The Qualities of Games for Use in Education

**J. Esterhuizen**

Thesis submitted for the degree *Honours in Computer Science and Information Technology* in 2021 at the North-West University

ITRI 671

Student number: 30285976

Supervisor: Prof Günther Drevin

Table of contents

[Chapter 1: Introduction 1](#_Toc74327488)

[1.1 Project Description 1](#_Toc74327490)

[1.2 Project Contents 1](#_Toc74327491)

[1.2.1 Problem Description and Background 1](#_Toc74327492)

[1.3 Aims and Objectives of Project 3](#_Toc74327493)

[Chapter 2: Literature Review 5](#_Toc74327494)

[2.1 Introduction 5](#_Toc74327495)

[2.2 An Issue with Instructional Education 5](#_Toc74327496)

[2.3 Pedagogy and Learning Theories 6](#_Toc74327497)

[2.4 Gamification 6](#_Toc74327498)

[2.5 An Approach Through Ludology 6](#_Toc74327499)

[2.5.1 What is Ludology 6](#_Toc74327500)

[2.5.2 Games as Simulation 6](#_Toc74327501)

[2.5.3 Serious Games 6](#_Toc74327502)

[2.6 Potential Issues and Effects of Game-Based Learning 7](#_Toc74327503)

[2.7 Existing Gamified Teaching Systems and Educational Games 7](#_Toc74327504)

[2.8 Conclusion/Summary 7](#_Toc74327505)

[Reference List 8](#_Toc74327506)

List of Figures

[Figure 1: Example (Quest Atlantis) of an Educational Game 2](#_Toc74327482)

List of Tables

[Table 1: Organisational Needs Between the Industrial and Information Ages - Adapted from Reigeluth (1996) 5](#_Toc74327485)

Chapter 1: Introduction

# Heading 1 won’t print. Don’t delete – doing so will lead to incorrect numbering.

## Project Description

A student’s learning experience is typically affected by their enjoyment of interacting with the material and their general interest in the topic material presented. As such, a student will have their own individual preferences and style of learning. Due to the rapid and prevalent development of technology, using video games as a means of teaching has been a topic of discussion.

This project aims to create an artefact in the form of a digital game and incorporate specific qualities into one level to demonstrate how a game may be used in a learning environment through the example of an “advanced game tutorial” that aims to not only act as the usual tutorial phase of the game but also to infer certain information about the game’s assorted enemy types.

## Project Contents

### Problem Description and Background

Education as it stands is still built on a system that is no longer needed in modern society. Ackoff and Greenberg (2008) explain that the current traditional methods of teaching are no longer as relevant as they once were as it is aimed to produce members of society that were likely to not question any fundamental aspects of how things operated. It is largely a system that focuses on teaching while disregarding learning as the last major stride in development in education was to industrialise it – having them operate efficiently like factories. While learning is the advancement of one’s understanding and knowledge on a given topic or subject, this can happen in the complete absence of teaching, which is the explanation of a subject from one person to another (Ackoff, 1991). The opposite of this is also true, teaching may occur with no learning.

One major flaw with this system currently is that it stifles the creativity and drive of some students as each level of education is largely the same and as such monotonous. As such, education needs some form of system to create an interest in learning for the students or risk providing only a means of teaching without individual students learning (Ackoff & Greenberg, 2008). It is therefore vital to provide learners in all levels of education with engaging content or methods of delivery that they will enjoy will cause them to be more motivated to learn and look further into that specific topic (Ackoff & Greenberg, 2008).

With the recent developments in technology and the fact that technology, in general, becoming more accessible, some institutions have adopted some forms of digital learning or assist traditional teaching with digital assistance. Deshpande and Huang (2011) state that the current generation of students is the first to grow up with abundant access to technology. They continue to state that, on average, these students spend almost double the time playing video games as they do reading (Deshpande & Huang, 2011).

Virvou, Katsionis and Manos (2005) echo the point that computer games are popular among individuals who are in schools and as such could provide a means to deliver content in an interesting and engaging manner. As such, the motivation behind this study is to further investigate the possibility of using video games as a means to encourage learning in teaching environments as current means of teaching may not be optimal for some individuals.



Figure 1: Example (Quest Atlantis) of an Educational Game

According to Annetta (2008), the movement for the inclusion of digital games to be used in teaching and training environments first started in 2003, two years after the field of ludology, the study of games, began to gain traction in academic literature. This initiative is what started the concept of a serious game as one that can be used in an academic sense to relay information (Annetta, 2008). After this point in time, various examples of serious games were made for purely academic study purposes and had found a very large use in simulation for use as explanation aides and medical training.

The use of games as simulations may stretch the colloquial definition of a video game but in academic terms, this is one facet of video games. Frasca (2002) cites that simulations, such as the ones discussed above, can fall into one of two categories, namely; Paidea (play) and Ludus (game). “Play” refers to the simulations that lack any defined set of rules and conditions to meet a fixed goal while “Game” refers to a simulation that has these conditions and a user can directly, according to the predetermined rules, move towards a fixed goal (Frasca, 2002).

From the abovementioned definitions and examples, there is a loose description of what a serious game typically looks like and where it can be applied. However, the qualities needed by these games to effectively relay information has not been directly explained in any one piece of literature. There is also a lack of explanation on how these qualities can be applied to a game to result in what may be described as a serious game.

## Aims and Objectives of Project

The primary aim of this study is to identify what qualities and principles can be applied to a video game to allow it to be used in a learning environment as a means to provide better engagement among certain students by providing an enjoyable delivery of information.

To effectively reach the aforementioned aim, all the following objectives will have to be met as certain objectives will benefit from the completion of others:

1. A literature study will need to be performed to gather information with a focus on:
   1. Ludology, narratology and simulation to better understand the academia centred around this project;
   2. Other implementations of serious games and the qualities they possess;
   3. The impact and effects of games in early development as this is the main “target audience” if this project were to be implemented as well as in a more general sense;
   4. Previous attempts to integrate game use in learning.
2. Collect examples of games that employ some form of teaching:
   1. Where objective 1-ii focuses on examples already discussed in an academic sense, this objective will make use of more informal analysis

The next aim of this project is to develop an artefact that the above knowledge can be applied to which will require the following objectives:

1. Learn and understand how to use the chosen development platform and associated environments;
2. Develop a base to build other levels/scenes off of;
   1. Development of basic scripts needed.
3. Create a specific scene/level within the aforementioned artefact that specialises in delivering information through various audio-visual stimuli that incorporates the principles and qualities found.

Chapter 2: Literature Review

# Chapter 2: Literature Review

## Introduction

This research study aims to develop a framework of qualities or principles needed for a digital game to be used effectively within an educational environment as well as whenever a game attempts to impart information in general. As such, this research study applies to any educational game and “serious games”.

This chapter will focus on available literature on several fields in an attempt to both explain the necessary background information and also perform a pseudo-meta-analysis on the available literature by presenting and then discussing what has already been done and what could still be done in each respective field, if applicable. These fields will include pedagogy, ludology and gamification as these are closely linked to the research question of this study. Pedagogy to discuss approaches to teaching, ludology to discuss the development and implementations of games and gamification to attempt to link the two.

## An Issue with Instructional Education

Education, as it stands, is still built on a paradigm that is no longer needed in modern society. One major flaw with the current system is that it stifles the creativity and drive of some students as each level of education is largely the same and is, as such, monotonous (Ackoff & Greenberg, 2008). Therefore, education requires some form of system to create an interest in learning for the students.

Ackoff and Greenberg (2008) explain that the current traditional means of teaching are no longer as relevant as they once were as it is aimed to produce members of society that were likely to not question any fundamental aspects of how things operated. It is largely a system that focuses on teaching while disregarding learning as the last major stride in development in education was to industrialise it – having them operate efficiently like factories (Ackoff & Greenberg, 2008).

|  |  |
| --- | --- |
| **Industrial Age** | **Information Age** |
| Standardisation | Customisation |
| Adversarial relations | Cooperative relations |
| Compliance | Initiative |
| Conformity | Diversity |
| CEO as “king” | Customer as “King” |

Table 1: Organisational Needs Between the Industrial and Information Ages - Adapted from Reigeluth (1996)

This current paradigm of education is operated on the basis of standardisation to accommodate the changes and needs required from the industrial age (Reigeluth, 1996). Reigeluth (1996) states that his system was developed on the core need of soring students into different categories to allow for comparisons so that the training of the workforce could also be separated into labourers and managers. However, with the shift into the “information age”, the requirements of the workforce have also changed. The industrial age being a time of mass-production with the emergence of various new processing technologies and the information age being characterised by the fact that information is being transmitted and generated at an ever increasing rate due to further technological developments (Gibson et al., 2006; Reigeluth, 1996). The most notable of the aforementioned paradigm shifts are that from conformity and compliance to initiative and diversity (Reigeluth, 1996). A few other differences between the industrial age and information age are depicted in the above table.

Reigeluth (1996) continues and states that the current paradigm is not focused on learning but rather categorisation. Institutions under this paradigm aim to give learners a verbose vocabulary to speak on topics that they do not fully comprehend while focusing on teaching rather than learning (Ackoff, 1991).

Learning is defined as increasing one’s ability to perform an act effectively while trying meet an objective through acquiring new knowledge (Ackoff, 1991). Ackoff (1991) states that teaching and learning are very distinct from one another as both can take place without the other.

[WIP]

## Pedagogy and Learning Theories

One of the fields that can help solve the presented problem is pedagogy, or the study of the transferal of knowledge in an educational environment through several lenses such as social, political and cultural (Li, 2012). This section will detail various principles found within pedagogy as well as theories dealing with learner motivation and engagement.

*“Learning by doing” turned out to be an important concept in professional human education. Basically, it says that humans are able to improve their skills and productivity through practice and self-perfection [1]. Companies, for instance, realize this concept by training new employees “on the job”. Although not very new, the concept of “learning by teaching” recently gained more and more importance. Essentially, it claims that peers, e.g., pupils or students, should improve their knowledge by teaching each other [2]. There might be two very different kinds of reasons to favor this concept. First, there might be simply not enough teachers (economic reasons). Second,it is argued that under certain circumstances this kind of learning might improve the overall learning process (didacticpedagogic reasons) - Fisch, Janicke, Kalkowski and Sick, 2009*

*Virvou, Katsionis and Manos (2005) mention that computer games are popular among those in schools and as such provide a means to deliver content in an interesting and engaging manner. Providing learners in all levels of education with content or methods of delivery that they will enjoy will cause them to be more motivated to learn and look further into that specific topic (Ackoff & Greenberg, 2008).*

## An Approach Through Ludology

To be able to implement a digital game as a means of learning, an understanding of games in general is needed.

[WIP]

### What is Ludology

Ludology is the formal and academic study of games

### Games as Simulation

Oievh

*Deshpande and Huang (2011:399) describe the use of games as a means of simulation for specific sections of work in physics and engineering courses as an addition to traditional teaching as it provides a relatively simple way to demonstrate certain phenomena. As such these authors discuss the simulation aspect of games rather than the narrative.*

*Annetta (2008) states that the movement to include video games in teaching and training began in 2003, two years after the field of ludology began to gain traction. These types of games are called “serious games”. These types of games have already had an impact on the military, medical and higher business education fields early in their conception and this trend continues to day with most serious games being used within the medical fields specifically (Annetta, 2008). However, there were attempts to use serious games, as simulations, within physics and engineering (Deshpande & Huang, 2011). Use as link to serious games*

### Serious Games

*Annetta (2008) states that the movement to include video games in teaching and training began in 2003, two years after the field of ludology began to gain traction. These types of games are called “serious games”.*

*Virvou, Katsionis and Manos (2005:54) mention that the endeavour to create serious games has yet to reach schools due to certain criticisms about games in general that hinders this.*

*The study of serious games became more theoretical and discussion-based at lower levels and more applied with actual use at higher levels, with a great impact on medical fields and training. As such, there is a fair amount of theoretical research on specific aspects that relate to serious games as simulations and within ludology as a whole, but only a few mention the qualities a game needs to better present information to a user. As such, theoretical knowledge on gamification an general learning theories will be analysed to develop this framework of qualities.*

Games Suited for Education

* Make use of case studies here
* Bulk of the qualities will come out here
* Sources:
  + Ludology from Representation to Simulation (Frasca, 2002)
  + Simulation versus narrative: Introduction to Ludology (Frasca, 2013)
* Serious Games for education and training (De Gloria, Bellotti, Berta, Lavagnino, 2014)

https://www.designtoolbox.co.uk/strategies/three-genres-of-game-research/

What are the characteristics of educational games?‎

|  |  |
| --- | --- |
| **Characteristic** | **Description** |
| Rule‎-based | Events occur based on a set of knowable rules. |
| Responsive | Environment allows for player to act and responds promptly and saliently. |
| Challenging | Environment provides opportunities for success on difficult tasks. |
| Cumulative | Current state of the environment reflects player’s previous actions and allows for assessment of progress towards goals. |

* + A cognitive theory of multimedia learning: Implications for design principles RE Mayer
  + Computer Games in Education (Mayer, 2019)

## Gamification

Gamification of Learning

* Discuss how gamification links to learning and what gamification is as well as how it typically works
* Link some qualities here
* Sources:
  + Karl Kapp book (is available @bib)
* Computer Games in Education (Mayer, 2019)

## Potential Issues and Effects of Game-Based Learning

Bfiufhhrufwof

Effects of Games (Both in General and During Early Development)

* Discuss how games affect the user
* Mention examples from case studies
* Sources:
  + The Effect of Adventure Video Games on The Development of Student’s Character and Behavior (Kristiadi, Hasanudin, Sutrisno and Suwarto, 2019)
  + The best game in the world: Exploring young children’s digital game -related meaning-making via design activity (Mertala & Meriläinen, 2019)
  + A Meta-Analysis of the Cognitive and Motivational Effects of Serious Games (Wouters , Van Nimwegen, Van Oostendorp and Van der Spek, 2012)
  + Extensive childhood experience with Pokémon suggests eccentricity drives organization of visual cortex (Gomez, Barnett, Grill-Spector, 2019)

## Existing Gamified Teaching Systems and Educational Games

Iuveiuehuhf just discuss briefly all the smaller examples -quest Atlantis, Babylon, wolfs den….

*Annetta (2008:230) discusses multiple examples of these games, such as Discover Babylon and Quest Atlantis, that had been developed to immerse children and young adolescents in an academic environment. Further examples of the use of serious games have already had an impact on the military, medical and higher business education fields early in their conception and this trend continues to this day with most serious games being used within the medical fields specifically (Annetta, 2008:229).*

## Conclusion/Summary

Damn, shit works….

Reference List

Ackoff, R. L. (1991). Teaching versus learning. *Systems practice*, *4*(3), 179-180.

Ackoff, R. L., & Greenberg, D. (2008). *Turning learning right side up: Putting education back on track*. Pearson Prentice Hall.

Annetta, L. A. (2008). Video games in education: Why they should be used and how they are being used. *Theory into practice*, *47*(3), 229-239.

Deshpande, A. A., & Huang, S. H. (2011). Simulation games in engineering education: A state‐of‐the‐art review. *Computer applications in engineering education*, *19*(3), 399-410.

Frasca, G. (2002). Ludology: From Representation to Simulation. Proceedings of the 29th International Conference on Computer Graphics and Interactive Techniques. Electronic Art and Animation Catalog.,

Gibson, D., Aldrich, C., & Prensky, M. (2006). *Games and simulations in online learning: research and development frameworks: research and development frameworks*. IGI Global.

Li, G. (2012). *Culturally contested pedagogy: Battles of literacy and schooling between mainstream teachers and Asian immigrant parents*. Suny Press.

Reigeluth, C. M. (1996). A new paradigm of ISD? *Educational technology*, *36*(3), 13-20.

Virvo….