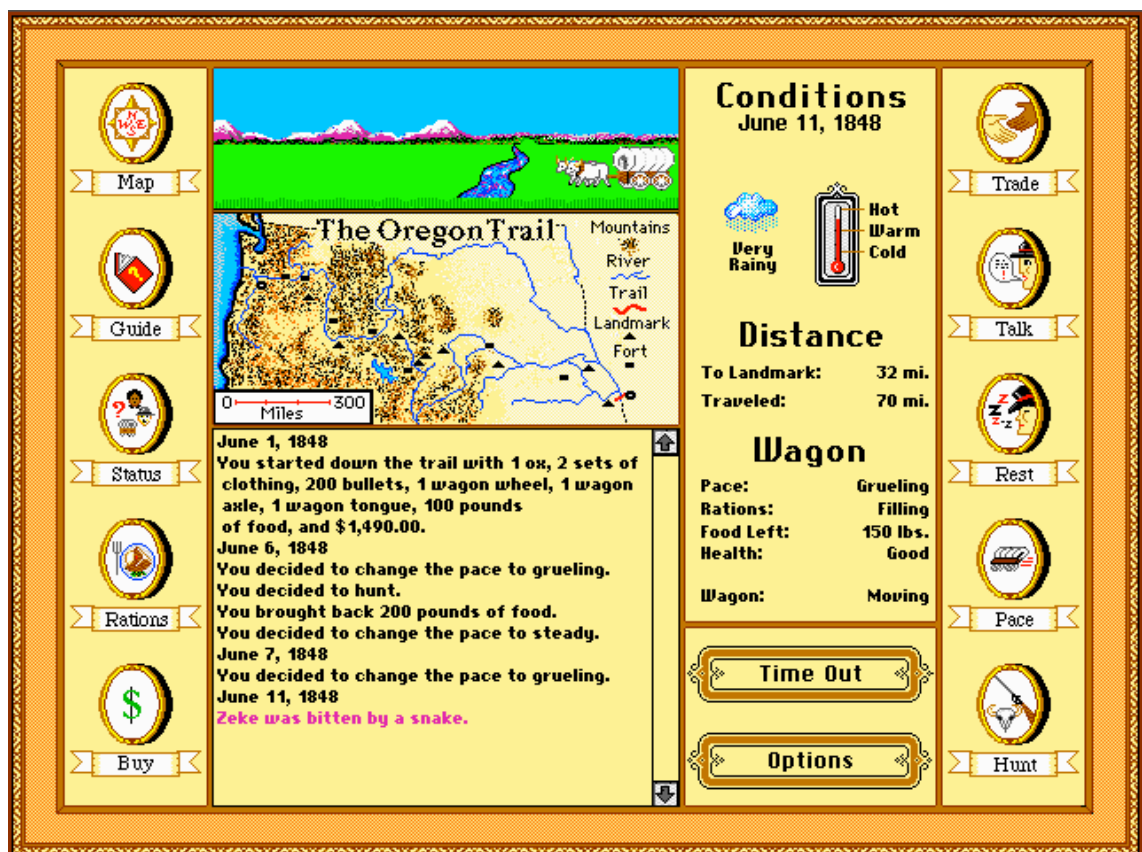
PICTURE 4. A screenshot of Matt's General Store in The Oregon Trail.

These simple actions change you from a passive spectator into an active, creative participant. You also have to choose your profession from a list of several occupations. Naming your characters and choosing your job turns the game into a more personal experience, giving an indication of meaning to the game. It also teaches you that there were all kinds of people taking the trek across the Oregon Trail and implies that they usually did this in groups with wagons. The next step is to choose what time of year

your group will leave and the game hints towards what might happen depending on your choice. This teaches something about the hard decisions these people needed to make.

After you have chosen your departure date, the game takes you to a new screen where you find yourself at Matt's General Store (picture 4). In this section you need to buy supplies for your journey from a list of different items like food, clothing, extra wagon wheels, oxen etc. Your occupation determines the amount of money you have to spend. While you are actively deciding what to buy and how to spend your money wisely, the game teaches you what sort of supplies pioneers needed to travel in the middle of the 19th century and how much things generally used to cost.

6.2 The Oregon Trail user interface



PICTURE 5. A screenshot of the main user interface in The Oregon Trail.

Once you set off on your journey to Willamette Valley, you are presented with a screen where most of the gameplay takes place. Vital information like your group's location,

overall health, the date, weather, temperature, etc., is displayed at all times. There is also a map of the western United States from Independence, Missouri to Oregon City, teaching the player a bit about the geography as well as what kind of routes the pioneers used while its main purpose is to let the player know of their location as well as upcoming landmarks.

A visible side menu provides sub menus in order to obtain more detailed information on your supplies and the individual health of each of the members in your group. There are other buttons that allows you to you rest, trade or talk to people.

There is also a section of the screen that provides the player with dynamic notifications about what is going in the game as they move forward. These notifications are in the form of text forming a list, describing all of the most recent events that have taken place. It keeps updating itself as notable events occur. Pop-up windows that appear whenever an important incident happens are also a major part of the game and provide information that helps the player decide on what actions to take next.

All of these elements are a major part of gameplay that helps the player to be able to properly play the game, but in the case of *The Oregon Trail*, they also serve as educational devices. The several dynamic notification systems mentioned above provide knowledge about what happens to the player, and in turn educates the player about the many things experienced by pioneers back in the mid 19th century on the Oregon Trail.

6.3 The Oregon Trail gameplay

The main gameplay of *The Oregon Trail* contains a continuous number of random events that can influence your (the player's) journey. These events and the way the game determines their probability are based on reports contained in the diaries of pioneers who really traversed the distance of the trail (An Interview With Don Rawitsch, Co-creator of *Oregon Trail*, 2014).

These random incidents range from illnesses in the group, breakdowns of the wagon, food becoming scarce, thieves stealing supplies, lack of water, inadequate grass for animals, death etc. While these events are occurring, the player is required to actively

keep track of what is happening and needs to make choices on how to react to them. Choices include resting, changing the speed of their wagon, hunting, attempting to repair a broken wheel or just replacing it with a spare etc.



PICTURE 6. A screenshot of the hunting screen in The Oregon Trail.

The player often encounters rivers to cross and is presented with choices like fording the river, taking a ferry, hiring an Indian guide or waiting to see if conditions improve. The choices made depend on the weather, the width and the depth of the river. Using ferrymen or a guide costs money or supplies. If the player fails, they can lose certain supplies, their wagon can get damaged, people in their group might die etc.

On the journey the player encounters historic landmarks presented as images of the landmarks accompanied by authentic music from that time period. There is an option to talk to people who will mention something about the landmark or tell you about notable people from that time. Occasionally the player encounters forts where they can stock up on supplies with any money they have left, or they can trade items.

At one instance through the game, the player reaches a point where the trail divides towards Green River crossing and Fort Bridger. The player can use the map to help them decide which direction to take. Another divide is between the Columbia River and the Barlow Toll Road. The player either pays money to stay safe and take the longer route, or save some money, take the shorter and more dangerous route where the player needs to guide their raft through the rushing waters of the Columbia river until safely reaching the trail to the Willamette Valley.

6.4 Gee's principles in The Oregon Trail

In this game there are numerous teaching methods taking place, focused on conveying educational knowledge to the player. Most of them correlate to many of Gee's principles:

1. Active, Critical Learning Principle

Most aspects of the game so far are designed to encourage active learning. Apart from a few sections where the player needs to passively read through some text in order to gain knowledge about the Oregon Trail, much of the teaching and learning takes place during the player's required input. The player becomes and remains an active participant in the learning process.

2. Amplification of Input Principle

The amount of knowledge being put out by the game outweighs the input needed from the player. Throughout the whole starting section of the game, the player does not need to use a lot of effort in order to receive a range of information surrounding the Oregon Trail.

3. Practice Principle

The player gets lots of practice involving the challenges that pioneers experienced during their journey across the trail by encountering numerous similar problems over and over again. For example, the player faces the task of crossing a river on multiple occasions.

4. Multiple Routes Principle

The player is presented with choices throughout the beginning of the game. Choosing an occupation determines the player's wealth and might add a certain bonus or penalty to their character. This, as well as choosing the date of departure and what supplies to buy adds multiple routes to the game and allows the player to rely on their own style of learning and problem solving, while teaching the player about the choices that people needed to make during the trek to Willamette Valley in the mid 19th century.

5. Situated Meaning Principle

The hardships experienced by pioneers on The Oregon Trail become more than just mere facts to the player after they have attempted to complete the game. By encountering a myriad of difficult obstacles, the player develops a deeper understanding of what people endured on their journey.

6. Text Principle

The literal text and academic information about challenges on the Oregon Trail become more than just mere second-hand knowledge. Even though encountering many difficult obstacles during the game is still an indirect experience compared to literally making the journey across the Oregon Trail, the player develops a deeper understanding of what people endured on their journey.

7. Intertextual Principle

By playing through the game and experiencing many of the dangers faced by the pioneers on the Oregon Trail, the player becomes familiar with them one by one and eventually understands all these obstacles as a family of obstacles. All the troubles encountered by those on the journey of the Oregon Trail are understood not only as individual instances, but also as part of a bigger whole. The player comes to understand the journey of The Oregon Trail much better in its entirety.

8. Multimodal Principle

Information about the Oregon Trail is conveyed via multiple modalities, such as images, sounds and text. Authentic music from that time period plays throughout the game, images give the player a sense of what things used to look like while text provides additional information. This teaching principle is existent in almost all video games, but it is necessary to mention it since games that rely solely on one modality such as purely

text-based games can exist. This principle is also not necessarily used as a teaching tool for educational purposes in other video games.

9. Material Intelligence Principle

The whole game environment holds information that can be accessed by the player at any time. Events occurring on the Oregon Trail are constantly being conveyed through notifications. The player is able to access detailed information about their current status through sub menus, which educates the player on many of the concerns that pioneers had to take into consideration while on their journey.

10. Intuitive Knowledge Principle

Without passively reading about the subject of the Oregon Trail, players gain knowledge about it by practicing it through playing the game. Attempting to survive the trail themselves makes players intuitively aware of the hardships faced by the pioneers.

11. Subset Principle

Learning about the hardships and realities of pioneer life on the Oregon Trail first takes place in a simplified form. The player learns that it is important to choose which time of year to depart and that different times of the year will present different kinds of challenges. Supplies like wheels for sale at the general store suggest that the player's wagon might encounter some trouble along the way. The real domain that will teach the player about experiencing a 2,200-mile long trek over wilderness is still ahead, but an idea of what lies ahead is given.

12. Bottom-Up Basic Skills Principle

Every single hardship the pioneers experienced during their journey is not learned about in isolation from one another. As the player struggles to get across rivers, hunt for food etc., they start to connect these experiences to one another as different types of the same element. By seeing all the individual challenges as a whole, the player comes to understand and learn about them more easily.

13. Explicit Information On-Demand and Just-In-Time Principle

As explained above, important information is provided at all times via the main user interface. Notifications and pop-up windows appear at crucial times to maximize proper responses from the player. For example, when the player reaches a river, a pop-up

window appears with information about the width and depth of the river. In order to cross the river the player is presented with a set of options on how to proceed based on the information given. Players are not informed about these conditions at the beginning of the game or at other awkward times. They are rather educated about the choices pioneers needed to make about crossing rivers on the appropriate occasion.

14. Discovery Principle

At the start of the game, very little is explained to the player about what sort of challenges are ahead. The player is left with ample opportunity to discover every obstacle on their own and learn about the Oregon Trail as they go along.

6.5 The missing principle: Meaning of life principle

There is one element of teaching present in this game that I believe is missing from Gee's list. For the time being I will call it the "Meaning of Life Principle". It is one feature that gives purpose to the educational subject being taught and brings personal meaning to the player's actions. In the case of The Oregon Trail, the player is meant to learn about the hardships of pioneer life and the history of the Oregon Trail, but that is not the goal of the game. The player is placed in the role of a desperate pioneer carrying limited supplies with the goal of reaching the west coast in order to make a new, better life. By placing the player in a specific role and giving them a higher reason for playing the game other than for the sole purpose of learning the educational subject, brings meaning to the game as well as the educational subject. The player becomes more personally invested in both.

7 ANALYSING WOLF QUEST

7.1 Wolf Quest introduction

When starting Wolf Quest, the player is immediately presented with the game character, a grey wolf. You have the options of customizing the colour of your character's fur and distributing a set amount of points among three main statistics namely strength, stamina and speed (picture 7). You can also choose the sex of the wolf and give it a name. The option of skipping these steps are also available by just pressing the "Play Game" button upon which the game will create a standard, ready-made wolf for you.



PICTURE 7. A screenshot of the character creation screen in Wolf Quest.

The game instantly turns you into an active participant and already teaches you a few simple things about grey wolves; they can come in a variety of different colours with unique attributes. Naming your character, choosing the fur colour and determining their

statistics turns the game into a more personal experience, giving an indication of meaning to the game.

After the initial character creation process a short text-based introduction appears explaining that you are a two-year-old grey wolf born in Yellow Stone National Park and that your main objective is to build a home and raise a family. Your first task is to find a mate. You need to hunt other wild animals like elk, otherwise you won't survive for long. By creating a goal for the player, the game further inspires a personal feeling of meaning while at the same time teaching a little bit more about the nature of wolves.

7.2 Wolf Quest user interface

After the player has chosen the wolf's sex, attributes and colour, the player is presented with a three-dimensional game world with the main character viewed in third person where most of the gameplay takes place. At first, apart from the game world and your main character, the only elements presented in the user interface are a wolf icon, the wolf's name given by the player and vital information including health and stamina. Whenever you perform actions like running or biting, your stamina meter goes down and when it reaches zero, you will have to stop what you're doing and rest. One more element of the user interface is a compass. The compass shows the cardinal directions, but also includes icons representing other animals and important locations that the wolf can either smell, see or is intuitively aware of. Whenever the player gets close enough to another animal, an arrow appears above the creature along with the name of the creature. The same applies for dead animals (picture 8).

All of the elements mentioned above are tools to help the player play the game, but they also serve as educational tools. Through gameplay the stamina bar shows that wolves do get tired and need to preserve their energy for certain tasks. Similarly, the health bar teaches that wolves need to keep their health up by eating and that elements in the wild such as other animals can cause harm, potentially killing them. The compass educates the player that wolves can smell other animals at a distance and that they have good eyes and are generally very aware of their surroundings.

By activating “scent view”, dynamic lines appear on the screen pointing towards things the wolf can smell such as other wolves, elk, coyotes etc. Each creature has its own scent and these scent lines portray this by giving each line a different colour. This helps the player to find certain creatures more easily and teaches them about the way wolves navigate.



PICTURE 8. A screenshot of the player eating an elk carcass in Wolf Quest.

As the game progresses, when you have found a mate, made pups and have established a territory, additional elements appear on screen as part of the user interface. For example, your territory is portrayed on screen as a semi-circle with segments. Each segment, depending on their colour, represents how well this territory has been marked. Every now and then you will need to re-establish these segments as your territory by urinating or howling while inside of them. This teaches the player about how wolves establish and keep their territories in the wild.

7.3 Wolf Quest gameplay

The main gameplay of Wolf Quest takes place in a three-dimensional game world representing 4 square kilometres of Yellowstone National Park where you (the player) can roam around freely. The first goal is to find a mate. As you roam around in the game world in search of a mate, you need to hunt for food. Animals like rabbits, elk, deer and coyotes are possible prey. You need to watch out for dangerous animals such as grizzly bears that can become aggressive if you get too close. Other wolves can challenge you for territory through intimidation and physical attacks.



PICTURE 9. A screenshot of the turn-based dialogue system in Wolf Quest.

You can interact with other wolves through a turn-based dialogue system (picture 9). The gestures options are displayed as text, but conveyed in game through wolf postures and vocalizations. Once you encounter a potential mate by means of exploration, howling, “scent view” and the compass, you need to use this dialogue system in order to find out if the potential mate is interested. Once it is established that the other wolf

wants to start a pack with you, they become your mate and you can give them a name. They will become your hunting and exploration partner.

Once you have found a mate, the goal of the game becomes to start a family. You need to find an unclaimed territory and an appropriate den site. An ideal den site should be close to food and away from danger such as rival wolf packs. There are many den sites to choose from within the game and if you cannot find this ideal place, you will have to decide whether food or safety is more important.



PICTURE 10. A screenshot of the player and pups in Wolf Quest.

Once a den has been created, you need to mark your territory by urinating throughout the chosen area to tell other wolves to stay away. Howling also announces to all within earshot that the area belongs to you. Your territory needs to be actively defended from other wolves and dangerous animals like grizzly bears. With a territory established, the game skips ahead where you and your mate have given birth to four pups. You must keep them from wandering too far by picking them up and taking them back to the den (picture 10). Feeding the pups requires you to hunt, eat, and return to the den so that you

can regurgitate some of the food for the pups. You also need to protect them from dangerous animals such as grizzly bears with the help of your mate. Keeping the territory marked continues to remain a necessity as well.

Once your pups are big enough, you and your mate need to guide them through the wilderness and across a river to reach a designated rendezvous spot while protecting them from birds of prey like hawks and other dangerous animals. Getting across the river requires you to find a shallow part where you can carry your pups across without them drowning. During this period you still need to hunt for food in order to keep your group's general health up. Once you, your mate and all of your surviving pups have reached the designated rendezvous spot, the game ends and a screen appears, congratulating you and explaining that this is where you and your pups will make a home for the summer, hunting for insects, mice and bird nestlings. Your pups will grow into adults and your wolf pack will grow bigger and stronger, continuing the cycle of life.

7.4 Gee's principles in Wolf Quest

Wolf Quest contains a number of teaching methods focused on conveying educational knowledge to the player. Most of them relate to many of Gee's principles:

1. Active, Critical Learning Principle

All aspects of the game are designed to encourage active learning. Apart from one section where the player needs to passively read through a brief explanation about the goals of the game, quite a bit learning takes place while the player chooses the appearance of their game character, whether the player is conscious about this or not. The player immediately becomes an active participant in the learning process.

2. Amplification of Input Principle

It is not necessary for the player to choose a name, change the fur colour or even distribute points to their game character's main attributes. Even if they decide not to, the game teaches the player that variations of these qualities exist in grey wolves and very little input is required from the player to receive educational output. If the player decides to change the fur colour, they are shown all of the potential colours the fur of a

grey wolf can have, and therefore puts out an even greater amount of knowledge with very little input required from the player.

3. Achievement Principle

The player gets awarded with experience points whenever they perform the correct action in relation to the nature of grey wolves. These actions include urinating and howling to establish and maintain territory, returning wandering pups back to the den, hunting for food etc. Experience points allow players to name their mate and their pups.

4. Practice Principle

The player gets lots of practice regarding the ecology and nature of wolves by being required to hunt for food, interact with other wolves, feed pups and explore etc., on a regular basis.

5. Ongoing Learning Principle

As the player finds a mate and starts a new family, they are forced to adapt to these new conditions by changing their strategy. Hunting for food now involves extra considerations like making sure the pups are safe while out hunting, making sure to bring some food back for the pups etc. Learning about wolves becomes more complicated, challenging and forces the player to change their pattern of action.

6. Regime of Competence Principle

Hunting for food, protecting your young and your territory is challenging, but achievable. Whenever a new concept such as raising pups is introduced, the necessary information is given to the player on how to proceed, but the process is still challenging. The player can function at the outer edge of their understanding about the nature of wolves while feeling challenged, but not overwhelmed.

7. Probing Principle

Elements in the game such as the dialogue system between the player and other wolves allow the player to test different postures and vocalizations while seeing the results they produce from the other wolf. Hunting for food, protecting pups from grizzly bears, finding a mate and surviving in general are all learned through experimentation with different actions and strategies.

8. Multiple Routes Principle

Being able to choose the sex, the fur colour, as well as how much strength, speed and endurance their character will have gives multiple routes to the game and the educational subject. A wolf with increased strength and less speed will perform differently in the wild than a wolf with different attributes. All of this allows the player to experience many variations of what the life of a wolf in the wild could be like.

9. Situated Meaning Principle

The life cycle and nature of grey wolves become more than just mere facts to the player during the course of the game. By being placed in the role of a wolf and going through a myriad of experiences throughout the game, the player develops a deeper understanding about grey wolves than what simply reading about it can provide.

10. Text Principle

Textual information on grey wolves becomes more than just mere facts to the player. Even though living the life of a grey wolf in Yellow Stone Park in a virtual environment is still an indirect experience compared to literally being a wolf or carefully observing them in the wild, the player develops a deeper understanding about the nature of grey wolves than what text can provide.

11. Intertextual Principle

After experiencing many instances of hunting for food, finding a mate and raising pups, the player starts to understand them not only as individual experiences, but also as part of a bigger whole. The player comes to understand grey wolves much better.

12. Multimodal Principle

Different modalities such as images and text convey information about grey wolves to the player. A visual representation of the game character teaches the player what grey wolves look like. Text as well as in-game sliders helps the player understand the wolf's attributes. Additional text provides information about the nature of wolves.

13. Material Intelligence Principle

The user interface holds crucial information for the player, not only to help the player play the game, but also to help teach the player about grey wolves. The awareness of

wolves is portrayed through the compass and dynamic notifications about other animals they encounter. Health and stamina bars make the player aware of how wolves need to carefully manage their energy output and overall health. The territory segments teaches the player about the necessity for wolves to mark their territory and how they go about doing it.

14. Intuitive Knowledge Principle

Without passively reading about grey wolves, the player gains knowledge about it by practicing it through playing the game. Attempting to survive as a grey wolf, to find a mate and successfully raise pups make the player intuitively aware of the lives of grey wolves by virtually experiencing it for themselves.

15. Subset Principle

The player learns about wolves in a simplified form at the beginning of the game. The appearance, goals and nature of wolves are conveyed in a concise manner. This provides the player with very basic knowledge about wolves, and this knowledge in turn prepares the player for the main domain of teaching that lies ahead.

16. Incremental Principle

The player is first introduced to the basic elements of a grey wolf, allowing the player to get used hunting for food first before attempting to find a mate and in turn make a pack together. All of these elements of a grey wolf's life are introduced incrementally as the player masters one after the other.

17. Concentrated Sample Principle:

As mentioned above, the user interface is first displayed as a simplified subset with additional elements becoming visible later on. This gives the player time to gain experience early on about the basic nature of grey wolves so that they can learn them well.

18. Bottom-Up Basic Skills Principle

Every single element of grey wolf's life is not learned about in isolation from one another. As the player struggles to hunt for food, protect their pups etc., they start to connect these experiences to one another as different parts of a wolf's life. By seeing all

the individual challenges as a whole, the player comes to understand and learn about them more easily.

19. Explicit Information On-Demand and Just-In-Time Principle

As aforementioned, when the player encounters another animal, an arrow appears above the creature along with the name of the creature. This is indicative of information that is displayed at the right time, when needed. Additional information becomes available in the user interface about territory when it is appropriate. Activating “scent view” provides information to the player when they demand it.

20. Discovery Principle

The player is allowed to roam around the game world freely, discovering elements of a grey wolf’s life at their own leisure. Not everything is explained to the player and they are allowed to discover things for themselves.

21. Transfer Principle

The player is given ample opportunity to practice and learn basic knowledge about grey wolves before moving on to more complex information such as raising pups. When the time comes to raise their young, the player can transfer their earlier knowledge about hunting and adapt it to a more complex system of hunting, protecting pups, and feeding etc.

7.5 The missing principle: Meaning of life principle

As it is in *The Oregon Trail*, *Wolf Quest* also contains the same element of gameplay that I believe to be an important part of teaching; the reason for learning the educational subject in the first place. The goal of *Wolf Quest* is to teach players about the nature and lives of grey wolves, but that is not the goal designated to the player. The player is placed in the role of a wolf and presented with the goal of surviving, making a life and starting a family. This brings meaning to the game as well as to the educational subject. The player becomes more personally invested in both. Even something as small as being able to give a name to the wolf, choosing its fur colour and main attributes makes the player more personally attached to the game and indirectly connects them to the educational subject.

8 ANALYSING PORTAL 2

8.1 Portal 2 introduction

When the player starts Portal 2, they find themselves in the role of a human test subject trapped inside a science facility. A robot with a vibrant personality tries to help the player escape the laboratory through a series of test chambers. These test chambers serve as the game's central gameplay through which the player is tasked to solve puzzles involving spatial reasoning and lateral thinking.



PICTURE 11. A screenshot of portals and lasers in Portal 2.

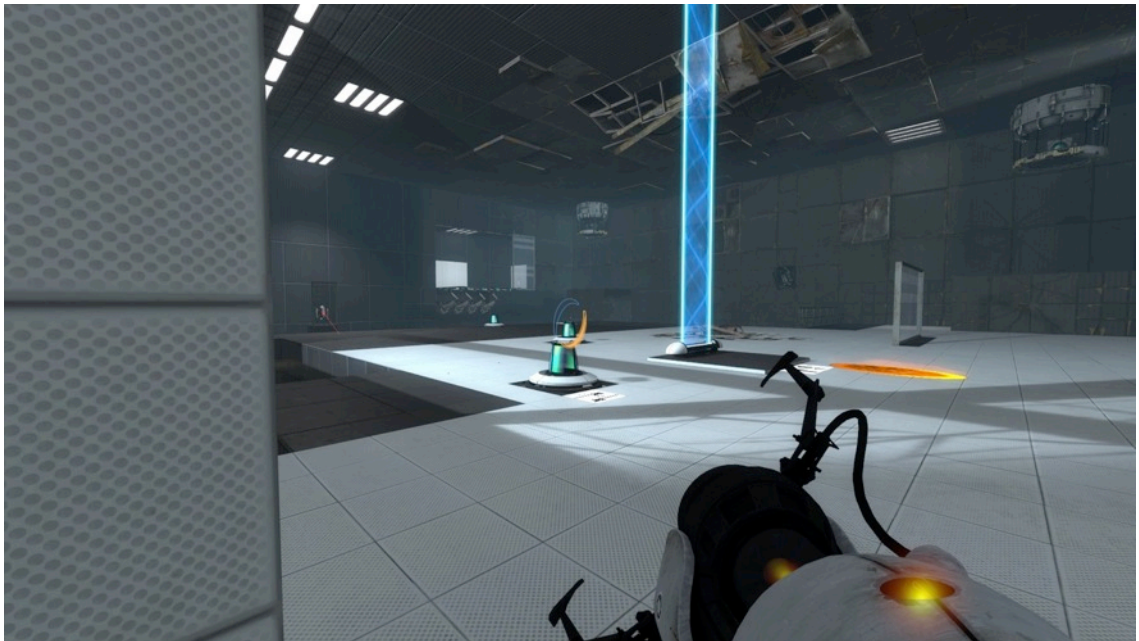
The initial part of the game introduces the player to core game mechanics such as movement, picking up objects as well as how to use the portal gun, which is a hand-held device capable of creating two separate gateways on specific surfaces by aiming and shooting the gun at these surfaces. The two gateways create a wormhole through which the player and other objects can move while retaining momentum with the potential of converting horizontal momentum into vertical momentum and vice versa (picture 11).

The first puzzle encountered in this game involves a laser being emitted from the roof of the chamber onto the ground surface. By shooting a portal onto that surface and creating a wormhole by shooting a second portal on another correct surface, the laser moves

through the wormhole, hits a button, which then activates the door leading to the next test chamber. These test chambers or puzzles become increasingly difficult and elaborate.

8.2 Portal 2 user interface

Apart from the visual representation of the game world, the user interface is very minimalistic. The player views the game from a first person perspective and can see the portal gun in front of them as if they were holding it out themselves. In the centre of the screen there are four dots, representing short intersecting lines (crosshair) that serve to show the player where they are aiming with their portal gun (picture 12).



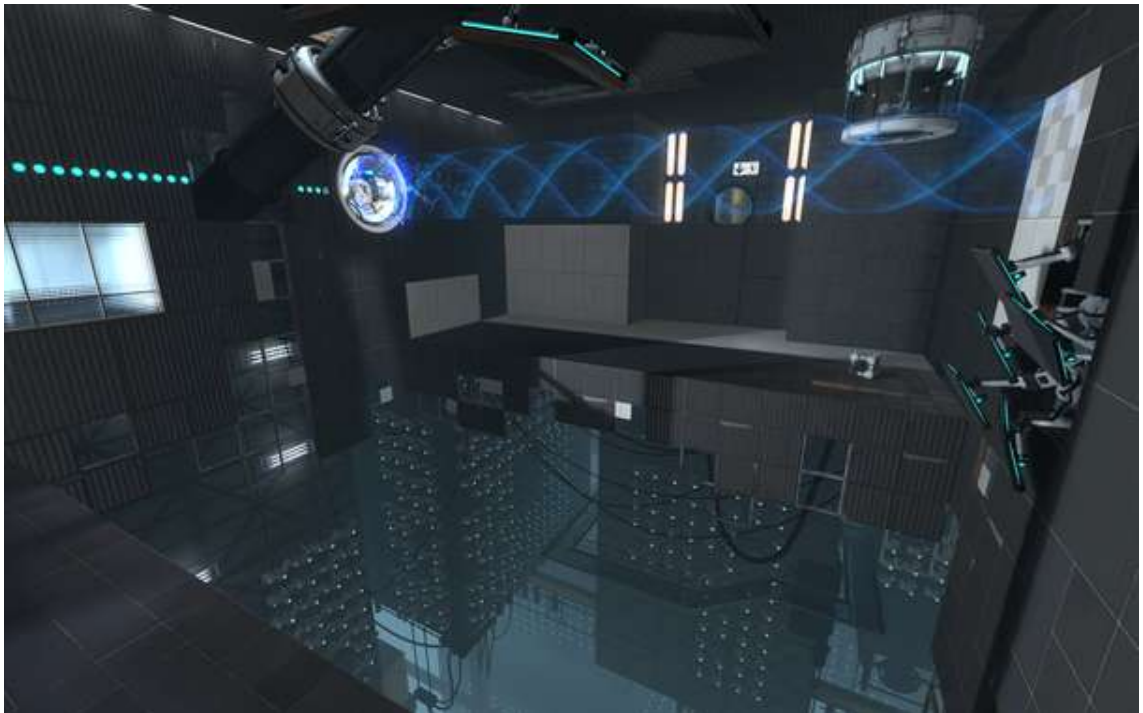
PICTURE 12. A screenshot of the minimalistic user interface in Portal 2.

On both sides of the crosshair there is an outlined crescent shape. The right is orange, and the left, blue. These shapes represent the two portals that can be created with the portal gun and each of them becomes highlighted when their corresponding portal is active. When a wormhole is created with these portals combined, both shapes are highlighted. This is a helpful tool for the player to know which portal is active.

Apart from these elements, the user interface is completely dynamic and other information like player controls, tips, player damage and other useful information are all displayed once it becomes necessary.

8.3 Portal 2 gameplay

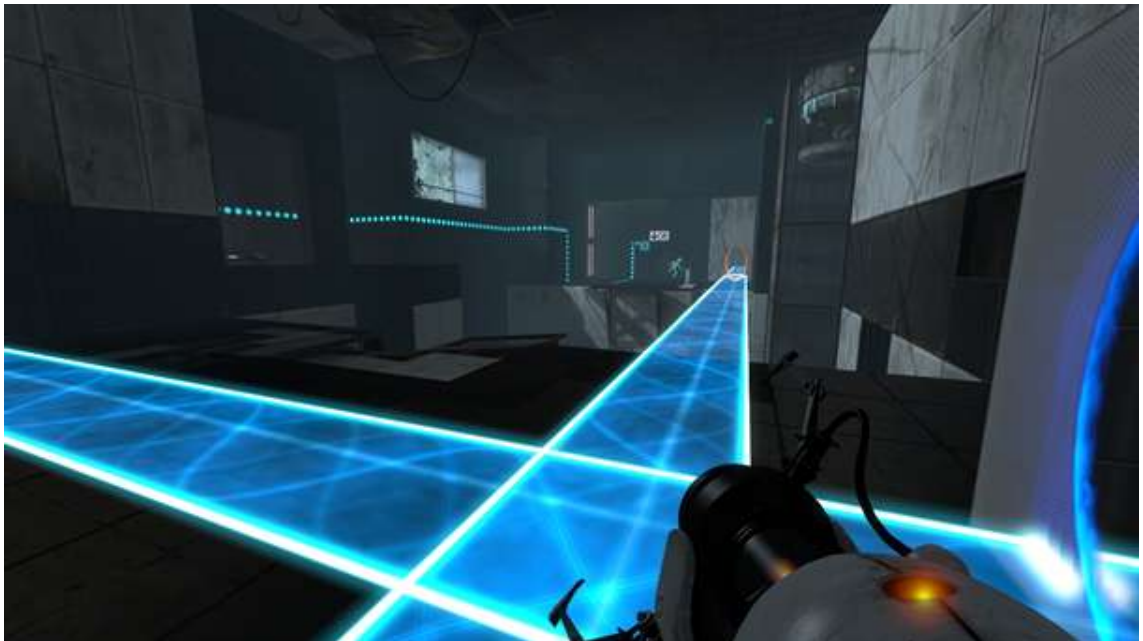
Portal 2 is a story-driven game full of different characters, in-game cut-scenes and plot twists, but the main gameplay remains the same throughout its entirety. The player is sent through numerous test chambers containing puzzles that become incrementally more elaborate and difficult as the player progresses. When the final puzzle is solved the game ends and story ends with a cut scene and credits.



PICTURE 13. A screenshot of a tractor beam in Portal 2.

Puzzle elements in the game include lasers, tractor beams (picture 13) and bridges made out of hard light (picture 14), which can all be transmitted through portals. Trampoline-like structures called Aerial Faith Plates can launch the player and other objects into the air and potentially through portals. Turrets that shoot at the player when noticed is required to be disabled or avoided by many different means including the use of portals, objects thrown at them and other, more complex strategies involving many different objects and elements in the game. Cubes containing prismatic lenses can be used to

redirect lasers, which in turn can activate buttons, destroy turrets etc. Coating a paint-like gel, which is dispensed from pipes and transported through portals, onto objects and surfaces can impart certain qualities to them. Orange gel makes the player cross surfaces more quickly, blue gel allows the player to bounce off surfaces and coating a white gel onto surfaces that would not ordinarily be compatible with portals, allows the player to create portals on those surfaces. Water is also another element in the game, which can wash away gels from surfaces, returning the surface or object back to its normal state. Toxic pools of water and bottomless pits kill the player instantly, making them restart from a previous checkpoint. All of these elements help or hinder the player from reaching the exit.



PICTURE 14. A screenshot of hard light bridges in Portal 2.

At the start of each test chamber (puzzle), the player can examine a screen on one of the walls, displaying a number of symbols. These symbols represent different elements in the game. By getting to know these symbols, the player can interpret them and be prepared for the gameplay elements present in the next puzzle.

Puzzle chambers are designed incrementally to help the player understand game mechanics. As new gameplay elements are introduced to the player, the game first presents the player with a relatively safe environment to allow the player to experiment with these new concepts. Once the player gets used to them, the game continues by

combining new elements with familiar ones in new ways, forcing the player to think laterally. This provides challenging and rewarding puzzles.

8.4 Gee's principles in Portal 2

Portal 2 contains a number of teaching methods focused on conveying educational knowledge to the player and most of them connect to many of Gee's principles:

1. Active, Critical Learning Principle

The player is required to be an active participant from the start of the game. As the player attempts to escape the facility, they are required to learn basic movement as well as how to use the portal gun. The whole game environment is set up to encourage active, critical learning.

2. Amplification of Input Principle

While practicing with the portal gun, the game needs very little input from the player to demonstrate much of what the portal gun can do. They only need to aim and pull the trigger. The game takes place in an elaborate, detailed three-dimensional world where the player can easily see the results of their actions by just looking at the screen, making learning about spatial reasoning more understandable and effective.

3. Achievement Principle

The player gets awarded for solving puzzles with story-driven elements. Cut scenes and reactions from in-game characters provide the player with a sense of achievement while the player feels that much closer to their main goal of escaping the facility as well. Solving each challenge also provides a great sense of accomplishment within itself.

4. Practice Principle

The player gets lots of practice regarding lateral thinking and spatial reasoning as they experiment with game mechanics and attempt to solve puzzles. No time restriction is placed on the player and checkpoints provides the player with unlimited tries if they die.

5. Ongoing Learning Principle

As the player gets accustomed to solving puzzles and thinking in certain ways, the game continues to challenge the player with different and increasingly harder challenges as well as new gameplay elements and concepts, forcing the player to come up with new ways of thinking and solving problems.

6. Regime of Competence Principle

As each subsequent test chamber becomes incrementally more elaborate, the player needs to function at the outer edge of their understanding. Each new puzzle is challenging, but achievable.

7. Probing Principle

Once the player gets their hands on the portal gun, they have the freedom and time to explore its capabilities. The player can shoot the gun at any surface while experimenting with different wormholes and results.

8. Situated Meaning Principle

Using of portals, converting horizontal momentum into vertical momentum, thinking in different ways and solving puzzles by examining them from different angles through lateral thinking etc., all becomes understood through embodied experiences, as opposed to learning about them by reading a book.

9. Text Principle

By playing Portal 2 and actually experiencing the puzzles presented within the test chambers, textual information on the concepts found within this game can be understood much easier.

10. Intertextual Principle

After solving many different individual problems and by combining different strategies and gameplay mechanics to solve more difficult puzzles, which contain a combination of simpler problems, the player can understand these concepts and appreciate them as different genres of a bigger whole, for example elements of physics and spatial reasoning.

11. Multimodal Principle

Portal 2 uses sound, images and text to produce a world where the player can practice and learn about physics.

12. Material Intelligence Principle

The user interface provides the player with important information. The crescent shapes indicating active or inactive portals greatly help the player solve puzzles. The game environment intelligently provides the player with notifications through sounds, images and text, as the player needs them.

13. Intuitive Knowledge Principle

Without passively reading about spatial reasoning and lateral thinking, the player gains knowledge about it by practicing it through playing the game. Attempting to solve all of the different puzzles in the game makes the player intuitively aware of these concepts and promotes a deeper understanding of them through gameplay.

14. Subset Principle

The first puzzle encountered by the player is a simplified form of all the puzzles in the game. The player first becomes accustomed to basic movement, basic gameplay mechanics and the main principles of the portal gun. This prepares the player for more complicated puzzles in the future.

15. Incremental Principle

The player is first introduced to the basic mechanics and concepts of the game, allowing the player to get used to them, while incrementally introducing newer concepts of physics and problem solving.

16. Concentrated Sample Principle

The player gains experience with the fundamental concepts of portals and game mechanics early on and they have ample opportunity to learn them well.

17. Bottom-Up Basic Skills Principle

Elements from earlier in the game become combined with later concepts. The player starts to connect these concepts so that they can use them in conjunction with one another in order to solve problems and to understand their nature as a whole.

18. Explicit Information On-Demand and Just-In-Time Principle

Information about gameplay, new puzzle elements and problem solving techniques is given to the player at crucial times, when needed.

19. Discovery Principle

Combining the properties of portals, lasers, boxes, trampolines etc., can produce a number of different results. These combinations are often necessary to solve puzzles within the game, but the player is left to discover the nature and concept of each of these elements and their combinations on their own, at their own leisure.

20. Transfer Principle

The player is given ample opportunity to practice and learn the basic principles about each element in the game before moving on to more complex systems. With later puzzles, the player is required to transfer their understanding from earlier stages to more complicated puzzles.

8.5 The missing principle: Meaning of life principle

As it is in *The Oregon Trail* and *Wolf Quest*, *Portal 2* also contains the same element of gameplay that I believe to be an important part of teaching; the reason for learning the educational subject in the first place. *Portal 2* is a game about problem solving, lateral thinking and spatial reasoning, but that is not the main goal of the player. The player is placed in the role of a human subject with the goal of escaping a deadly facility. There is a higher reason for solving all of the puzzles in the game. By being given a backstory and a goal, the player becomes more personally involved in the game as well as the educational subject.

9 ANALYSING AND RE-EXAMINING THE RESULTS

9.1 Results of the analysis

After examining and analysing three successful educational video games according to the restrictions, limitations and methods placed on this thesis, with the teaching methods based on and compared to James Paul Gee's 36 principles of learning (explained in chapter 4.2), it would seem that twenty one of Gee's principles correlate strongly with the educational methods employed within successful educational video games:

1. Active, Critical Learning Principle
2. Amplification of Input Principle
3. Achievement Principle
4. Practice Principle
5. Ongoing Learning Principle
6. Regime of Competence Principle
7. Probing Principle
8. Multiple Routes Principle
9. Situated Meaning Principle
10. Text Principle
11. Intertextual Principle
12. Multimodal Principle
13. Material Intelligence Principle
14. Intuitive Knowledge Principle
15. Subset Principle
16. Incremental Principle
17. Concentrated Sample Principle
18. Bottom-Up Basic Skills Principle
19. Explicit Information On-Demand and Just-In-Time Principle
20. Discovery Principle
21. Transfer Principle

A certain teaching method is also present in all three selected games (as explained in sections 6.5, 7.5 and 8.5) that does not relate to any of Gee's Principles, and I have taken the liberty of labelling it myself in the same style as Gee:

22. The Meaning of Life Principle

9.2 Extrapolating the results

This section is an attempt at creating a more concise list of educational methods. Gee's principles are compared and categorized according to their similarity and relevance to one another following some explanations. These groups are then given new terms, each with an explanation. Finally, they will serve as a general basis and practical guide for the proper implementation of learning into video games.

9.2.1 Group 1: The Evolution Method

The following list of Gee's principles forms the biggest group and consists of principles involving the quantity, pace and level of challenge by which the educational subject is being taught:

1. Practice Principle
2. Ongoing Learning Principle
3. Regime of Competence Principle
4. Subset Principle
5. Incremental Principle
6. Concentrated Sample Principle
7. Bottom-Up Basic Skills Principle
8. Transfer Principle

All of these principles connect strongly to one another in the way that they portray a certain evolution involving the educational subject and the player. First, the educational subject is taught in its most basic form so that the player can grasp the fundamental concepts. New elements of the subject are added as the player becomes accustomed to

them in order to educate further and to keep challenging the player's knowledge. All of this happens over an extended time of practice and repetition. Because of the aforementioned relation to evolution, the term "Evolution Method" will be applied to this group.

9.2.2 Group 2: The Communication Method

This collection of Gee's principles forms the second biggest group and consists of principles involving the use of multiple means of communication to convey information about the educational subject to the player:

1. Situated Meaning Principle
2. Text Principle
3. Intertextual Principle
4. Multimodal Principle
5. Intuitive Knowledge Principle

These principles connect strongly to one another in the sense that they all focus on the way the educational subject is communicated to the player through different mediums such as symbols, text, images, sound and embodied experiences. Together they press the importance of teaching through multiple media. Because of this, the term "Communication Method" will be applied to this group.

9.2.3 Group 3: The Exploration Method

The third group of principles all focus on allowing the player freedom to experiment with the educational subject on their own.

1. Probing Principle
2. Discovery Principle
3. Multiple Routes Principle

Together, these three principles stress the importance of discovery based on the player's terms. The player is given different choices on how to proceed, the freedom to discover elements of the subject on their own and the ability to experiment with certain elements in order to discover new information about the educational subject. Because of the aforementioned relation to exploration, the term "Exploration Method" is applied to this group.

9.2.4 Group 4: The Rewarding Method

The fourth group of principles relates to rewarding the player with either new information or with a means of congratulations determined by the player's effort and their knowledge of the educational subject.

1. Amplification of Input Principle
2. Achievement Principle

The player needs to be able to receive all vital information about the subject with very little effort on their part, while being rewarded in some way for proving their knowledge about the subject. Because of the aforementioned relation to reward, the term "Rewarding Method" is applied to this group.

9.2.5 Group 5: The Intelligent Information Method

The fifth group consists of two principles which, when combined, relates to information being conveyed to the player from relevant sources, at the right time or whenever the player demands it.

1. Material Intelligence Principle
2. Explicit Information On-Demand and Just-In-Time Principle

Information about the educational subject needs to be available to the player when they need it. The game environment needs to be a source of dynamic information that produces contextual information to the player from in-game entities at crucial times or

whenever the player demands it. The term “Intelligent Information” is applied to this group.

9.2.6 Group 6: The Experience Method

Gee’s Active, Critical Learning Principle is one that stands out on its own. Based on the analysis of the selected games in this thesis, it seems to be a crucial element of teaching, not only in video games in general, but also in relation to academic subjects in educational video games.

The player needs to be actively involved in the learning process. Knowledge about the educational subject should be conveyed through the required participation of the player and through embodied experiences, instead of just passively learning about it. For the purposes of creating a new expression for this method of teaching in educational games, the term “Experience Method” will be applied to this group.

9.2.7 Group 7: The Meaning of Life Method

This teaching method could not be found on Gee’s list of learning principles. As explained in sections 6.5, 7.5 and 8.5, the Meaning of Life principle requires an educational game to have a higher reason for playing the game other than the sole purpose of learning the educational subject. The main goal of the game brings meaning to the game as well as to the educational subject. The player becomes more personally invested in both.

10 A GUIDE FOR IMPLEMENTING EDUCATION INTO VIDEO GAMES

In this section the goal of this thesis is realised by producing a concise, practical list of principles to incorporate educational learning into video games.

1. The Evolution Method
2. The Communication Method
3. The Exploration Method
4. The Rewarding Method
5. The Intelligent Information Method
6. The Experience Method
7. The Meaning of Life Method

10.1 The Evolution Method

First, the educational subject is taught in its most basic form so that the player can grasp the fundamental concepts. New elements of the subject are added as the player becomes accustomed to them in order to educate further and to keep challenging the player's knowledge. All of this happens over an extended time of practice and repetition throughout the whole game.

10.2 The Communication Method

The educational subject is communicated to the player through different mediums such as symbols, text, images, sound and embodied experiences. The educational subject belongs to all parts of the game, not just as static text.

10.3 The Exploration Method

The player is given different choices on how to proceed, the freedom to discover elements of the subject on their own and the ability to experiment with certain elements in order to discover new information about the educational subject.

10.4 The Rewarding Method

The player needs to be able to receive all vital information about the subject with very little effort on their part, while being rewarded in some way for proving their knowledge about the subject.

10.5 The Intelligent Information Method

Information about the educational subject needs to be available to the player when they need it. The game environment needs to be a source of dynamic information that produces contextual information to the player from in-game entities at crucial times or whenever the player demands it.

10.6 The Experience Method

The player needs to be actively involved in the learning process. Knowledge about the educational subject should be conveyed through the required participation of the player and through embodied experiences, instead of just passively learning about it.

10.7 The Meaning of Life Method

There exists a higher reason for playing the game other than the sole purpose of learning the educational subject. The main goal of the game brings meaning to the game as well as to the educational subject. The player becomes more personally invested in both.

11 PRACTICAL APPLICATION

11.1 Introducing Enter The Flesh Again



PICTURE 15. A screenshot of the title screen for Enter The Flesh Again.

During the process of this thesis, I have started to work on an educational video game called “Enter The Flesh Again”. The game is based on *The Tibetan Book Of The Dead*, which is meant to be a guide to those who have died as they transition from their former life to a new destination (Evans-Wentz, W. 1927, p.1). The game aims to teach players about the basic principles of Buddhism and is especially focused on the events between death and rebirth as explained within *The Tibetan Book Of The Dead* (1927).

The goal of the game is to serve as an engaging substitute for understanding the contents, meanings and teachings of *The Tibetan Book Of The Dead* as well as the basic principles of Buddhism based on the teachings of Siddhartha Gautama; the founder of Buddhism thousands of years ago. The game revolves around reincarnation, which is a word derived from Latin, literally meaning, “entering the flesh again”, and that’s where the title comes from.

11.2 Enter The Flesh Again synopsis

The basic idea of the game is to live through many lifetimes, not just as a human, but as many different kinds of possible creatures. Through these lives your main goal, apart from survival, is to acquire wisdom through certain actions. Discovering specific places, texts, helping others or speaking to people can also give you wisdom. I'm still working on these elements, but I want there to be many ways for your character to gain wisdom while still providing you with information and knowledge about Buddhism and The Tibetan Book Of The Dead.

During each lifetime you grow older with time. You also grow hungry and need to eat regularly in order to stay alive. You can find vegetables and fruits, mushrooms etc., and you can also hunt other creatures for their meat. Predators will also hunt you. At a certain age, you will grow into an adult and become bigger, stronger and faster. You are then able to find a mate and have children of your own. As a human, things will be more complicated than with most creatures.

Between your lifetimes, when you are dead, gameplay takes place in the bardo. This is a place, or state of mind, described in *The Tibetan Book Of The Dead* (first English translation, originally published in 1927). It is a surreal, fantastic creation of your own thought and this is where your acquired wisdom will come into play. You will use your wisdom to solve puzzles, fight demons and to open your eyes to infinite possibilities. The end goal of the game is to one day finally escape the cycle of death and rebirth by realising certain fundamental truths and becoming enlightened. That could take a very long time to accomplish.

11.3 The Bardo briefly explained

One of the two main parts in my game *Enter The Flesh Again* is the bardo. Almost all of the contents in The Tibetan Book Of The Dead will appear in this part of the game. In this section of my thesis a brief explanation of the bardo and the events therein is given.

The time between a previous life to the time of conception in a womb is called the bardo, or the “intermediate state” (Rinpoche, T. 2004, p.4). The Tibetan Book Of The Dead describes the bardo in three sections:

1. The Chikhai Bardo

At the moment of your death, you experience The Fundamental Clear Light. It is the light of reality, formless, with unobstructed intellect. Knowing this to be your own consciousness by recognizing your true self, you become enlightened and liberated from the cycle of death and rebirth. If you do not recognize this, you continue on to the second phase of the bardo called the Chönyid Bardo.

2. The Chönyid Bardo

This is where the Peaceful and the Wrathful deities make their appearance. A sequence of apparitions will appear before you of many different Buddhist deities. Each apparition comes with an accompanying colored light, which represents a potential plane of existence for your next life. The peaceful deities appear first, and if you cannot recognize that they are the thought forms of your own mind, their wrathful counterparts appear one after the other. They are terrifying illusions of the mind, and if you cannot recognize them to be creations of your thought, you continue on to the third phase of the bardo called the Sidpa Bardo. If you become too attracted to the planes of existence that accompany them, you will be reborn into those planes.

3. The Sidpa Bardo

In this last phase of the bardo you appear to have a physical body. It is a radiant body, resembling the former body of your previous life, in perfect health. You also seem to be able to go anywhere without being impeded. For example you can be inside a house and do not have to leave through the door. You can just think of another location and be there, such as on top of a mountain. The experience is very similar to that of a dream. Sometimes you are aware that it is a dream, other times you think you are really experiencing what is taking place. Many different apparitions of the mind also appear during this phase of the bardo and if you have meditated and can see the true nature of the mind, then it will be very beneficial during the bardo because the mind will be still, stable, and peaceful. No harm will ensue. Finally you will choose your next birth, either through careful consideration and meditation or through frightened grasping. You will be reborn and continue the cycle of death and rebirth.

11.4 The Six Realms of Existence briefly explained

A big part of my game *Enter The Flesh Again* takes place in the physical realm called Samsara. This is where you live through many different lives as different creatures. You collect wisdom and prepare for the bardo. According to Buddhism there are six realms of samsara, which are the possible types of rebirths (Rinpoche, T. 2004, p.6). In this section of my thesis, brief explanations of these six realms are given. Thrangu Rinpche describes the six realms of samsara in his book *A Brief Overview Of The Bardo* (1999) as follows:

1. **God** (*Skt. deva, Tib. lha*) Sanskrit for god. These are more highly evolved beings who is still part of samsara and therefore in need of Dharma teachings to reach enlightenment.
2. **Jealous gods** (*Skt. asura, Tib. lha ma yin*) These beings are very jealous of the gods and are often depicted as cutting down the wish-fulfilling trees of the gods.
3. **Human** This is the world of human beings and is considered the best realm to be born in because it is the realm which has the best possibility of reaching enlightenment. Even in the god realm, the gods are so involved in their pleasures that they don't seek enlightenment.
4. **Hungry ghosts** (*Skt. preta, Tib. yadik*) A type of being who is always starving and thirsty. This is the result of excessive greed in previous lifetimes and are depicted as having an enormous stomachs and a thin throat. See the six realms of samsara.
5. **Animal** This is the realm of animals who have the main obstacle of stupidity. Even though they may want to reach happiness, as all sentient being do, they do not have the intellectual capacity to understand how to do so.

6. *Hell* In this realm there is much suffering with one being either extremely hot or extremely cold with there being no end of the feeling. The beings of these realms are consumed with anger or aggression.

11.5 Researching Buddhism and The Tibetan Book Of The Dead

Enter The Flesh Again is based on the first English language translation of the famous Tibetan death text, *The Great Liberation upon Hearing in the Intermediate State*. Also known as the *Bardo Thodol* which means "liberation by hearing on the after death plane" (*Bardo*: after death plane, *Thodol* or *Thotrol*: liberation by hearing), it was originally written in the Tibetan language and is meant to be a guide for those who have died as they transition from their former life to a new destination. (Evans-Wentz, W. 1927, p.1)

In order to accurately integrate the contents of this book into my game and to be able to educate players properly on its subject matter, it is necessary to do extensive research on Buddhism, especially on the meanings and interpretations of The Tibetan Book Of The Dead. Apart from using the first English translation as a constant guide for creating this game, I have collected and read a great number of other documents on the subjects of Buddhism and The Tibetan Book Of The Dead. Notable sources are Walpola Rahula's *What The Buddha Taught* (1974), *The Dhammapada* Translated by F. Max Muller (1999) and Thrangu Rinpoche's *A Brief Overview Of The Bardo* (1999). Film sources include *The Tibetan Book Of The Dead: A Way Of Life* (1994) and *The Tibetan Book Of The Dead: The Great Liberation* (1994). Many online sources such as buddhanet.net, exoticindiaart.com and Wikipedia are used as sources of information on the Buddha, The Tibetan Book Of The Dead and other relevant subjects such as Buddhist beliefs, symbolism, rituals, folktales, deities etc.

The game is still early in development stages, but the foundation is set and there are already quite a few educational elements in place. In the next section, the process of using my 7-point guide for implementing education into "Enter The Flesh Again" is explained by analysing the game according to these teaching methods.

11.6 Enter The Flesh Again gameplay

When you start Enter The Flesh Again, you are introduced to the main character, a spiritual being (seemingly female) who can remember everything since her first birth into this world throughout countless lifetimes. You are introduced to her through an introductory cut scene as she explains her need to find out why she is trapped inside this cycle of death and rebirth, and if there is a way out.

The game takes place in two different realms; the physical realm called samsara and the spiritual realm called the bardo. You play as this spirit being throughout the entire game, taking the forms of many different types of creatures in samsara and the form of her spiritual female appearance on the after death plane (the bardo).

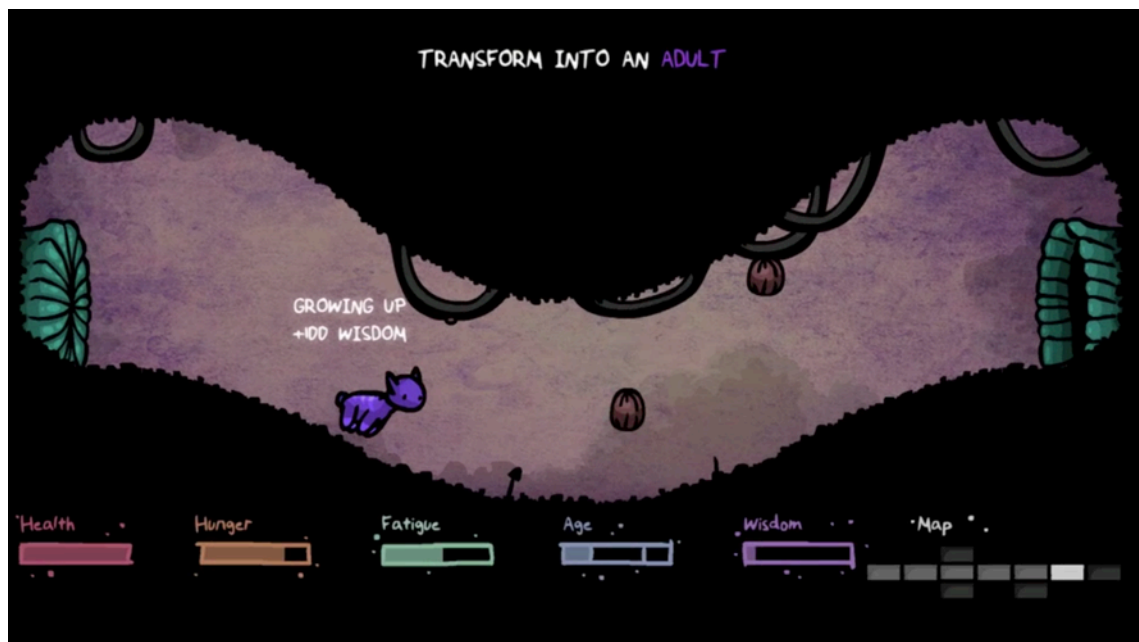
As you start the game, you are placed into the physical realm as a randomly selected creature at the moment of your birth (picture 16). Creature types in the physical realm can include humans, various mammals, insects, reptiles, amphibians and metaphorical creatures from Buddhist lore like Hungry Ghosts etc. The creature type for your first lifetime is completely random, but the ones afterwards will be determined by your actions in the bardo and in previous lifetimes. Your wisdom will also play a role.



PICTURE 16. A screenshot of a mongoose giving birth to the main character.

After a short in game cut scene of your birth, you are required to learn the basics of the character's movement and possible actions like biting, eating and attacking/defending. You need to eat food in order to survive, either by hunting or foraging from plants. Doing certain actions like jumping and attacking tires you. The world around you can also damage you and you need to keep an eye on your health. You grow older throughout your lifetime and will eventually die of old age if you survive that long.

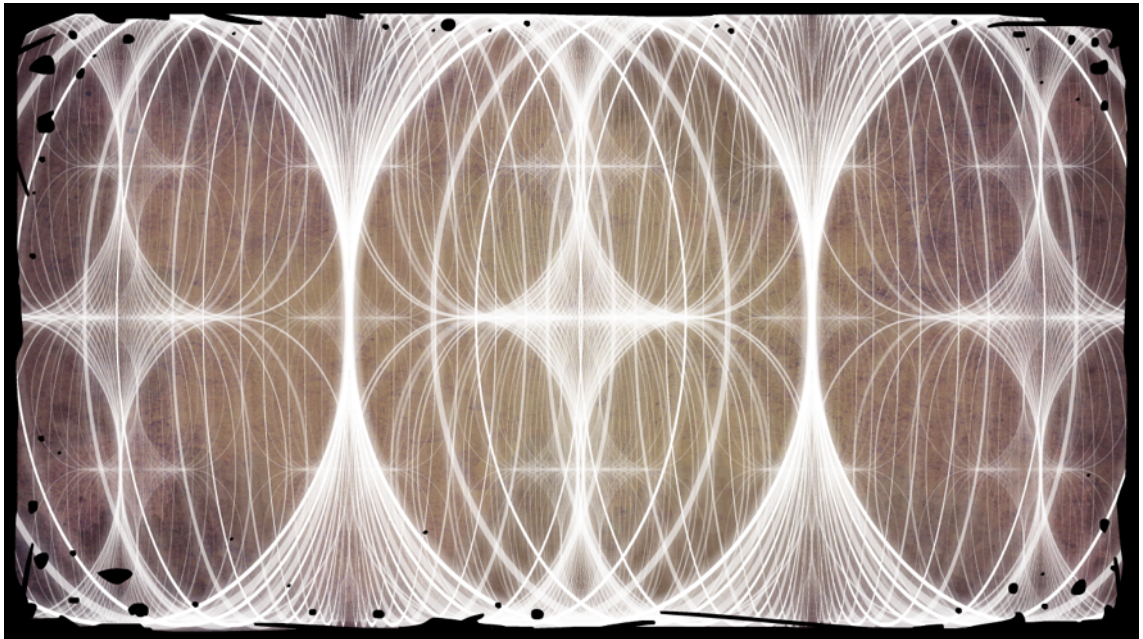
Your main goal in the physical realm is to acquire wisdom through certain actions and experiences like growing into an adult (picture 17), helping others in need, meditation, the discovery of ancient texts etc. Acquiring wisdom will help you in the bardo after you die, but during your first life in the game, your main goal is to survive and to learn how to play. By doing these actions, the other aspects of the game gradually present themselves, like the collection of wisdom and the role it plays in the game.



PICTURE 17. A screenshot of the main character transforming into an adult.

When you die, you take the form of a spirit being and enter a place called the bardo. This is the state of mind in between death and rebirth filled with puzzles and strange, surreal environments and characters. Events will take place described in The Tibetan Book Of The Dead in order of appearance and relevance to the player's progression throughout the game and according to their amount of wisdom. It is also possible to

gain more wisdom within the bardo. The final goal to complete the game is to gain enough wisdom in order to defeat everything encountered within the bardo and to attain enlightenment. This will take a very long time and many lifetimes to achieve.



PICTURE 18. A screenshot of The Chikhai Bardo at the moment of death.

12 APPLYING MY GUIDE OF TEACHING METHODS INTO MY GAME

The educational methods used to convey the contents of The Tibetan Book Of The Dead and the basic principles of Buddhism to the player are explained in the following chapter based on my final guide of implementing education into video games. As previously mentioned, this game is still early in development and although there is already a lot of content in the game, much of the game and educational subject are still in the form of ideas.

12.1 The Evolution Method

At first, the player is only required to focus on survival. As the player becomes accustomed to the game world, they are taught about hunger, growing up, finding food and gaining wisdom through certain actions and events such as raising their young, finding Wisdom Lotus Flowers (picture 19) etc. By the time the player dies and experiences the bardo for the first time, they have been shown the basic idea of the game.



PICTURE 19. A screenshot of the player discovering a Wisdom Lotus Flower.

As the player progresses through different lifetimes, they are gradually shown more of the game world and taught more about Buddhism and The Tibetan Book Of The Dead.

Players can progress at their own pace. Once they have acquired enough wisdom and skill to overcome certain obstacles, they prove themselves worthy of learning more. For example, one of the first places you find yourself when you die is an area with three doors. These doors represent the three stages in the bardo and you can only enter a door if you have enough wisdom. The door leading to the Sidpa Bardo is the only door that does not require any wisdom to enter. This helps the player to learn about the educational subject incrementally while at the same time holding some information back to prevent the player from feeling overwhelmed with information. The game only presents the next step of education to the player once they are ready.

12.2 The Communication Method

The subjects of Buddhism and the Bardo are experienced through embodied experiences by the player through the use of images, sound and text. In order to complete the game, the player will need to die and experience the after death plane many times. Through personally going through these experiences, the player becomes accustomed to the events in *The Tibetan Book Of The Dead* through repetition and active participation.

The educational subject is communicated to the player through different mediums such as symbols, text, images, sound and embodied experiences. The educational subject belongs to all parts of the game, not just as static text.

12.3 The Exploration Method

Once the player is born, they are free to explore the world as they please. The player can choose what to eat (picture 20), how to interact with other creatures and how to handle certain situations. The player can react violently or passively towards all creatures and plants, and they are free to explore the world map in any possible order.

Once the player dies, they enter the bardo where they are placed into certain scenarios described in *The Tibetan Book Of The Dead*. Each scenario has many possible outcomes and requires the player to make choices. These choices then determine whether the player will be reborn or whether they will become enlightened.



PICTURE 20. A screenshot of the player eating flower nectar as a butterfly.

The player is given different choices on how to proceed, the freedom to discover elements of the subject on their own and the ability to experiment with certain elements in order to discover new information about the educational subject.

12.4 The Rewarding Method

Very little effort is needed from the player for the events of The Tibetan Book Of The Dead to unfold, but by making an effort, the player can earn rewards, power-ups and more wisdom in order to make it further into the bardo and to learn more of its teachings.

For example, by learning how to meditate as a human character, the player gains some basic understanding of meditation through a Buddhist viewpoint while being rewarded with wisdom points, which will in turn be useful in the bardo. When using wisdom points in the bardo, the player uncovers more parts of The Tibetan Book Of The Dead as it becomes necessary and appropriate.

12.5 The Intelligent Information Method

Dynamic information about the player's condition and their statistics like health, hunger, age, wisdom etc., are always visible when necessary in the user interface. Notifications about gaining health, wisdom, nutrition etc., are quickly displayed above the player to keep them informed. Objects in the game react both visibly to your actions as well as with accompanying notifications and sounds.

When the player finds textual information about Buddhist teachings, they can always find those teachings again when they need it. For example, the player may encounter a lotus flower in the game that imparts Buddhist knowledge through text. The player can always return to that area and read the text again if they so desire. Another example is when the player learns from another character the art of meditation. Whenever the player returns to this character, they can be taught about meditation from the beginning as many times as they want.

Whenever the player arrives in the bardo, they have the choice to take part in previously unlocked puzzles for as many times as they like and for as long as their wisdom holds out. The whole game environment is a source of dynamic information that can be easily accessed at crucial times and when necessary.

12.6 The Experience Method

Apart from the introductory cut scene in the start, the player is immediately placed into the role of a creature in the physical realm. The player needs to actively participate in order to survive and to learn. By experiencing the many lifetimes of different creatures, the player gains more intuitive knowledge about experiencing the world other than just being a human. This is one of the first steps in understanding Buddhism, by having compassion and empathy towards other living beings.

The player is kept actively involved in the learning process by taking the roles of many different characters with unique attributes through embodied experiences. Each time the player dies, they are taken to the bardo in spirit form and are tasked to solve puzzles and

make choices with real consequences while experiencing the events described in The Tibetan Book Of The Dead.

12.7 The Meaning of Life Method

The player is placed in the role of a spiritual being trapped in an endless cycle of birth, death and rebirth. The goal is to uncover the mystery of the player's situation and how to get out of it. This gives the player a reason to play the game and to learn about Buddhism and the events occurring in The Tibetan Book Of The Dead. There exists a higher reason for playing the game other than the sole purpose of learning the educational subject. The main goal of the game brings meaning to the game as well as to the educational subject. The player becomes more personally invested in both.

13 CONCLUSION

The original goal of this thesis was to gain a better understanding of the educational methods present in successful educational video games and to provide a general basis and practical guideline for the proper implementation of educational learning into video games.

In order to do that, the plan was to find books and sources about this subject and to compare their findings to successful educational video games. It was incredibly difficult for me to find any documents on this subject, and the closest source I could find was James Paul Gee's book *What Video Games Have To Teach Us About Learning And Literacy* (2004). In his book, Gee examines teaching methods in games focused mainly on entertainment. This worried me a bit at first, but the fact that Gee was concerned with how these teaching methods can be used for educational purposes made me pay close attention.

I was pleasantly surprised when I compared his 36 principles of learning to the teaching methods used in my three selected educational games. It turned out that his principles correlated strongly with the teaching methods employed within these games, and I found it feasible to create my own concise guide from these findings by using Gee's principles as a basis.

There are a few drawbacks to this thesis that forced me to have somewhat of a narrow view on the educational methods in educational games. The first drawback was the lack of documents about this subject with which I could compare my findings. The second drawback was the limited time and scope of this thesis. If I had more time, I could have chosen to examine more than three games. I also chose to ignore some of the teaching methods in the selected games as well as some of Gee's principles that had to do with social and cultural aspects. These are very important parts of our lives, especially because of our connection to the Internet and the important part games can play in this environment.

Apart from these drawbacks, I am quite pleased with the end result of this thesis and I feel like I have a much better understanding of the teaching methods used in games as

well as the way they are implemented for educational purposes. I've managed to create a practical understanding on how to effectively incorporate education into video games, which will greatly assist me in the creation of my latest video game... and that was the main point of this whole process.

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