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# VIABLE HEALTH GAMES

## Elements for Success

Master´s Thesis
in International Business
Liiketaloustiede, kansainvälisen
liiketoiminnan pro gradu -tutkielma

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## Table of contents

## List of figures



## List of tables

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# 1 INTRODUCTION

In this chapter, we provide an overview for this study. Chapter starts with a background for the children's health games by overviewing the subjects at the core of children's health games. The purpose of this study and research question follow. Finally, chapter ends with the overview of the contents of this study.

## 1.1 Background

As long as humankind has existed, so have games and information technologies. Although these two have not met until the recent past, they separately existed with their complementary pairs. For games, it was the play and for information technologies, it was the knowledge. As the earliest game to be played, Senet, which was recorded in Egyptian burial grounds around the year of 3100 B.C.E, has a history of possibly more than 5500 years (Piccione, 1980). In addition, it has been stated that "play" is a notion that cannot be denied; it extends beyond any known human civilization, human life or any known temporal limit of humankind (Huizinga, 1955). Thus, humankind came to play. On the other hand, knowledge always has been a matter of information, meaning knowledge is affected by learning and by being informed. Our distant ancestors informed each other of their knowledge with the available technology of that time in the form of primitive pictures and produced examples of the first meaningful ways of communication. The history of information technology begins within these times, the pre-mechanical era, between 3000B.C.E and 1450B.C.E. Thus, humankind came to know (Laudon, Traver & Laudon, 1996).

What we played, we came to know; what we knew, we came to play. Together with time, as the largest complements of these notions, games and information technologies (IT) evolved. IT became an inseparable component of a much greater field as information systems (IS) and games as a system evolved with humankind's ever-enriching culture. Inevitably enough, the merger of these two fields created a new field called, "video games" between the years 1940 and 1950[1]. With the reciprocal relation between IS and video games, an exponentially growing industry arose called the "video game industry".

[1]Pinpointing the date when the first "video game" was created is a challenging task due to the definition of video game itself. For example, the very first patented digital game ever was "Machine to play game of nim" which is a computer that plays a traditional game called "Nim" against humans by representing matchsticks with lamps. The patent has was claimed by Edward U. Condon in the year 1940 with the patent publication number US2215544 A. On the other hand, at John Hopkins University in 1948, a computer based military war game was developed as a belligerent game.

That industry led to numerous different video game types emerging and evolving within and around the field of video games from the 1950s until today; and this granted an ever-expanding definition to the term “video game” itself.

Serious games, as a title, should be acknowledged as being concurrent with video games, and has a history as old as video games. Throughout the time from the moment, the term was first coined in the literature (Abt, 1970) and until today, the definition of “serious games” has been discussed by many academics. However, the most acceptable description would be Ben Sawyer’s, which is “Any computerized game whose main mission is not entertainment or all entertainment games, which can be reapplied to a different mission other than entertainment.” (2007). Therefore, we can say that serious games primarily offer something else, something more than just fun and entertainment. The boundaries of this versatile primary offer are ever expanding whenever serious games are used in a new area of knowledge. Currently, the most popular knowledge are-as, where serious games are being used are the advertising, education, healthcare, ecology, corporate and humanitarian (Djaouti, Alvarez, Jessel, 2011).

Healthcare as one of these areas is a subject concerned with health. Health is a notion that affects every human being at every moment of his or her live, and is, therefore, one of the primary needs of humankind (Maslow, Frager, Cox, 1970). However, considering infancy, childhood or adolescence are the ages when the foundation for many health behaviors are built in, those ages gain a different level of importance in means of health promotion. Ending these ages without health promotion may lead to health disparities, which may cause various problems as individual suffering, productivity loss, or costly healthcare services. In that manner, Shonkoff et al. (2010) state that health is a condition that has to be maintained constantly, with a well-formed basis, starting from infancy.

## 1.2 Purpose of Study

As a subject formed by all the topics above, health games and their effects on children has been studied extensively in various contexts based on the type of health games, the type of health affairs, or the gender and age of intervention subjects (Wattanasoontorn et al., 2013; Papastergiou, 2009; Guy, Ratzki-Leewing, & Gwadry-Sridhar, 2011). However, there is very little written about the elements and the structure of children’s health games (Thompson et al. 2008; Lieberman, 2001). In addition to that, while the consumers of health games have been observed for the effects of health games, there is a lack on studies working on the reasons of these effects. On the other hand, these studies approach the children’s health games subject heavily from either the psychological or the pediatric aspect. A focus on the elements of impact has not been considered. This study will seek these elements.

Children's health games, as a topic involving multiple disciplines requires scrutiny about the elements that operate as the factors of positive impact. We acknowledge this interdisciplinary nature of children's health games, and with this understanding, we scrutinize the field acting parallel with the principles of knowledge work. Nurminen (1995) argues on the issue of the effectiveness and quality of the work with how to increase those by re-evaluating the core of the work itself through the relationship with IS. The purpose of this study is to explore children's health games starting from the phase of their production to consumption in order to understand their architecture and outline the positive impact factors. With this understanding, we aim to proffer a result based on the relatedness of IS and children's health games domains limited with certain health affairs.

## 1.3 Outline of the Research Question

The main research question of this study is:

*What elements of health games have a positive impact on children's health promotion? (Q1)*

Thus, this study of searching for the elements of positive impact in children's health games guided by the following tasks:

1. *To describe and explain the structure of health games regardless of its level of impact on promotion of health (T1),*
2. *To outline the elements (i.e. game design elements, gameplay elements, theoretical backgrounds used during the development of the game, or any other likely items) of health games that may or may not contribute on the positive impact for children's health (T2),*
3. *To formulate a pragmatic proposal, which is applicable for possibly better or more successful health games in order to increase the level of the positive impact of health games on children's health promotion (T3).*

From the given tasks above, the results of the first and second tasks are descriptive and the third is prescriptive. Due to the limited scope of this study, the following constraints have been applied:

- The case studies on health games (which are used for the main research of this study) are limited only with the studies done with people who are below the age of 18 years.
- These same case studies mentioned above are also limited to only five diseases and/or health conditions these are: asthma, cancer, diabetes, nutrition, and obesity.

## 1.4 Description of the Thesis Contents

This first chapter briefly introduces the areas of the study starting from the roots of games, going through video games and finalizing with health games under the title of serious games. Following, the purpose, and the outline of the research question with the applied constraints for the empirical study. Finally, this chapter gives the general description of the chapters of this study.

The second chapter begins with literature review on the background of games, video games with their structure, children's gameplay with their preference of games, and serious games. The chapter continues with the notion of health, the health affairs we are concerned with, and the field of health promotion in the context of health games with the description of theories and concepts used in health promotion. The chapter ends with the definition of health games and the applications of health games for children.

The third chapter starts with a brief background of the Grounded Theory Method (GTM), which is used as the research method of this study, and instructions on how GTM is applied to this qualitative research. The chapter continues with the description of subjects, sample selection, and sample used in research. This includes the search strings and criteria used in literature research, and other details such as the number of studies found. The data found is organized into tables and figures when necessary. In addition to these, the third chapter includes the details of coding procedure that has been done through the research in a Glaserian Approach along with the substantive coding stage. The chapter ends with the re-statement of the research question and tasks.

The fourth chapter presents the specific findings throughout the analyzed data. Due to the structure of GTM analysis, we give the details of the remaining stages of the coding procedure in this chapter. Those stages of the coding procedure respond to the tasks of our research, therefore, chapter starts with the axial coding stage that responds the first task of our research. The chapter continues with the outlining of the elements of impact in children's health games as the second task of our research. After this part, the main research question is answered and the chapter is finalized with the explanation of theoretical coding part that responds to the third task of the research.

The fifth chapter summarizes the study in brief and gives answer to research question with the resolution of the subtasks. The chapter continues with the discussion about the implication of the proposition and the results. The fifth chapter finishes with the description of the limitations of this study and concludes with the recommendations for the future of the research.

# 2 LITERATURE REVIEW

## 2.1 Games, Video Games, Children's Gameplay, and Serious Games

### *2.1.1 Games*

"Game" is a term that comes with a particular type of challenge for comprehension since it can be utilized in numerous ways within the English language. However, when the lifelong comrade "play" comes next to "game", as studied by many scholars, the meaning becomes easier to comprehend. Therefore, before going into the definitions of "video game", "serious game", and "health game", we dared to act as an argonaut in order to cobble a definition of game, which expectantly will be accepted by some (if not many) and especially be more suitable for this study.

In his seminal work "The Art of Game Design", Jesse Schell defines games as a playfully approached problem-solving activity (Schell, 2014). In order to give this brief, industry-friendly, yet strong definition, he drew on the works of various scholars, philosophers, and authors who explored both the terms "play" and "game". His approach for obtaining this definition has several resemblances to the definition by a duo in his list of scholars, namely Salen and Zimmerman. This duo as the two earliest game researchers also drew on the works of several scholars (Table 1), and maybe for that reason their definition is more elaborate compared with Schell's definition.

Salen and Zimmerman's exact definition of games (Salen & Zimmerman, 2004) is as follows:

*"A game is a system in which players engage in an artificial conflict, defined by rules that results in a quantifiable outcome."*

## Table 1 Various studies on game and play

| Focused term | Described or Explored by | Description | Used by |
|---|---|---|---|
| Game | Elliot Avedon and Brian Sutton-Smith | *"Games are an exercise of voluntary control systems, in which there is a contest between powers, confined by rules in order to produce a disequilibrial outcome."* (Avedon & Sutton-Smith, 1971) | J. Schell and K. Salen & E. Zimmerman |
| Game | Greg Costikyan | *"[A game is] an interactive structure of endogenous meaning that requires players to struggle toward a goal."* (Costikyan, 1994) | J. Schell and K. Salen & E. Zimmerman |
| Game | Tracy Fullerton | *"A game is a closed, formal system that engages players in structured conflict, and resolves in an unequal outcome."* (Fullerton, 2014) | J. Schell |
| Play | Friedrich Schiller | "*Play is the aimless expenditure of exuberant energy*." (Mellou, 1994) | J. Schell |
| Play | Jon Barnard Gilmore | "*Play refers to those activities which are accompanied by a state of comparative pleasure, exhilaration, power, and the feeling of self-initiative.*" (Gilmore, 1971) | J. Schell |
| Play, game | Katie Salen and Eric Zimmerman | "*Play is free movement within a more rigid structure.*" (Salen & Zimmerman, 2004) | J. Schell |
| Play | George Santayana | "*Play is whatever is done spontaneously and for its own sake*." (Santayana, 1896) | J. Schell |
| Game | David Parlett | Instead of giving a concise definition, Parlett proposes a descriptive model in order to understand games. He categorizes games as formal games and informal games, then clarifies this distinction with means and ends (Parlett, 1999). | K. Salen & E. Zimmerman |
| Game | Clark C. Abt | *"Reduced to its formal essence, a game is an activity among two or more independent decision-makers seeking to achieve their objectives in some limiting context. A more conventional definition would say that a game is a context with rules among adversaries trying to win objectives."* (Abt, 1987) | K. Salen & E. Zimmerman |
| Play | Johan Huizinga | *"Summing up the formal characteristic of play, we might call it a free activity standing quite consciously outside 'ordinary' life as being 'not serious' but at the same time absorbing the player intensely and utterly. It is an activity connected with no material interest, and no profit can be gained by it. It proceeds within its own proper boundaries of time and space according to fixed rules and in an orderly manner. It promotes the formation of social groupings that tend to surround themselves with secrecy and to stress the difference from the common world by disguise or other means."* (Huizinga, 1955) | K. Salen & E. Zimmerman |
| Play, game | Roger Caillois | Instead of giving a concise definition, Caillois identifies the six characteristics of play from a broad game perspective. Based on the characteristics that he identifies, Caillois argues that play is free (voluntary), separate (nominal reality), uncertain, unproductive, governed by rules and a make-believe (Caillois, 2001). | K. Salen & E. Zimmerman |

| | | | |
|---|---|---|---|
| Game | Bernard Suits | *"To play a game is to engage in activity directed towards bringing about a specific state of affairs, using only means permitted by rules, where the rules prohibit more efficient in favor of less efficient means, and where such rules are accepted just because they make possible such activity."* (Suits, 1990) | K. Salen & E. Zimmerman |
| Games | Chris Crawford | Instead of giving a concise definition, Crawford defines games by listing four main qualities of what we call games. These qualities are *representation* (defines the simplified nominal reality that games present in our actual reality), *interaction* (defines how the changes in that nominal reality happen), *conflict* (defines the intrinsic elements of all games that arise from interactions between the player and the game) and *safety* (defines the safe nominal environment that games provide while offering so-called "dangerous" conflicts) (Crawford, 1984). | K. Salen & E. Zimmerman |

Despite these results of Schell and Salen & Zimmerman, there are two points that need to be reconsidered for the integrity of this thesis.

First, "players" is a plural term, which represents the individuals who perform the activity of play. Although it is clearly explained further in their work that the term "players" represents one or more participants of the system, it would be beneficial to state the fact that games can be played alone or together depending on the game.

Secondly, it is true that one or more players engage in an artificial conflict when playing games. However, there is a feature of play that enables an ordinary person to become the player of a game. In the studies of Caillois (2001), Suits (1990), and Avedon & Sutton-Smith (1971), this feature is defined as the willingness (or voluntariness) of the player to engage. While Salen and Zimmerman (2004) avoid using this feature of play in their definition (as there are situations where playing a game is not voluntary but in a manner forced), Schell (2014) concludes that the willingness is a matter of playfulness. Consistent with this, Lieberman (2001) critiques that playfulness is the apotheosis of play. Therefore, a playful attitude while engaging in an artificial conflict is a quality that enables to define that conflict as a game.

Considering these adjustments, the revised definition is:

*"A game is a system in which one or more players willingly engage in an artificial conflict defined by rules, which results in a quantifiable outcome."*

It should be pointed out that this definition makes no distinction between the types of games. However, with this definition in hand, defining the other necessary game-related terms will be smoother. Therefore, now it is time to look into the definition of video games in order to get one-step closer to reach the focus term of this study.

### *2.1.2 Video Games*

Considering even the spelling of the term is still open to debate, that whether it should be written as video game or videogame, it would be rather easy to state that there is no generally accepted definition for the term "video game". Looking into the field of games itself, it is possible to divide the whole field into two as digital and non-digital games where all the video games are inherently digital. Likewise, it is also possible to claim that all games can be separated into electronic and non-electronic games where all the video games are again inherently electronic. However, the terms "digital games" and "electronic games" are rather obsolete when compared to "video games". On the other hand, there are numerous borderline cases where identifying the system at hand as a "gamified" software would make more sense than identifying it as a video game.

Therefore, for the sake of practicality and simplicity, this study acknowledges all these terms (digital games, electronic games, gamified software) under the title "video games". Due to these facts and the complex form of video games, it would be more beneficial for our study to give a pragmatic definition of the term "video games" instead of a succinct definition of it as given for the terms defined previously (games, serious games, and health games). In order to do so, two generally accepted and complementary works in the field of video games are explained together below.

First, considering video games as a different world, Schell provides a helpful tool which lists the elements that form that world and shows what it is made of and how (Schell, 2014). The four constituents of Schell's elemental tetrad are Technology, Mechanics, Story, and Aesthetics, which are interdependent with one another (Figure 1). Secondly, considering video games as an entertainment product that is consumed in a different way than others (such as theatrical plays, books, music, movies, et cetera), MDA (stands for *Mechanics*, *Dynamics*, and *Aesthetics)* framework is a prominent tool that can be used for analyzing video games and their interaction with players as their consumers (Hunicke, LeBlanc & Zubek, 2004). The MDA framework establishes three design counterparts in response to the components of the exclusive consumption continuum of games (Figure 2). Before going further, there are two important points that require caution about these two works: First, the "mechanics" component of MDA contains both the "mechanics" and "technology" elements given in the elemental tetrad. Secondly, the "aesthetics" component in the MDA stands for a type of entertainment peculiar to the gaming experience, whereas in the elemental tetrad "aesthetics" stands for something closer to the regular sense of the word and defines the audiovisual elements of video games.

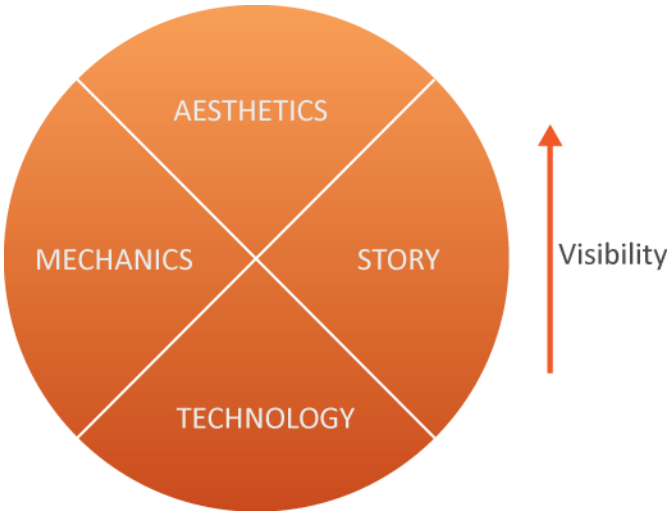


**Figure 1 Elemental tetrad (Adapted from Schell, 2014)**

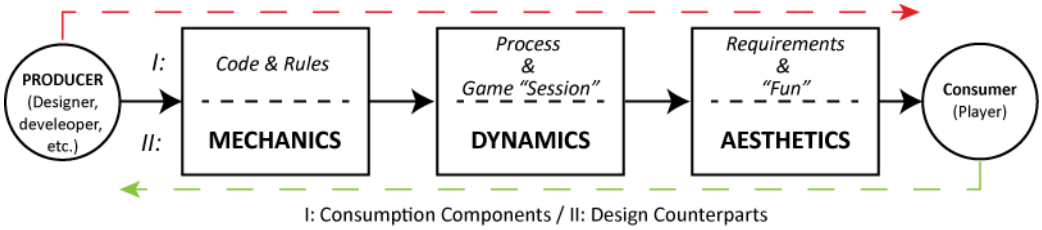


**Figure 2 MDA framework (Hunicke, LeBlanc & Zubek, 2004)**

In the MDA framework, mechanics are the particular components like the rules and the concepts of the "game-as-a–system", which are the algorithms and technological representations of data in video games. Although LeBlanc claims that there are countless game mechanics out there (LeBlanc, 2004), a list of the seven main game mechanics is provided by Schell (Schell, 2014) as given below:

I. *Space*: Space represents the area within the game world; or in other words, the abstract construct of the game world that is stripped away from all other visuals.

II. *Time*: Time as a game mechanic is a reflection of the actual time experienced in the real world cast by designers upon the game world.

III. *Objects, Attributes and States*: *Objects* are the matters of the game world like material entities; every object has one or more *attributes* (e.g., color, amount, or position of the matter) and each attribute has *states* (e.g., current amount or maximum amount). In Schell's words, if the objects are the "nouns" of the game mechanics, then attributes and states are the "adjectives" modifying those nouns (Schell, 2014).

IV. *Actions*: Actions are the activities that are performable within the game world.

V. *Rules*: Rules are the borders of all the mechanics given above, defining their limits.

VI. *Skill*: A skill can be two things. First and mainly, it is the ability that the game world requires from the player in order to cope with its rules and, therefore, pursue existence in it. Secondly, skill is the virtual skill that the player pretends to have within the game and through the game character.

VII. *Chance*: Chance is the element of uncertainty and the source of surprise, which is also the secret agent of fun.

According to the elemental tetrad, these *mechanics* are actualized by *technology*, formed around the *story*, and expressed to the player by *aesthetics.* However, as stated before, according to MDA, mechanics are a component of games that not only contains Schell's list of mechanics but also contains the technology that actualizes them. From MDA's point of view, when mechanics are used in a context, they cause the emergence of *dynamics*. Therefore, dynamics appear when players enter input and activate the mechanics; in other words, dynamics happen within gameplay and they are the fuel of the "flow state"[2]. As an example case for seeing what mechanics and dynamics look like inside an actual game, Pac-Man can be useful. In Pac-Man, one of the game mechanics used is "*objects, attributes, and states"* in the form of four (the attribute of the object) collectable (the state of the object) energizers (the object). When the player makes Pac-Man collect one of the four energizers, player's expectations from the game temporarily changes. Such an act transforms the harmful ghosts that Pac-Man must evade into harmless ones Pac-Man may hunt down, thus the player temporarily becomes free from the obstacles. This turn of events brings forth a dynamic that can be called "the release of obstacle pressure". An important point about dynamics is that there is no unified theory for them, but instead a collection of various dynamic models (LeBlanc, 2004). Throughout this process, the player experiences game-specific entertainment. This experience of the player is identified by the type of entertainment upon which it is founded. MDA calls this experience *aesthetics* and provides a list of eight different types of it (Table 3). Continuing from the Pac-Man example, the obstacle pressure dynamic produces the aesthetics of "challenge" (obstacles make the game more challenging) and "sensation" (overcoming these obstacles creates a sense of pleasure). Another important trait of aesthetics in MDA is that they are able make the line that separates video games and other software more apparent. Considering the fact that every video game is a piece of software that systematically processes a certain type of collected and organized information, video games can

[2] "Flow state" is a phenomenon introduced by Mihaly Csikszentmihalyi to refer to the state of an individual who is experiencing the peak of their abilities while unselfconsciously having the utmost concentration on a specific task that increases happiness (Csikszentmihalyi, M., 2014) .

be classified as a part of information systems (IS). However, LeBlanc (2004) differentiates video games by pointing out the fact that video games are made for evoking user emotions while the rest of the IS (e.g. communication software, productivity applications, management applications, and such products. These products can only be a convenient mean for providing emotion-evoking products such as music, porn, or movies) avoid user emotions.

**Table 2 Aesthetics and their meanings**

| Type of Aesthetic | Type of Game-specific Entertainment |
|---|---|
| Sensation | Sense-pleasure |
| Fantasy | Make-believe |
| Narrative | Drama |
| Challenge | Obstacle Course |
| Fellowship | Social Framework |
| Discovery | Uncharted territory |
| Expression | Self-discovery |
| Submission | Pastime |

In the path to understanding video games, MDA shows that video games are software that arouses and embraces the emotions of the user with aesthetics, and points out that a productivity software seeks no such behavior from the user. However, MDA is a framework, which is completely blind towards the audio, visual, and intellectual aspects of video games (Egenfeldt-Nielsen, Smith & Tosca, 2013). These aspects are maybe the most visible elements of any video game for an everyday player. The elemental tetrad, because of this lack of information in MDA, is a complementary work. In the elemental tetrad, *Story* represents the intellectual aspect of video games. A video game does not necessarily have to have a deep story since a story can be linear or shallow, and in some rare cases, there is no story at all. However, the interrelated form of the four elements in the tetrad allows video games to create experiences. Therefore, a story can be a critical tool for such a task. In addition to stories, video games have to be seen, heard, and felt by their audience. In the elemental tetrad, *Aesthetics* is the element for satisfying these requirements. Moreover, aesthetics reinforces the story while it represents the mechanics in a meaningful manner (Schell, 2014).

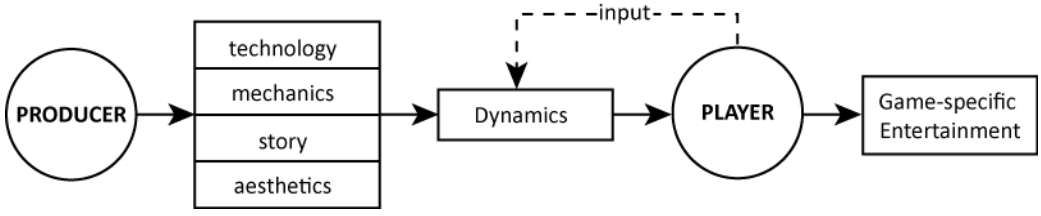


**Figure 3 Synthetize of the MDA framework and the elemental tetrad**

The synthesis of the MDA and the Elemental Tetrad models provides a sufficient pragmatic definition of video games (Figure 3). Nevertheless, this synthesis is not sufficient to scrutinize the specifics of players as a strong determinant of every video game as a product.

### *2.1.3 Children's Gameplay*

It is possible that any video game producer can disregard the player as the target that steers the content of their video game and proceed regardless of the player's preferences. However, studies show that specific age and gender groups among players have different preferences on video game genres in addition to having different motives to play video games (Kafai, 1998; Bonanno & Kommers, 2005; Baranowski, 2008; Boyle, 2008; Sherry, Lucas, Greenberg & Holmstrom, 2013). Thus, since the people under the age of 18 are the focus of this study, it is essential to see the gameplay patterns of this target population.

In order to understand children's motivation behind the video game play, Olson (2010) held a study on more than 1000 students (between the 12 and 15 years of age) and the results show that regardless of gender, all children play video games mainly because "it is fun". This shared motivation differs according to gender when asked for a secondary reason. For male children the second reason of playing video games is they like to compete with and win against others; whereas for female children playing video games is a pastime activity when they are bored. For the third reason of playing video games, both female and male children agree on the "challenge of problem-solving" as a motivator (Olson, 2010). In a likely manner, Sherry et al. (2002) outline that fifth-grade children (10-11 years old) play video games mainly for the fantasy and challenge that video games provide. However, this attitude changes in time and the same group seeks competition and social interaction as shown by Bonanno and Kommers (2005). Considering the MDA's aesthetics that represent the game-specific entertainment (Table 3) and the studies of Olson (2010) and Sherry et al. (2002), the most preferred outcomes from entertainment video games among children can be listed as sensation, submission, challenge, fantasy, and fellowship.

Besides the motivation of playing a video game, children also have preferences on video game genres. Although, in his study, Baranowski (2008) defines genre as the way of expressing the story through the video game storytelling, genre is a trait of video games that encompasses their aesthetics, mechanics and technology as well as their story (Apperley, 2006). Nevertheless, regardless of the continuing arguments on the genres of video games (Wolf, 2002; Arsenault, 2009) the core genres of video games can be listed

as *adventure*, *arcade* (action), *fighting*, *puzzle*, *racing*, *role-playing* (RPG), *shooter*, *simulation* (including virtual life or world simulations), *sports*, and *strategy*.

Considering these as the main genres in focus, studies of Greenberg et al (2010) on 692 children and Homer et al (2012) on 213 children demonstrates that both age and gender of players affect the game genre preferences. The study of Greenberg et al conclude with the result that male children primarily prefer to play the shooter, fighting, racing and sports video game genres from age 9 to 18. Male children's secondary preferences for video game genres are adventure, RPG, and strategy. While the difference between the primary and the secondary preferences is significant during the early ages, during the late ages this difference is insignificant. The same study of Greenberg et al. also conclude with the result that female children's primary preference for the video game genres are arcade, puzzle, and simulation. Female children's secondary preferences are the same as males; and even with the increase of age, they show the same tendency with male children towards video game genre preference. In addition to Greenberg et al, the study of Homer et al show the same results where the only difference is the age of subjects, which ranges between 10 to 15 years old.

It is clear that studies on video game genre preference and video gameplay motivation of children under 9 years of age lack attention. Nevertheless, only with this information given on games, video games and gameplay, it is now possible to explore games with a different purpose than entertainment as their priority.

### *2.1.4 Serious Games*

The term "serious games" was first used by Abt (1987) in his same-titled book in the context that it is used today. In his work, Abt presented ways of utilizing games for the field of education and training. He also gave a clear definition of serious games in his studies. According to Abt, the attitude towards or intention behind playing a game can be serious or casual. Abt was interested in serious games for their setting education, rather than entertainment as games generally do, as primary purpose. He also clarifies that this does not mean serious games are not or should not be entertaining. Despite the fact that Abt's definition was highly focused on a single domain, it showed potential for further development. Therefore, with the works of many other scholars (Jansiewicz, 1973; Sawyer & Rejeski, 2002; Zyda, 2005; Michael & Chen, 2005) "serious games" have been shaped into its current definition:

*"All entertainment games, which can be reapplied to a different mission other than entertainment or any computerized game whose main mission is not entertainment."* (Sawyer, 2007)

**Table 3 Serious games taxonomy (Adapted from Sawyer & Smith, 2008)**

| | | GENRES | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **Games for Health** | **Adver-games** | **Games for Training** | **Games for Education or Edutainment** | **Games for Science and Research** | **Production** | **Games as Work** |
| **DOMAINS** | **Government & NGO** | Public Health Education & Mass Casualty Response | Political Games | Employee Training | Inform Public | Data collection / Planning | Strategic & Policy Planning | Public Diplomacy Opinion Research |
| | **Defense** | Rehabilitation & Wellness | Recruitment & Propaganda | Soldier/Support Training | School / House Education | War-games / planning | War planning & weapons research | Command & Control |
| | **Healthcare** | Cyber therapy / Exergaming | Public Health Policy & Social Awareness Campaigns | Training Games for Health Professionals | Games for Health Education and Disease Management | Visualization & Epidemiology | Biotech manufacturing / design | Public Health Response Planning & Logistics |
| | **Marketing & Communication** | Advertising Treatment | Advertising marketing with games, product placement | Product Use | Product Information | Opinion Research | Machinima | Opinion Research |
| | **Education** | Inform about diseases/risks | Social Issue Games | Train teachers / Train workforce skills | Learning | Computer Science & Recruitment | Documentary (?) | Teaching Distance Learning |
| | **Corporate** | Employee Health Information & Wellness | Customer Education & Awareness | Employee Training | Continuing Education & Certification | Advertising / visualization | Strategic Planning | Command / Control |
| | **Industry** | Occupational Safety | Sales / Recruitment | Employee Training | Workforce Education | Process Optimization Simulation | Nano / Biotech Design | Command / Control |

During this period of development, serious games have also been applied on numerous different domains. Although nowadays these domains are somewhat identified and stable, there is still not one single generally accepted classification method for all the types of serious games (Djaouti et al, 2011a). In this regard, as a work in progress, Sawyer's "serious games taxonomy" matrix is a sufficient model[3] to see the sub-types of serious games

[3] Although we found this model sufficient for pointing out the types of serious games, the use of "Games for Health" genre in the domain of healthcare is a matter of discussion. The current use of the term "Games for Health" includes more elements than given in the related collum of the Table 3; Sawyer and Smith (2008) attempts to clarify this further in their study with providing an additional taxonomy designed specifically for games for health. In this taxonomy, disease management considered as a type of games for health in the personal and professional therapeutic manner

with respect to the domains and genres to which they belong (Table 3). Amongst the given domains in Table 3, healthcare is the third biggest domain of serious games (Djaouti et al, 2011b). However, before going into the serious games within this domain, it is necessary to look into the topic of health and health related subjects on which this study focuses.

## 2.2 Health, Health Affairs and Health Promotion

### *2.2.1 Health*

Health is a subject that takes part in every stage of human life starting from birth to old age, and is a basic need for every individual. The World Health Organization defines health (WHO, 2006) as:

*"Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity."*

The given definition above mentions only three dimensions, which are physical, mental, and social health and the number of dimensions can increase to six with the addition of emotional, spiritual, and societal health (Scriven, 2010). However, even with the increase in number of dimensions, this definition of health disregards how the state of health is experienced by individuals. Regarding this, Svenaeus proposes an alternative definition for health and explains health as a condition where a person is at their "home-like-being in the world". On this matter, Koskinen (2010) discusses the Heideggerian definition of health presented by Svenaeus (2001). Koskinen points out that Svenaeus' phenomenological definition of health provides a long overlooked individual-centered basis to health where diseases or health condition are prioritized secondly. On this basis, healthcare or health improvement primarily focuses on the health-related needs of individuals, and not on the treatment or intervention requirements of diseases or health conditions. Such a view also consolidates the inseparability of patient, healthcare, and health as associated notions (Koskinen, 2010).

With all these dimensions considered, health is a condition that has to be maintained constantly, with a well-formed basis, starting from infancy (Shonkoff et al., 2010). Therefore, understanding the affairs that alienate individuals from their homelike-being state, as well as understanding the individuals themselves, is crucial. For this reason, in the next part we deal with the health affairs this study focuses on.

### *2.2.2 Health Affairs*

The results of the study of Parisod et al (2014) on children, video games, and health outline a focus on specific health affairs such as asthma, cancer, diabetes, obesity, and nutrition as the health affairs seen in health games. Considering that these titles form the primary focus of this study, it is necessary to obtain an adequate understanding on the details of these affairs.

As the first health affair topic this study focuses on, *asthma* is an incurable and chronical lung disease with an unknown reason of its cause. It often starts in childhood and causes the inflammation and contraction of the airways of an individual. Today in the US alone, children comprise one-third of the total asthmatic population. People with asthma suffer from shortness of breath, chest tightening, and cough attacks (occurrence of these attacks increases during night or early morning), and often tend to let out a whistling sound when breathing (also known as "wheezing"). Since asthma is a health condition without a cure, it requires a certain level of knowledge about the disease and disease management to enable people with asthma to live - in Svenaeus' words (2001) - "home-like" lives. Disease management skills for asthma can be obtained through the education provided by healthcare professionals (National Heart, Lung, and Blood Institute, 2014). However, this education programs may lack personalization and can be economically burdensome for families with low income (Bodenheimer, Lorig, Holman, & Grumbach, 2002; Guendelman, Meade, Benson, Chen, & Samuels, 2002)

As the second health affair topic of this study, *cancer* is a collective name given to a group of diseases. Cancer occurs when some of the body cells invade the surrounding tissue due to continuous dividing activity and reaches to life threatening levels. The number of known cancer types is more than 100 and any of these types can arise genetically, or when an individual is exposed to certain cancer-causing substances (e.g. ultraviolet (UV) radiation, tobacco smoke). Although there is no conclusive cure for the many types of this health issue, there are treatment methods such as chemotherapy, radiation, or stem cell transplantation (National Cancer Institute, 2015). Since these treatment types often have devastating side effects, they require a better awareness on both the cancer and on the method of treatment. Regardless of their high cost, psychoeducational interventions provided by experts for improving the necessary awareness have been a promising method for children with chronical illnesses and cancer (Beale, Bradlyn & Kato, 2003). In addition to all these treatment methods and interventions, there are also methods for preventing certain types of cancer, such as skin cancer, to occur (Hornung et al., 2000). Similar to intervention methods for children, these prevention methods are also based on the education of the targeted population by experts (Marston, 1992).

As another incurable disease, *diabetes* (also known as diabetes mellitus) occurs when blood glucose or sugar levels reach above the normal. The main reason of such abnormality is the insufficient activity of an internal organ called pancreas whose main role is to produce the hormone called insulin. Insulin enables the glucose or sugar taken from food to enter body cells. Therefore, whenever there is a lack of or inefficient insulin in the body, blood glucose, or sugar levels increase, and thus diabetes occurs. This abnormality may cause various health conditions such as kidney failure, blindness, and heart diseases. There are two main types of diabetes which are Type 1 (formerly known by the name of "juvenile diabetes" where the pancreas does not produce insulin) and Type 2 (a more common and preventable type of diabetes that occurs due to insufficient or inefficient insulin in the body). While the causes of Type 1 diabetes are rather unknown, the generally known causes and risk factors of Type 2 diabetes are physical inactivity, obesity, old age, genetics, and race or ethnicity (Centers for Disease Control and Prevention, 2015). Since there is no known cure for diabetes, a disease management method that involves exercise, weight control, and planned nutrition advised by a healthcare professional enables controlling diabetes. Along with disease management, diabetes requires motivation dependent self-caring skills since monitoring the glucose levels of the body and taking prescribed medication are essential as well (U.S. National Library of Medicine, 2014). Just as with asthma, these intervention methods can be costly and require a certain level of personalization on individuals. According to the World Health Organization, today there are approximately 350 million people worldwide with diabetes and it is estimated that by the year 2030 diabetes is going to become the seventh leading cause of death in the world (World Health Organization, 2014).

As a preventable disease, *obesity* is the condition which occurs when the fat in the human body reaches to an excessive and health impairing level. This health impairment leads to others such as diabetes, heart diseases, joint diseases, and cancer types such as breast and colon cancer. Although obesity is a disease that may occur regardless of age, sex, race, or economical income, childhood obesity, or overweight is associated with a higher chance of adulthood obesity. The World Health Organization identifies obesity with the formula called body mass index (also known as BMI; the ratio of body weight in kilograms to the square of body height in meters). If an individual's BMI calculation results are equal to or higher than $30kg/m^2$, that individual is considered as obese. The first of the two main factors that lead to obesity is nutrition. The increased amount of fat-based food intake is a nutrition-based problem, which is preventable as explained before (Subject IV). The second factor is the increase of physical inactivity that causes the body fat to accumulate. Especially for children, increase of physical inactivity is confined with sedentary screen time (Hill, Wyatt, Reed, & Peters, 2003; Dietz, Bandini, Morelli, Peers, & Ching, 1994), which is also avoidable by increasing regular physical activity time with alternative motivations (WHO, 2015; Al-Hrathi, Karime, Al-Osman & Saddik, 2012).

*Nutrition*, as the last of the health affairs this study focuses on, lies in the core of many other health affairs as well as obesity and diabetes. Since the food intake of an individual provides the necessary energy and nutrients to maintain their life, a habitual healthy diet is one of the key factors of increasing the quality of life. Whether the issue is obesity, diabetes or increasing the quality of life, developing and maintaining the necessary healthy diet happens through education-based influence and motivation. However, studies demonstrate that when compared to adults, children are at an advantageous position for benefiting from nutritional education since their capability for learning is higher (Birch, 1998; Epstein, Valoski, Kalarchian & McCurley, 1995).

Considering that these given descriptions of the health affairs are another part of health games, now we can cover the last necessary step in the path to attain health games.

### *2.2.3 Health Promotion*

As a process, health promotion is the enhancement of individual control over health and improvement of self-health (WHO, 1986). This process of enhancement and improvement happens through increasing knowledge of health and changing behavior on health related issues. Through these acts, health promotion enables prevention from diseases or other health issues and increases both the individual and the societal quality of life (Nutbeam, 1998). Related to this, Glanz, Rimer, & Viswanath (2008) outline the most commonly used theories and models in health education and health behaviors. Their study identifies Health Belief Model (HBM), Social Cognitive Theory (SCT), Theory of Planned Behavior (TRA/TPB), The Transtheoretical Model (TTM), Social Support and Social Networks, Social Marketing, Diffusion of Innovations, Stress and Coping, and lastly Ecological Model/Social Ecology as the most commonly used theories or models in the field of health promotion.

Regarding these trends in the field of health promotion, a narrower list of theories, models, and concepts are formed for this study, since we deal with health promotion infused through health games for a limited number of health affairs. In order to assess the process of the infusion of health promotion through health games, it is necessary to obtain an adequate understanding on the details of these theories, models and their concepts. Therefore, we explore the mainly used models, theories and their concepts. We explain Social Cognitive Theory and Self-Determination Theory more thoroughly as they are the most commonly used theories in health games. In addition to these two, we also explore the theories or models that are seldom used in health games (Table 4).

**Table 4 Theories seldom used in health games**

| Theory or Model | Description | Author, year | Used by and for |
|---|---|---|---|
| Inoculation Theory | Inoculation theory explains that individuals can be inoculated against attempts of persuasion for behavioral change in a similar way to becoming immunized to a virus by getting an injection of a weak form of that same virus (Banas & Rains, 2010). | McGuire, 1961 | Baranowski et al (2011) / healthier diet, activity promotion; Thompson et al (2008, 2010) / diabetes intervention & prevention, obesity prevention |
| Elaboration Likelihood Model (ELM) | ELM offers a theoretical model to explain the level of influence of a persuasive message directed to an individual. This level depends on two factors: (1) the cognitive energy that recipients attribute to the message; (2) the context the message is directed in. (Angst & Agarwal, 2009) | Petty & Cacioppo, 1986 | Thompson et al (2008) / Prevention of type 2 diabetes and obesity through behavior change |
| Self-Modelling Theory (SMT) | SMT offers a model of intervention for adapting the self-behavior through the observation of oneself (Dowrick, 1999). | Dowrick, 1976 | Beale et al. (2007) / disease management education for cancer patients |
| Self-care Deficit Nursing Theory (SCDNT) | Formed out of three theories (theory of self-care, theory of self-care deficit, and theory of nursing system), SCDNT proposes that each individual is capable of regulating their life and able to take action for their health and well-being. In order to do so, they must perform various necessary actions regularly and when in need, competent nurses shall guide them through (Cox & Taylor, 2005). | Orem, 2001 | Moore et al. (2009) / obesity prevention through behavior change |
| Transition Theory (TT) | TT argues how to make experiences more enjoyable for consumers by carrying them into a world of fiction. According to them, this fictional world can be in the form of a brief announcement, a long drama, or likely fictitious way of expressions. | Green & Brock, 2000 | Lu et al. (2012) / narrative transportation for influencing diabetic adolescent |
| Theory of Planned Behavior (TPB) | TPB was formed based on the Theory of Reasoned Action (TRA) in 1991 with the introduction of the perceived control of an individual on their intention to perform a behavior. The perceived control that TPB introduces is a product of perceived power and control beliefs of the individual. For these reasons, TPB plays an important role in the measurement of the motivation of an individual for the tasks that require intention. | Icek, 1991 | Rhodes et al. (2009) / activity promotion of young men by an exergame |

*Social Cognitive Theory* (SCT) is one of the most popular theories used in the development of health games (Papastergiou, 2009; Lu, Kharrazi, Gharghabi & Thompson, 2013) for health promotion on affairs like asthma, nutrition, and obesity prevention. Introducing his concepts of *self-efficacy*, *observational learning, self-regulation, and moral disengagemen*t, Bandura built the SCT (1977) based on the Social Learning Theory (Miller & Donald, 1941; Rotter, 1954). In the most succinct terms, SCT is used for explaining

the acquisition of knowledge through cognitive information processing between individuals and their environments. For this knowledge acquisition, in addition to the concepts that Bandura introduced, there are several other key concepts such as *outcome expectations, collective efficacy, reciprocal determinism, incentive motivation, facilitation* that have to be taken into consideration (Glanz et al., 2008).

Self-efficacy, as a widely shared key construct of various theories of health promotion (i.e. HBM, TRA, TPB, TTM, SCT, et cetera), is an individual's belief in their own ability of doing something with the desired outcome (Bandura, 1977). Bandura introduces self-efficacy as one of the two personal-level psychological determinants of individual behavior identified by SCT. In addition to this, Bandura (1997) concludes that self-efficacy can be developed through its four aspects:

- Mastery experience (incrementally increasing success of individual's performance on the desired behavior),
- Social modelling (taking example from social environment that desired performance is manageable starting from a simple level and later to a complex level),
- Improving physical and emotional states (providing suitable or safe individual conditions for performing the task),
- Verbal Persuasion (encouraging individual with a persuasive verbal manner)

Considering all the health affairs mentioned earlier, self-efficacy clearly stands out as a matter of importance. For example, people who suffer from asthma have to carry out certain tasks such as using their inhalers whenever necessary or avoiding environments hazardous to their condition; People who suffer from cancer have to manage their condition with certain mastery; people with high BMI have to be more active in performing certain tasks. Thus, self- efficacy plays a crucial role for health promotion especially when it is applied to health games (Bartholomew et al., 2000; Goran & Reynolds, 2005; Thompson & Baranowski, 2009; Baranowski et al., 2011; Kato et al., 2008).

Other key concepts of SCT that stand out for health promotion through health games are as follows:

*Outcome expectation* is the second personal-level psychological determinant along with self-efficacy. It is the belief on the possible consequences of behavioral choices made towards performing a task. This duo is considered as the physiological determinants of behavior and they are often handled together in means of health promotion (Glanz et al., 2008).

- *Collective efficacy* is an extension of self-efficacy again presented by Bandura (1997) where belief on performing a task is carried from the individual level to a group-wise level (Glanz et al., 2008). Regarding health games, co-operative play and task completion within the game are matters of collective efficacy (Lieberman, 2001).

- *Observational learning* is the process of learning to perform certain tasks through observing the task performed by third party sources. Regarding health games, learning how to perform a task by observing the in-game character(s) performing a relevant task is a matter of observational learning.
- *Incentive motivation* is the reward process for motivating the individual towards or against (punishment) a desired behavior.
- *Self-regulation* is the administering of oneself through the setting of goals, instructing, monitoring, rewarding, and giving feedback to oneself. It is widely used for asthma and diabetes cases within health games (Brown, 1997; McPherson, 2006)

In addition to SCT, Self-Determination Theory (SDT) explains the three psychological needs of an individual to be satisfied in order to actualize a behavior. These three psychological needs are relatedness, autonomy, and competence. These psychological needs also happen to be in the basis of motivating oneself, integration of personality and personal well-being (Ryan & Deci, 2000). For this reason, STD explains these three psychological needs through the exploration of human motivation.

To Ryan and Deci (2000), human motivation has two aspects. *Intrinsic motivation*, as the first aspect of human motivation, represents the satisfaction that comes inherently from the activity itself. It is the natural catalyzer that leads an individual to perform an activity, which provides the personal stimulation for the individual to keep seeking more, exploring more, and learning more through that activity. In order to explain the intrinsic motivation thoroughly, Ryan and Deci built the Cognitive Evaluation Theory (CET) in 1985 as the first subtheory of SDT. CET especially deals with autonomy and competence. It explains *autonomy* as the individual willingness to perform an activity due to personal interest or the value seen within that activity (Deci & Ryan, 1980). CET describes *competence* as a matter of challenge and achievement that an individual seeks from an activity where the individual can perceive such concepts by using their personal skills and the feedback taken from the activity (Deci, 1975).

On the other hand, as the second aspect of human motivation, *extrinsic motivation* is the contrast to intrinsic motivation; it represents the rewards that are not inherent to an activity; instead, there are outer stimuli to perform the activity (Ryan & Deci, 2000). In order to explain extrinsic motivation and self-regulation, Ryan and Deci introduced the Organismic Integration Theory (OIT) as the second subtheory of SDT (Deci & Ryan, 1985). With OIT, Ryan & Deci demonstrated that extrinsically motivated activities are behaviors that are the least autonomous since they are dependent on factors outside. For the same reason, the development of competence is slower than intrinsically motivated activities (Ryan & Deci, 2000).

As the last psychological need in Ryan and Deci's list, *relatedness* is explained as the individual feeling of connectedness to other individuals (Ryan & Deci, 2001). In infancy,

relatedness is observable through the attachment of the infant to the parent, which is a factor for the infant to perform more activities of exploration (Frodi, Bridges & Grolnick, 1985). The need of relatedness expands from a parent to other people through time and gains a new level of importance in means of both intrinsic and extrinsic motivation.

Considering all these psychological needs along with intrinsic and extrinsic motivation, Ryan and Deci's studies have been tested in more than a hundred studies that involve not only health games (Thompson et al, 2007, 2008; Lu et al, 2014) but sports, games (Deci, Koestner & Ryan, 1999) and video games (Ryan, Rigby and Przybylski, 2006). However, regarding health games, whether it is intrinsic or extrinsic, providing the necessary motivation and relatedness for players is an important factor of health promotion (Fuchslocher 2011).

## 2.3 Health Games and Health Game Applications

### *2.3.1 Health Games*

All the subjects mentioned up to this point have been covered only to reach one unifying title: health games. Considering Sawyer's definition of serious games (2007), we can define health games as:

"*All entertainment games which can be reapplied to a mission of promoting health or any computerized game whose main mission is to promote health rather than to entertain.*" (Adapted from Sawyer, 2007)

The first reason for defining all the former subjects is to prevent a possible confusion that may occur due to the position of video games. We first distinguished games, video games and serious games because: (1) Health games, which this study concentrates on, are still video games (Figure 4); (2) The games industry is currently invaded by video games. This invasion has created a tendency in people to specify the type of games only when the game is not a video game (for example a board game, a card game or shortly non-digital games). The development of this tendency has been nearly in an "organic" manner so much so that people also show the same tendency for sub-categories of games, which include health games as well. Today, because of this reason, health games are also called by terms like "games for health" or "serious video games for health" or such. While these terms are generally accepted and adequate to define the specific games for the industry, the term "health games" will be used in this study for representing health video games.

Secondly, we have discussed health, identified certain health affairs, and explained the relevant health promotion theories. Considering health games are the serious games within the cluster of "health" (Figure 5), it is clearly needed to discuss what health is. In addition to that, health games are tools of health promotion that focus on certain health affairs. They are not just games that contain random health content; instead, they are designed to make a positive impact on the health of people with the particular theoretical basis they have (Thompson et al., 2009).

As the definition of health games have been given with an in-depth analysis of all its related fields, now we can see the application of health games.

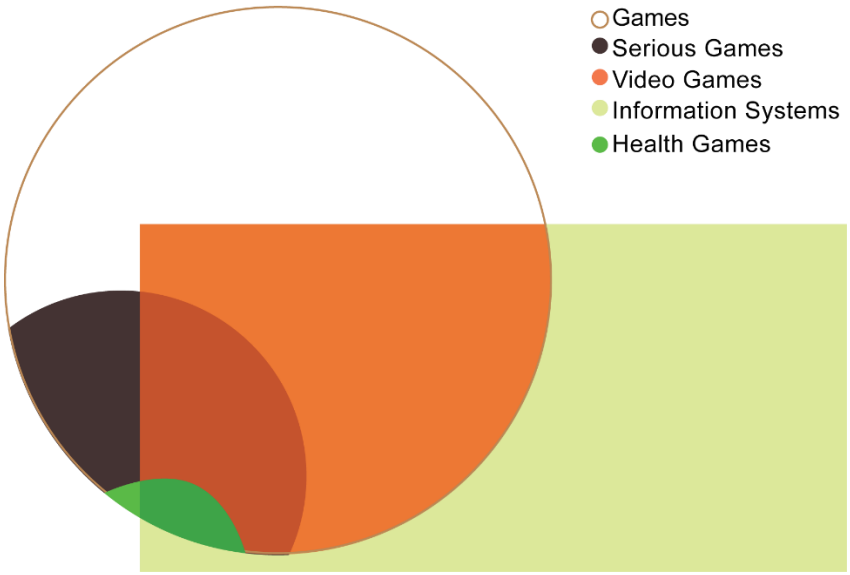


**Figure 4 Mapping of health games**

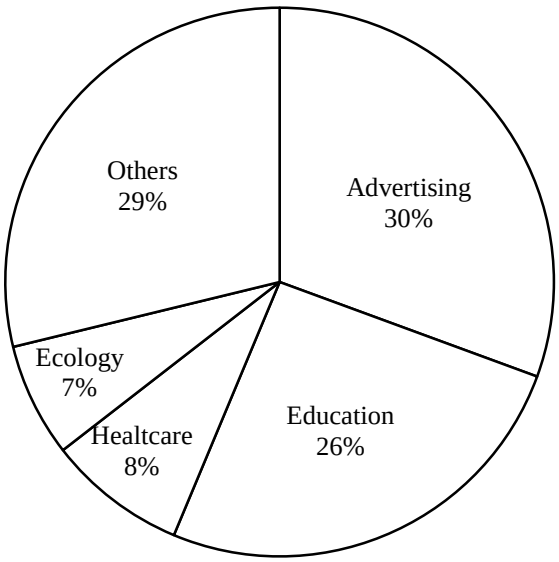


**Figure 5 Market share of popular serious game cluster** (Adapted from Djaouti et al. ,2011b)

### *2.3.2 Health Game Applications*

While defining the serious games, the types of health games according to their field and genre were given in Table 2 and marked with grey. However, when health games target a specific group of people, the applicability of the health game types becomes limited. Since this study focuses on specific health affairs and considers only children as the target group, the list of applicable health game types for this target group narrows down. Thus, the definition of health game types that are applicable for children considering the specific health affairs they are related with are given as following.

- *Edutainment*: Edutainment is the term used for the type of education that relies heavily on audio-visual material in order to enhance the learner's experience of learning with entertainment. Although edutainment did not use to be confined to the serious games cluster, the expansion in use of video games in every industry has affected education as well and edutainment has become identifiable with educational video games (Okan, 2003). Edutainment (also known as edugames, games for education, and learning games) is mainly used for the education of the patient on the health affair they have or as a support for disease management.

- *Advergames*: The term advergames is a product of the merger of the terms "advertisement" and "game". During the studies on the classification of serious games, Djaouti et al (2011a) evaluate advergames according to their purpose and define them as games designed to convey a message in a persuasive manner. Advergames can be applied to every domain (Table 2), but when applied to the healthcare domain, advergames are usually used for promoting a healthy diet, especially for children. With the persuasive nature of advergames, it is possible to infuse health improvement through the promotion of a healthy diet (King, 2012; Dias, & Agante, 2011).

- *Exergames*: The type of video games that involves physical exercising activities as the main game objective is called exergames (also known as *exertainment*) (Wüest, van de Langenberg, & de Bruin, 2014). The commercial exergaming systems generally require an additional input device to the game platform (i.e. PlayStation®) on which they are played. These additional apparatus enable the consumer to interact with the platform physically and fulfil the physical exercises the game motivates them to do. These apparatus may come in different forms as exercise bikes, foot operated pads (i.e. dance mat) or motion sensors (i.e. Xbox

Kinect® or Wii Nunchuk) (Sinclair, Hingston, & Masek, 2007). Exergames are also a part of a broader game type called *active games*[4].

[4] Active games are the video games that require the player to play the video game in a non-sedentary manner. Active games are not considered as serious games or health games since active games are not designed for another (prior) purpose than entertainment. However, studies show that their natural difference from traditional video games gives them a potential to be used for improving health conditions as a health game (LeBlanc et al, 2013; Nishiwaki, Kuriyama, Ikegami, Nakashima, & Matsumoto, 2014; Primack et al, 2012; Biddiss & Irwin, 2010; Barnett, Cerin, & Baranowski, 2011). The most known example of active games is the Dance Dance Revolution™ (DDR) where the player actively dances and sends input to the game platform by a dance mat while dancing.

# 3 RESEARCH METHOD AND ANALYSIS

## 3.1 Grounded Theory Method (GTM) and Its Application

### *3.1.1 Grounded Theory Method*

"Grounded theory" as a term was first coined by Barney G. Glaser and Anselm L. Strauss (Glaser & Strauss, 1967). The emergence of grounded theory happened during Glaser and Strauss' collaborative study on deaths of seriously ill patients in hospitals. Their study was concluded by the development of systematic methodological strategies that were adopted by other social scientists for many other studies. However, the development of these systematic methodological strategies was unorthodox. Glaser and Strauss made a social research where they observed an environment in which deaths were happening, made one-on-one interviews with the people who were part of that environment and gathered data from these observations and interviews. Later, they analyzed these collected data with a strict analytical manner in order to produce a theoretical analysis. Thus, Glaser and Strauss demonstrated the first application of the "grounded theory method" by proposing a theory that was grounded inside the data, which is classified as "grounded theory" (Charmaz, 2014).

Although grounded theory method (GTM) developed by the joint work of Glaser and Strauss, over time certain conflicts occurred between them based on the guidelines and procedures of the GTM that they thought they agreed. The separate studies Glaser and Strauss published proposed several different procedures (Table 5) of how to apply GTM and guidelines for it. Regardless of the other additional works done on the principles of GTM that neither Glaser nor Strauss personally involved (Benoliel, 1996; Schreiber, 2001; Charmaz, 2006), their differences in applying the method created two different main standards for GTM known as "Glaserian" and "Straussian".

**Table 5 List of different GTM procedures** (Adapted from Urquhart, 2012)

| Studied by | Suggested procedure for analysis | Type of Standard |
|---|---|---|
| Glaser & Strauss , 1967 | Open coding → Selective coding + Theoretical coding → Selective coding + Theoretical coding | Original version (Glaserian)[5] |
| Glaser, 1978 | Open coding → Selective coding → Theoretical coding | Glaserian |
| Strauss, 1987 | Open coding → Axial coding → Selective coding | Straussian |
| Strauss & Corbin, 1990 | Open coding → Axial coding → Selective coding | Straussian |
| Glaser, 1992 | Open coding → Selective coding → Theoretical coding | Glaserian |
| Strauss & Corbin, 1998 | Open coding → Axial coding → Selective Coding | Straussian |
| Charmaz, 2006 | Initial coding + Focused coding → Axial coding → Theoretical coding | Glaserian[6] |
| Corbin & Strauss, 2008 | Context (Open coding + Axial Coding) → Process → Theoretical Integration | Straussian |

As can be seen from the Table 5, the main difference between the Glaserian and Straussian grounded theory is the way they conduct the analysis of data. However, this difference between data analysis approaches is a result of the different beliefs that Glaser and Strauss have on data. Regardless of numerous studies on criticizing of both sides (Charmaz, 2000; MacDonald, 2001; Holloway & Wheeler, 2002; Heath & Cowley, 2004; Boychuk & Morgan, 2004), the central issue between this conflict is the approach to the "grounded" theory. In a simpler manner, as a positivist and hermeneutic approach, (Åge, 2011) Glaserian is a method for development of a theory; as a postmodern approach (Breckenridge et al., 2012), Straussian is a method for the verification of a theory at the end of the analysis. Lastly, an important point that is common for all types of GTM is taking memos. It is essential for the researcher to keep memos of their analysis during the coding stages in order to reflect the results in an effective descriptive manner.

Considering all these GTM types, we chose to adopt the Charmaz's GTM for our study; and the reason of this decision gets clearer in the description of coding procedures (see 3.1.2 Coding). However in brief, Charmaz's GTM (also known as constructivist GTM) provides a more conducive environment for data analysis and it offers more for contemporary thinking. Thus, although we recognize all types of GTM, we determined Charmaz's GTM as the most suitable one for this study due to its constructivist character (Breckenridge et al., 2012).

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[5] Since the principles of the original version of GTM protected by Glaserian GTM, the original version can be considered as a Glaserian GTM.

[6]Although Glaser himself criticizes (2007) Charmaz's first introduction of the "constructivist grounded theory" (2000), we preferred to include Charmaz's grounded theory into the Glaserian group since in principal it concentrates on the development of a theory instead of verification of a theory.

### *3.1.2 Coding*

Considering GTM is an exploratory research method, it requires a systematic analysis of the collected qualitative data. Coding, in that manner, as a general technique for analyzing qualitative data, is an essential part of GTM. However, coding is not a technique that is confined to GTM, and there are various coding approaches. Therefore, GTM requires a specific type of coding and this varies depending on the type of GTM as well. Since Charmaz's GTM includes procedural stages from both the Glaserian and the Straussian GTM, we will look into those first.

For the Glaserian GTM (Glaser, 1978; 1992), coding involves three consecutive stages, which are *open coding*, *selective coding*, and *theoretical coding*. *Open coding* is labeling of the data with initial tags while analyzing it line by line. Since there will be great amounts of data, iterative comparison of tagged data during open coding is important for uniformity. After completing this initial labeling procedure, tags that have been created through open coding becomes suitable for organizing. This process of tag organizing happens under categories and organizing these tags to create the core categories (also known as themes) is the second step of Glaserian GTM coding, which is called *selective coding*. In order to complete the coding process, the connection between these categories must be revealed. Thus, as the third and last step of Glaserian GTM coding, *theoretical coding* requires relating the categories generated through open and selective coding.

For the Straussian GTM (Strauss & Corbin, 1990; 1998), coding again involves three consecutive stages, yet as different from Glaserian, those are *open coding*, *axial coding*, and *selective coding*. Although the name of open coding is the same with Glaserian, for Straussian, the open coding should be carried out differently. For Straussian, the *open coding* is more of a labeling process of the data for noticeable categories; and while doing so it is imperative to use short labels rather than descriptive word groups, in addition to comparing those labels ( also known as codes or for the Straussian GTM "categories".) for saturation. After completing the open coding stage, the exploration of the relationships between the categories at hand begins and this stage is called *axial coding*. The purpose of the axial coding stage is to find those relationships and create a model out of them. This model is called Coding Paradigm and it is the equivalent of Theoretical Model. Thus, with the end of the axial coding, the theory is generated and *selective coding* starts. The purpose of selective coding is to elucidate the general phenomena of the research and this happens through identify and select a single category in order to build the necessary story around it. Since it involves selecting one core category to relate to another within a systematical manner, it is called selective coding.

Considering the procedures of both GTM types explained above, all the stages of those procedures are just heuristic devices that should be useful for the analysis of the data.

Regardless of the differences they have in means of open coding, that name is given to that stage because it requires a certain type of mindset from the researcher; being open-minded towards the data. However, both GTM types have certain criteria for the open coding stage that eventually restricts the researcher. In this sense, Charmaz (2006) offers the *initial coding* and the *focused coding* stages instead of the open coding stage, which is relatively more user-friendly to researchers. During the *initial coding*, the researcher is free to code the data with any desired way (i.e. word-by-word or line-by-line or part-by-part); and without being linear, researcher becomes more focused to some certain codes due to their frequency or significance. Thus, in order to refine the initially emerged codes, *focused coding* stage begins where the comparison between data segments happens. When considering initial coding and focused coding together, they show resemblance to open coding stage. However, they also known as *substantive coding* aggregately due to the fact of emerging usable substantive codes in the end. After the completion of this stage, *axial coding* begins, where the generated codes categorized into coherent groups. Forming those coherent groups help researchers to answer the sub-questions of their study. Although the results of the axial coding stage are substantial for the study, it can be cumbersome for the emerging theory. Therefore, in the *theoretical coding* stage, first if necessary the researcher refines the substantive codes and then relates the emerging theoretical codes with conceptualizing them.

## 3.2 Data Collection

As stated before, GTM requires data collected from fieldwork interviews, observation reports, and documents. However, collected data for this research is confined to academic documentation. Thus, we initiated the data collection by reviewing four systematic reviews of health games given in Table 5.

After that pre-phase of the literature review, in order to include more up to date articles, an additional systematic literature search starting from January 1989 has been carried out during January 10, 11, and 12 of 2015. This literature search was made within the following databases: Science Direct, Association for Computing Machinery (ACM), Institute of Electrical & Electronical Engineers (IEEE), Computer Society Digital Library (CSDL), Cambridge Journals Online, NRC Research Press, The CINAHL Database, BioMed Central, Emerald, and Pubmed. The words and terms used for this search are the following keywords: “game”, “video game”, “play”, “serious game”, “simulation”, “virtual”, “virtual reality”, “game based learning”, “training”, “health*”, “health promotion”, “health education”, “edutainment”, and “exergam*”.

**Table 6 List of initially reviewed systematic reviews**

| Article | Years Covered | Databases Used | Keywords Used |
|---|---|---|---|
| Wattanasoontorn, Boada, García & Sbert, 2013 | January 2004 – December 2012 | Science Direct, ACM[7], IEEE, CSDL, Cambridge Journals Online, Oxford University Press (journals), NRC Research Press, The CINAHL database, BioMed Central, and Emerald. | ‘‘game’’, ‘‘video games’’, ‘‘play’’, ‘‘serious games’’, ‘‘simulation’’, ‘‘virtual’’, ‘‘reality’’, ‘‘game based learning’’, ‘‘training’’, ‘‘health’’, ‘‘clinical’’, ‘‘treatment’’, ‘‘rehabilitation’’ and ‘‘medicine’’. |
| Papastergiou, M., 2009 | 2000- April 2008 | ISI Web of Knowledge, EBSCO Host, PubMed, ERIC, and EdITLib Digital Library for Information Technology and Education | (‘‘physical education” OR ‘‘health education” OR sport) AND (‘‘computer game” OR ‘‘video game”) AND (teaching OR learning OR education) |
| Guy, Ratzki-Leewing & Gwadry-Sridhar, 2011 | 1998 - 2011 | EMBASE, PubMed | obesity, overweight, physical activity, fitness, exercise, energy expenditure, heart rate, energy metabolism, nutrition, BMI, diet, video gam∗, exergam∗, active video gam∗, active computer gam∗, new generation computer gam∗, exertainment, active gam∗, and computer gam∗ |
| Hieftje, Edelman, Camenga & Fiellin, 2013 | 1950[8] – September 2010 | MEDLINE , PsycINFO | Video game$, multimedia game$, computer game$, interactive game$, educational game$, health game$, online game$, learning game$, exergame, interactive computer, interactive game |

The inclusion criteria for the review of reviews and the literature search were selected to get a relevant sample that was still small enough to handle. Only articles on the five specific health affairs (asthma, cancer, diabetes, nutrition, and obesity) are included in the data. All these selected articles study the health promotion of the health games[9] in means of the given health affairs. The selected articles focus on children[10] as target population. With these criteria in hand, the first step of the literature review concluded with 124 articles. After the elimination of the repeated articles, there were 118 articles left. After this

[7] ACM Association for Computing Machinery, IEEE Institute of Electrical and Electronics Engineers, CSDL Computer Society Digital Library

[8] PsycINFO search started from 1967.

[9] In Chapter 2, it has been explained that not all active games are serious games. However, their capability of improving the health has been proven with numerous studies. For this reason, articles that study active games and their level of health improvement through activity promotion are also included to this study.

[10] ”People under 19 years of age” is the United Nations Human Rights Office of the High Commissioner for Human Rights’ definition of children from Convention on the Rights of the Child, Part 1, Article 1 (http://www.ohchr.org/en/professionalinterest/pages/crc.aspx , Retrieved 21.09.2015). Thus, this study is limited with this age limit.

elimination, a posteriori elimination phase begun. During this phase, we have read the abstract parts of every article in order to ensure the articles were focusing on games that are specifically for children and made for improving their health. In addition to this, the articles that study wide-scope multimedia intervention packages where the health game is an insignificant part of the package program. Based on these, the articles using gamification software as a health game and the articles does not use the term "game" for defining the intervention or treatment tool were eliminated in three steps. Data collection has resulted in 87 articles in total. Although these 87 articles were used in the beginning of the analysis process, with the deeper understanding gained on the articles after reading them thoroughly 31 of them eliminated based on same criteria given above. Thus, the data analysis completed with 56 articles (Table 7).

**Table 7 List of articles used as data**

| Author / Year | Disease | Game | Theory | Impact (If any) |
|---|---|---|---|---|
| Rubin et al, 1986 | Asthma | Asthma Command | SCT | Significant improvement in disease management and positive behavior change; no significant change in self-control and self-esteem. |
| Bartholomew et al, 2000 | Asthma | Watch, Discover, Think and Act | SCT | Improvement in disease management only with older children. Improvement in quality of life of only children with milder symptoms. |
| Yawn et al, 200 | Asthma | Air Academy: The Quest for Airtopia | n/a | Significant improvement in health affair related knowledge. |
| Huss et al, 2003 | Asthma | Wee Willie Wheezie | n/a | No significant improvement in health statuses, quality of life, and health affair related knowledge |
| McPherson et al, 2006 | Asthma | The Asthma Files | n/a | No significant improvement in quality of life; insignificant improvement in health affair related knowledge, and disease management. |
| Kauhanen et al, 2014 | Cancer | DDR, Kinect, Wii, Eyetoy | n/a | n/a |
| Brown et al, 1997 | Diabetes | Packy & Marlon | SCT | Significant improvement in parent-children communication, self-efficacy, and self-care; insignificant improvement in quality of life; no significant improvement in disease knowledge |
| Aoki N. et al, 2004 | Diabetes | Tamagoya, Tantei, Magic Toom | n/a | n/a |
| Fuchslocher, Niesenhaus & Krämer, 2011 | Diabetes | Balance | SCT | Insignificant improvement in self-efficacy |
| Baños et al, 2012 | Nutrition | Etiobe Mates (3in1) | n/a | Significant increase in health affair related knowledge |
| Turnin et al, 2008 | Nutrition | Alimentary my dear Joe (4in1) | n/a | Significant improvement in health affair related knowledge; no significant improvement in dietary habit |
| Lu et al, 2014 | Nutrition | n/a | SDT/ TT | n/a |
| Baranowski et al, 2003 | Nutrition | Squire's Quest! | SCT | Significant improvement in dietary attitude and health affair related knowledge |
| Baranowski et al, 2011 | Nutrition | NanoSwarm, Escape form Diab | SCT/ SDT | Significantly positive change in diet of children only in means of fruit consumption |
| Inglés-Camats et al, 2011 | Nutrition | Yummy Tricks | n/a | n/a |
| Pempek & Calvert, 2009 | Nutrition | Altered Pac-Man | n/a | Improvement in positive behavior change by promoting healthy nutrition |
| Pollak et al, 2010 | Nutrition | Time to Eat! | SCT/ SDT | Significantly positive change in diet of children |

| | | | | |
|---|---|---|---|---|
| Khanana & Law, 2013 | Nutrition | n/a | n/a | n/a |
| Cullen et al, 2005 | Nutrition | Squire's Quest | SCT | Significantly positive change in diet of children only in means of fruit consumption |
| Maloney et al, 2008 | Obesity | DDR | n/a | Significant decrease in sedentary screen time with the success of physical activity promotion; no significant extra benefits |
| Simons, Bernaards & Slinger, 2012 | Obesity | Kinect, EyeToy™, Move, DDR, Wii | n/a | Successfully contributed to physical activity promotion |
| Simons et al, 2014 | Obesity | Sony Move Games | SDT/ TPB | n/a |
| Maddison et al, 2012 | Obesity | EyeToy™ | n/a | No significant effect; Successfully contributed to physical activity promotion |
| Fawkner et al, 2010 | Obesity | (Dancing Game) | n/a | No significant effect; Successfully contributed to physical activity promotion |
| McDougall & Duncan, 2008 | Obesity | EyeToy™ | | No significant effect; Successfully contributed to physical activity promotion |
| Epstein et al, 2007 | Obesity | DDR, Cateye™ | n/a | n/a |
| Mhurchu et al, 2008 | Obesity | EyeToy™ | n/a | No significant effect; Successfully contributed to physical activity promotion |
| Macvean, 2012 | Obesity | iFitQuest | n/a | n/a |
| Sit, Lam & McKenzie, 2010 | Obesity | XAxiX bowling, Aerostep | n/a | No significant effect; Successfully contributed to physical activity promotion |
| Straker &Abbott, 2007 | Obesity | EyeToy™ | | No significant effect; Successfully contributed to physical activity promotion |
| Murphy et al, 2009 | Obesity | DDR | n/a | Significant improvement against obesity through physical activity promotion |
| Adamo, Rutherford & Goldfield, 2010 | Obesity | GameBike | n/a | n/a |
| White, Schofield & Kilding, 2011 | Obesity | Wii Bowling, Wii Boxing, Wii Tennis, Wii Fit Skiing Wii Fit Step | n/a | No significant effect; Successfully contributed to physical activity promotion |
| Maddison et al, 2007 | Obesity | EyeToy™ | n/a | No significant effect; Successfully contributed to physical activity promotion |
| Graves et al, 2008b | Obesity | Wii Sports | n/a | No significant effect; Successfully contributed to physical activity promotion |
| Lanningham-Foster et al, 2006 | Obesity | DDR, EyeToy™ | n/a | No significant effect; Successfully contributed to physical activity promotion |
| Unnithan, Houser & Fernhall, 2006 | Obesity | DDR | n/a | No significant effect |
| Madsen et al, 2007 | Obesity | DDR | n/a | Insufficient effect for obese children; no significant effect |
| Johnsen et al, 2014 | Obesity | Virtual Pet Game | SCT | Significant improvement against obesity through physical activity promotion and behavioral change |
| Penko & Barkley, 2010 | Obesity | Wii Boxing | n/a | No significant effect; Successfully contributed to physical activity promotion yet not enough for obese children |
| Paez et al, 2009 | Obesity | DDR | SCT | Significant improvement against obesity through physical activity promotion with the addition of socialization and behavioral change |
| Graf et al, 2009 | Obesity | DDR, Wii Boxing, Wii Bowling | n/a | No significant effect; Successfully contributed to physical activity promotion |
| Haddock, Siegel & Wikin, 2009 | Obesity | Cateye™ | n/a | No significant effect; Successfully contributed to physical activity promotion |
| Graves, Ridgers & Stratton, 2008a | Obesity | Wii Boxing, Wii Bowling, Wii Tennis | n/a | No significant effect; Successfully contributed to physical activity promotion |
| Azevedo et al, 2014 | Obesity | (Dancing Game) | n/a | Negative effect on physical activity promotion; significant improvement against obesity and quality of life |

| | | | | |
|---|---|---|---|---|
| Fogel et al, 2010 | Obesity | Dog Fighter, Cateye™, Wii Baseball, Wii Tennis, Wii Boxing, iTech Fitness XrBoard, Fit Interactive 3 Kick | n/a | Significant improvement of physical activity promotion |
| Gao et al, 2013 | Obesity | DDR | n/a | No significant effect; Successfully contributed to physical activity promotion |
| Selmanovic, 2010 | Obesity | (custom-made game based on Wii systems) | n/a | n/a |
| Paw et al, 2008 | Obesity | (Dancing Game) | n/a | Significant improvement of physical activity promotion with the addition of socialization |
| Scarle et al, 2011 | Obesity | (custom-made game based on Wii systems) | n/a | n/a |
| Tan et al, 2002 | Obesity | DDR | n/a | No significant effect |
| Al-Hrathi et al, 2012 | Obesity | ExerLearn Bike System | n/a | Improvement in nutritional knowledge and successfully contributed to physical activity promotion |
| Lieberman, 2001 | Asthma, diabetes | Bronkie the Bronchiasauras, Packy & Marlon, Rex Ronan | SCT | Significant improvement in health affair related knowledge, disease management, and self-efficacy; no significant improvement in quality of life. |
| Munguba, Valdes, da Silva, 2008 | Obesity, Nutrition | n/a | SDT | n/a |
| Thompson et al, 2007 | Obesity, Diabetes, Nutrition | Escape from Diab, Nanoswarm: Attack from Inner Space | SCT/ SDT/ BIT/ ELM | n/a |
| Thompson et al, 2008 | Obesity, Diabetes, Nutrition | Escape from Diab | SCT/ SDT/ BIT/ ELM / TT | n/a |

## 3.3 Data Analysis

Data analysis of this study has been made with initial coding, focused coding, axial coding, and theoretical coding using grounded theory. Figure 6 shows the diagram of the analysis process of this study.

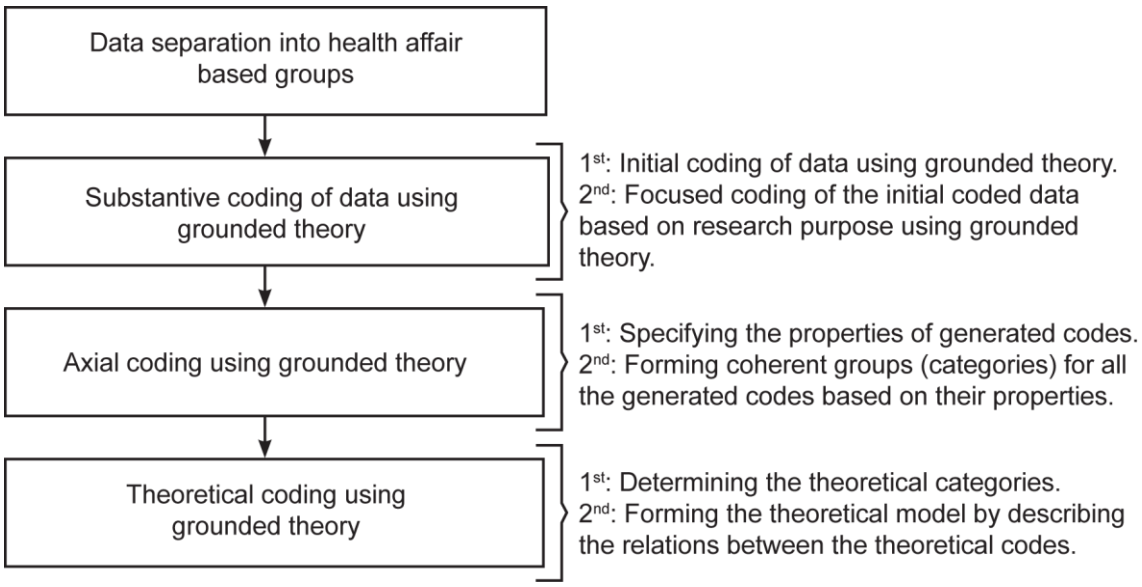


**Figure 6 Data analysis process diagram**

### *3.3.1 Substantive Coding Phase*

The collected qualitative data is first separated into groups based on the health condition on which the material focuses (Table 7).

**Table 8 Data separation and grouping**

| Group Name | Group Description | Number of Articles |
|---|---|---|
| Asthma | Articles on health games for asthmatic children | 5 |
| Cancer | Articles on health games for children with cancer or cancer prevention | 1 |
| Diabetes | Articles on health games for diabetic children | 3 |
| Nutrition | Articles on health games for nutritional education of children | 10 |
| Obesity | Articles on health games for obese children | 33 |
| Hybrid | Articles on health games for multiple children with asthma, diabetes, and smoking prevention (1); diabetes, obesity, and nutrition (2); obesity and nutrition (1) | 4 |

Grouped materials are first initially coded with sentence-by-sentence coding technique. After completing this on-paper initial coding, the focused coding stage has been carried on with the qualitative data analysis software QSR International's Nvivo© 10 for Windows. Since all the articles collected as data are scientific articles, the majority of the information within these articles was not entirely necessary for this study (e.g. information about the study methods or description of study designs). For this reason, during the transmission of the initial codes from paper to software, the majority of the codes have been eliminated to a manageable amount at the beginning of the focused coding. This elimination was made according to the main research question and the tasks needed to be done in order to answer the main research question. Thus, the substantive coding phase of the analysis has been completed with the 139 different codes. However, before going forward to axial coding, it is necessary to restate the research question and the tasks needed to be done in order to answer the research question.

### *3.3.2 Restatement of the Research Question and the Selective Coding Process*

As stated in Chapter 1, the main research question of this study is:

*What elements of health games have a positive impact on children's health promotion? (Q1)*

In order to answer this given question, the empirical study has been made using the given tasks below:

1. *Describe and explain the structure of health games regardless of its level of impact on promotion of health (T1),*
2. *Outline the elements (i.e. game design elements, gameplay elements, theoretical backgrounds used during the development of the game, or any other likely items) of health games that may or may not contribute on the positive impact for children's health (T2),*
3. *Formulate a pragmatic proposal, which is applicable for possibly better or more successful health games in order to increase the level of the positive impact of health games on children's health promotion (T3).*

After the completion of the substantive coding stage, we proceeded to the axial coding stage where we gained a deeper understanding and better insight especially in means of the result of this research. We pointed out the potential factors of impact form these studies and we reviewed the outcome of these studies. Finally, we combined these with the recognized impacts to define the nature of the impact; whether the impacts was positive,

neutral, or negative. Thus, the following phases of axial coding and theoretical coding of the analysis are considered as a part of the result of this study and are explained in the next chapter in order to avoid repetition.

# 4 RESULTS

## 4.1 Structure of Health Games

The axial coding stage for this study resulted with nine different categories and the list of all axial codes (categories) with their substantive codes can be found in Table 10.

**Table 9 List of axial codes (categories) and their substantive codes**

| Axial Codes (Categories) | Substantive Codes |
|---|---|
| Consumer | aesthetics specifically designed for target population of health game |
| | health game target population has a preference of a certain type of learning strategy |
| | health game target population has a preference of aesthetics |
| | health game target population has a preference of technology used in the game |
| | health game target population usually are not considered well enough |
| | target population has no specific game preference |
| | target population has specific preferences for health game type |
| | target population has specific preferences for video games |
| Health Affair | advertisement has an effect on nutrition |
| | asthma as a children's disease |
| | asthmatic population |
| | causes of obesity |
| | consequences of asthma |
| | consequences of obesity |
| | diabetic children's population |
| | nutrition as an important agent related with other health conditions or diseases |
| | obesity as a cause of type 2 diabetes |
| | obesity as an epidemic |
| | probability of cancer occurrence in children |
| Physical Activities in the Health Games | baseball activity in health game |
| | bowling activity in health game |
| | boxing activity in health game |
| | cycling activity in health game |
| | dance (aerobic) activity in health game |
| | skating activity in health game |
| | tennis playing activity in health game |
| Health Game Component | aesthetics as a part of an health game |
| | affinity as a part of an health game |
| | challenge as a part of an health game |
| | entertainment as a part of an health game |
| | feedback as a part of an health game |
| | health game has an expectancy on the game impact |
| | health game has a target population |
| | health game has a tutorial for player |
| | intrinsic motivation as a part of an health game |
| | motivation as a part of an health game |
| | personalization (customization) as a part of an health game |
| | rewarding mechanism as a part of an health game |

| | |
|---|---|
| | scientific theories as a part of an health game |
| | simulation as a part of an health game |
| | social gameplay is a part of an health game |
| | story as a part of an health game |
| | use of additional apparatus |
| Health Game Impact Factor | additional, easy-to-reach apparatus as an impact factor |
| | avatar use an impact factor |
| | awareness about the target population as an impact factor |
| | behavioral change expectancy during the production as an impact factor |
| | characteristics of the target population as an impact factor |
| | competition as an impact factor |
| | engagement as an impact factor |
| | entertainment as an impact factor |
| | feedback as an impact factor |
| | in-game challenge for player as an impact factor |
| | in-game character as an impact factor |
| | involvement of healthcare professionals in development as an impact factor |
| | iterative information transfusion as an impact factor |
| | mobility as an impact factor |
| | parents' involvement as an impact factor |
| | play as an impact factor |
| | playability analysis as a potential impact factor |
| | providing knowledge as an impact factor |
| | releasing updates for the health game as an impact factor |
| | retention as an impact factor |
| | social gameplay as an impact factor |
| | tutorial as an impact factor |
| | use of recent technology as an impact factor |
| | video game design elements as an impact factor |
| Health Game Impact Result | boxing activity in health game has significant impact (compared to others) |
| | customization may improve serious impact |
| | cycling activity in health game has no significant effect |
| | dance (aerobic) activity in health game has better impact compared to other methods |
| | health game caused positive behavior change |
| | health game do educate |
| | health game does not get better results than traditional methods |
| | health game educate while entertaining |
| | health game gave better results than other treatment methods |
| | health game had negative impact |
| | health game has no significant impact |
| | health game improved communication |
| | health game improved communication with healthcare professionals |
| | health game improved health condition(diet) significantly |
| | health game improved knowledge on disease |
| | health game improved self- efficacy |
| | health game improved self-concept insignificantly |
| | health game improves health indirectly |
| | health game improves health significantly |
| | health game increased knowledge |
| | health game versus other education methods; results are equally effective |
| | there is no decrease in sedentary time when active games are involved with life of the sample group |

| | |
|---|---|
| Health Game Limitations and Capabilities | commercial video games and health game can be perceived as the same by youngsters |
| | commercial games are more appealing than health game |
| | different active game genres have different impact as a health game |
| | entertainment is the latter objective of health game, not equally with medical improvement |
| | health game achieved its purpose |
| | health game aesthetics usually are not good enough |
| | health game alone are not enough (without additional intervention) |
| | health game are not commercialized |
| | health game can be mobile |
| | health game can provide experiences relevant with health condition that can teach |
| | health game can't be a substitute of real sports |
| | health game challenge usually are not designed well enough |
| | health game's game quality can be comparable with commercial video games |
| | health game promises to change behavior |
| | health game promises to improve health conditions |
| | health game requires meticulous balance between education and entertainment |
| Health Game Production | artists involved in the health game development |
| | healthcare professionals were involved in health game development |
| | medical information affects choice of health game's game elements |
| | medical information affects choice of health game's game story |
| | medical information affects choice of health game's technology |
| | medical information use in health game's game design |
| | playability heuristics can be applied to health game |
| | producers involved in the health game's game development |
| | programmers involved in the health game's game development |
| | story writers involved in the health game's game development |
| | target population involved in health game's game development |
| | usability testing as a part of health game's game development |
| Health Promotion | being at a specific age has an effect on learning capability |
| | being observed improves the efficiency of learning |
| | being physically active as a part of healthy life |
| | better nutritional habits requires motivation |
| | challenges of other treatment (intervention) methods |
| | diabetes treatment in children |
| | education as an intervention |
| | family involvement is an important factor of treatment-intervention of children |
| | feedback is the attention attractor during education |
| | games(video games) as an attractive way of learning would affect behaviors |
| | intervention for children with cancer |
| | intrinsic motivation through affinity ensures retention |
| | knowledge as an important factor of nutrition |
| | motivation is a part of intervention (treatment) |
| | nutritional intervention |
| | physical activity as a part of post-cancer intervention |
| | self-efficacy as a part of treatment process |
| | self-management as a part of treatment |
| | treatment (intervention) of asthma |
| | treatment of obesity |
| | treatment (intervention) of diabetes |
| | video games attracts attention |

As it was described before in Chapter 3.1.2, the main purpose of the axial coding stage is to generate categories that are coherent to each other. Hence, in order to finalize the axial coding stage, we have illustrated this coherence between the categories through their relationships (Figure 7). However, this illustration is not merely a result of the axial coding stage, but it is also a generic and pragmatic definition of health games through their structure (T1). Thus, the relationships between the categories identify the structure of the health games in two different layers as operational structure (Figure 7, area framed with red color) and the internal structure (Figure 7, area framed with green color).

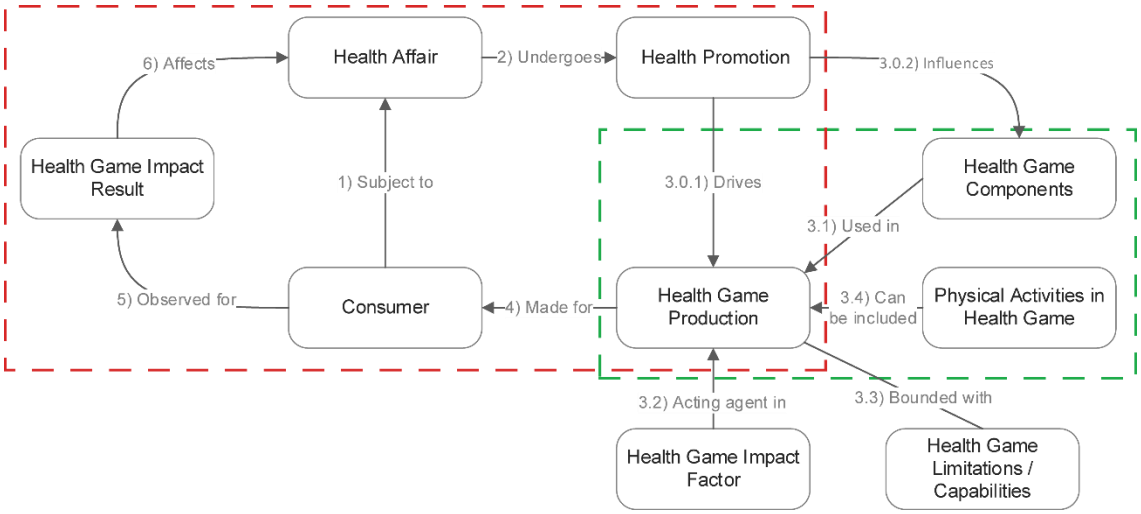


**Figure 7 Illustration of axial coding coherence / Structure of Health Games**

The operational structure of the health games forms by five categories and it describes how health games operate. *Consumer* as the first category of the operational flow represents the group of people subject to a certain type of *health affair*. This health affair may require a certain type of an intervention method or has a way of treatment. The methods of intervention or treatment, which we call *health promotion*, are the major factors that drive the *health game production*. Therefore, health game production is specifically made for that group of people who eventually can be observed for the *results of health game impact*. Regardless of their level, these impacts affect the health affair of the group of people mentioned at the beginning of this loop. Thus, operational structure indicates that health games have consumer-centric structure.

The internal structure of health games forms by three categories and it explains what forms the health games along with how they form the health games. The green framed area in Figure 7 represents the health games as a product; a product for a specific type of consumers with the production phase driven through health promotion methods for specific types of health affairs.

Regarding the *production of health games*, it has been observed that during the production phase, game artist (story writers, graphic artists, and sound artist), game programmers, game producers, and healthcare professionals are involved with the development. During this development phase, the creation of the game elements (aesthetics, story, mechanics, and technology) happens under the influence of relevant medical information. It has been offered that playability heuristics can be applied to health game development (Khanana & Law, 2013) and usability testing with the involvement of the target population is a part of health game production.

Health games share various common elements with other video games. Beside these shared elements as aesthetics, story, game challenges, entertainment, and likely that are altered with the influence of relevant medical information, health games has different *components* as well. Different from traditional video games, health games often use scientific theories that are specifically for health promotion. Depending on the theory in use, motivation (often intrinsic) of the player is well considered by the majority of the health games. Health games strive to ensure this motivation through the appealing aesthetics, game story, feedback, social gameplay, appropriate challenges, entertainment, and internal rewarding mechanisms. In addition to these, consumer's affinity, which at times ensured through an optional personalization or customization feature, is another part of health games relevant to motivation. In health games, the use of an additional (to usual standard mediums where video games played) apparatus as the input or output device for the consumer is a common tendency. Since health games are produced for a specific customer group, the target population can be considered as a part of health games. In this manner, health games have certain expectancy for the impact of the product on the target population. To ensure this and for the ease of usability, health games tend to provide a tutorial part at the beginning of the game. Next to all these, it has been observed that health games tend to simulate real life health promotion related activities for providing a convenient, safer, and risk-free environment for their consumers to experience or practice those activities.

Although they are not entirely confined to health games and more related with active games (or activity promoting games as described in Chapter 2.3.2 Health Game Applications), there are certain *physical activities* commonly used within. Regardless of the traditional in-game activities, which can be seen in commercial video games, we observed that dancing (aerobic), bowling, boxing, baseball, cycling, tennis and skating are the most common activities used in health games.

In addition to this two-layered structure of health games, we have also observed that health games are bounded with certain limitations; in addition to these limitations, we have also observed the capabilities of health games. To begin with, it is well observed that entertainment is the latter objective of health games and improving health is always a bigger concern. Health games promise to this to their targeted consumer, as they are

capable of improving health. In order to do this, they often promise behavioral change and provide opportunities to experience the relevant activities to the focused health affair. Nearly in all cases, including when they are mobile, health games achieve their purpose even though exergames not capable of being a substitute of the activities done in real sports. In the cases when active games considered as health games, the impact of the active games varies based on the genre of the game and they are usually not enough to promote health without additional intervention elements. Furthermore, when the focus of health games is to educate, during the production it is crucial to balance the factors of entertainment and education meticulously.

Lastly considering the capabilities of health games, although in some rare cases it is observed that, the game quality (in means of production value) of health games can be comparably close to commercial video games, it is a fact that commercial video games are more appealing than health games due to their higher quality. This difference in quality is often a result of health games' lack of commercialization in addition to the poor aesthetics and inadequate challenges used within the health games; yet regardless of these facts, health games and commercial video games can be perceived as the same by children.

## 4.2 Health Game Elements of Impact

In the former section, we explained the operational and the internal structure of health games with their limitations and capabilities, yet we excluded one category named as "health game impact factor". Since our study focuses on a task for outlining the impact elements of children's health games regardless if they are positive, negative, or neutral on impact (T2), we chose to assess this category under a separate title within the results of our study.

We have listed these impact factors in Table 10 based on the results of our analysis. Along with this, for the integrity of this study, it is also necessary to discuss all these factors in a descriptive manner. Thus, for the description of this data, we have benefited from the memos that we have kept through the analysis stage especially for this section.

To begin with, *the awareness of the (health game) production team on their target population is an impact factor* (3). In several cases, we have observed that (Turnin et al., 2008; Thompson et al., 2007) the production team makes an analysis on the characteristic of their target population. With this analysis, they gain the necessary awareness and knowledge about their target population in order to produce a more suitable product for them. Considering that impact of the health game varies based on the characteristics of the consumer who has been targeted (Graves, Ridgers & Stratton, 2008a; McPherson, et al., 2006; Sit, Lam & McKenzie, 2010) the level of impact that health game infuses

changes based on this fact. While the *characteristics of the target population are an impact factor* (5), the impact varies based on this awareness and effectively using this knowledge in the production phase as well.

Another relevant impact factor to these above is the *video game design elements* (24). Considering that all the health games are indeed video games, they share the same design elements with video games. For example, the game story as a design element is an impact factor. The choice of the game story and the way it is used within the game are especially important for developing the necessary affinity between the consumer and health game, as well as for engaging the consumer (Fuchslocher, Niesenhaus & Krämer, 2011; Paez et al., 2009). We will return to this affinity and engagement subjects later on yet another example would be the game aesthetics. The choice of audiovisual elements during production, their quality and implication effects the way that target population perceive the health game (Huss et al., 2003; Brown et al., 1997). On top of these, when the audiovisuals come together with the story there are other video game elements appear. One of these is the in-game character. In a health game with a profound story, *the in-game character can be an impact factor* (11) if that character is somehow able to build the affinity needed with the consumer (Biddiss, E., & Irwin, 2010). Coupled with this, if the in-game character can be a role model to the targeted children again that alters the impact of the health game (Thompson et al., 2007). Health games may also choose to use customizable avatars instead of in-game characters that are not capable of customization (meaning, including personal values from the consumer, by the consumer to the character). Therefore, *avatar use is an impact factor* (2) as well (Johnsen et al., 2014)

Beside these video game design elements, video game development elements are also an element of impact for health games. For example, the *use of most recent technology* (23) for video games in a sound manner affects how the game will be played and, therefore, alter the impact (Paw et al., 2008; Johnsen et al., 2014). If the health game has been published already and within time, the game becomes lacking certain technological features (this can be any other feature or there may even be bugs that appeared after release), it is possible *to release updates* (19) or even expansion packs for the continuity of that game Baranowski et al., 2003; McPherson et al., 2006). In addition to these, the use of *additional apparatus* (1) for the input of consumer or for providing a specific output that standard devices are not capable of is an impact factor as well. The ease of use and the low prices of these extra apparatuses alters the impact of health games (especially for exergames and active games) proportionally (Epstein et al., 2007; Simons et al., 2014; Maloney et al., 2008). Lastly, for the technological aspect of health games, *the mobility of the health games* (14) is also an impact factor. For example, when the health game is usable via mobile devices, the consumer becomes able to play the game in anywhere when they carry their devices with them. This enables the health game to give feedbacks to its consumer in an efficient and timely manner (Pollak et al., 2010).

We can also consider the activity of *play itself as an impact factor* (16). This is because when the opportunity of play provided to children they tend to be more interested and enthusiastic to learn, practice, exercise, and be active (Kauhanen et al., 2014; Yawn et al., 2000). However, considering play itself as an independent factor would be misleading. The idea of the children going into that magic circle[11] does not happen just by the play itself; the magic circle that video games provide are alternative environments for children that are safer to act in and entertaining at the same time. Therefore, *entertainment is an impact factor* (8) as well (Aoki et al., 2004; Epstein et al., 2007). However, too much entertainment may lead the children to drift away from the actual purpose of health game and too little entertainment may lead children to lose interest in the game.

This task of adjusting the right level of entertainment and balancing it with the "serious" purpose of the health game is a fastidious one for the health game producers (Baños et al., 2012; Lu et al., 2014). Related with this, the *in-game challenges* (10) presented to players are another impact factor. Overcoming the challenges that are within the suitable level of hardness for the targeted population would entertain the consumers (Biddiss, E., & Irwin, 2010; Thompson et al., 2007) and ensure retention. One way to familiarize the consumer with the in-game challenges is to provide them with a gameplay tutorial. Therefore, we can *consider tutorial as an impact factor* (22) as well, since we have observed that some games may be too hard to understand for the children and lead them to miss the main purpose of health game while trying to overcome these challenges or even quit playing (Kauhanen et al., 2014; Bartholomew et al, 2000). In that sense, *retention is an impact factor for health games* (20) as well since the more children play the health game, the more they will be exposed to the health promotional features of the health game (Macvean, 2012; McPherson et al., 2006; Fawkner et al., 2010). Another thing to ensure retention is *the social gameplay* (21). It has been observed that children who can play the health game with friends or family members become more encouraged to play the game and engage to it (Epstein et al., 2007; Simons et al., 2014). This can also be related with several things; one of which is *competition* (6). Competition between friends or even between siblings can be an impact factor that encourages playing more and increases engagement to the game (Fawkner et al., 2010; Kauhanen et al., 2014). Another one is the parents' involvement. *Parent's involvement is an impact factor* (15) as well related with both retention and play due to the cases where parental approval for playing the game can be occasionally necessary; also, an environment where children communicate with their parents can be more beneficial for health promotion (Simons et al., 2014; Maloney et al, 2008). Lastly related with all these, although it is a work in progress, *playability analysis*

[11] A term firstly used by Huizinga (1955) and then re-defined by Salen & Zimmerman (2004), "Magic Circle" is the fictitious premises that games provide to their players that they can step in and be bounded by the rules of the game world.

*of the health games can be an impact factor* (17) since such an analysis promises to boost the playability of the game and eventually engagement (Khanana & Law, 2013).

Considering all these above, we can also say that player *engagement itself is an impact factor* (7) (McPherson et al., 2006; Sit, Lam & McKenzie, 2010) that depends not only on all the things mentioned above but also many other video game features and psychological needs of the consumer (Przybylski, Rigby, & Ryan, 2010). One element that satisfies the psychological needs of the consumer is *feedback* (9). However, getting feedback from a health game is not only for satisfying the need of approval and such but it can be also for showing how the player makes progress in means of health improvement, learning improvement and likely issues (Lieberman, 2001; Macvean, 2012). Considering that, this kind of information is rather sensitive for a regular game production team, the *involvement of healthcare professionals* (12) or likely personnel during production or even after gameplay sessions is a necessity for health games. Therefore, we can say that involvement of healthcare professionals is an impact factor as well (Baranowski et al., 2003). These healthcare professionals can be an influence on many different areas of the game production process. For example, one of these would be (with the expectation of these healthcare professionals having a better command on health improvement theories) their essential contribution to games that aim to change the behavior of the target population. In one of his studies, Contento et al. (1995) concluded that out of more than 300 nutrition education interventions the most effective ones were those with the focus on behavior change. Beside other the components of behavioral change we mentioned before, *providing knowledge to the targeted population* (18) on the relevant health affair (Thompson et al., 2008; Bartholomew et al, 2000; Aoki et al., 2004) is a point that should be a dealt with the authority of healthcare professionals during the production phase. To ensure the knowledge improvement, one of the characteristics of video games can be used; that is *iterative information transfusion* (13) (Lieberman, 2001). Therefore, we can count these as impact factors as well. Based on these and the observations we made, lastly, we can also say that *expecting a behavior change and producing games* (4) with this focus is an impact factor as well (Thompson, et al., 2008; Bartholomew et al, 2000; Baños et al. 2012).

## Table 10 List of health game impact factors with their nature of impact

| | Sources where the nature of impact is | | |
|---|---|---|---|
| **Impact Factor** | ***negative*** | ***neutral*** | ***positive*** |
| (1) additional, easy-to-reach apparatus as an impact factor | Selmanovic, 2010 | | Macvean, 2012; Scarle et al., 2011; Pollak et al., 2010; Epstein et al., 2007; Simons et al., 2014; Maloney et al., 2008; McDougall & Duncan, 2008; Fawkner et al., 2010 |
| (2) avatar use an impact factor | | | Johnsen et al., 2014 |
| (3) awareness about the target population as an impact factor | Thompson et al., 2007; Fuchslocher et al., 2011 | | Lieberman, 2001; Turnin et al., 2008; Thompson et al., 2007; Fuchslocher et al., 2011 |
| (4) behavioral change expectancy during the production as an impact factor | | | Thompson, et al., 2008; Bartholomew et al, 2000; Lieberman, 2001; Rubin et al., 1986; Baños et al. 2012 |
| (5) characteristics of the target population as an impact factor | Fuchslocher et al., 2011 | McPherson, et al., 2006 | Graf et al., 2009; Penko & Barkley, 2010; Bartholomew et al, 2000; Graves, Ridgers & Stratton, 2008a; Sit, Lam & McKenzie, 2010; Unnithan, Houser & Fernhall, 2006; Murphy et al., 2009 |
| (6) competition as an impact factor | Fawkner et al., 2010 | | Fawkner et al., 2010 |
| (7) engagement as an impact factor | | | Lieberman, 2001; Selmanovic, 2010; Munguba et al., 2008; McPherson et al., 2006; Sit, Lam & McKenzie, 2010; Brown et al.,1997 |
| (8) entertainment as an impact factor | Aoki et al.,2004; Paw et al., 2008 | | Baranowski et al., 2003; Selmanovic, 2010; Haddock, Siegel & Wikin, 2009; Epstein et al., 2007; Maloney et al., 2008; Pollak et al., 2010 |
| (9) feedback as an impact factor | | | Lu ,et al. 2014; Lieberman, 2001; Baranowski et al., 2011; Brown et al., 1997; McPherson et al., 2006; Yawn et al., 2000; Macvean, 2012 |
| (10) in-game challenge for player as an impact factor | Kauhanen et al., 2014; Thompson et al., 2007 | | Rubin et al., 1986; Biddiss, E., & Irwin, 2010 |
| (11) in-game character as an impact factor | Fuchslocher, Niesenhaus & Krämer, 2011 | | Fuchslocher, Niesenhaus & Krämer, 2011; Sit, Lam & McKenzie, 2010 |
| (12) involvement of healthcare professionals in development as an impact factor | | | Baranowski et al., 2003 |
| (13) iterative information transfusion as an impact factor | | | Lieberman, 2001; Munguba et al., 2008; Brown et al., 1997; Aoki et al., 2004 |
| (14) mobility as an impact factor | | | Pollak et al., 2010 |
| (15) parents' involvement as an impact factor | | Paez et al., 2009 | Kauhanen et al., 2014; Paez et al., 2009; Maloney et al, 2008; Simons et al., 2014 |
| (16) play as an impact factor | | Huss et al., 2003 | Straker & Abbott, 2007; Kauhanen et al., 2014; Yawn et al., 2000 |
| (17) playability analysis as a *potential* impact factor | | | Thompson et al., 2007; Khanana & Law, 2013 |

| | | | |
|---|---|---|---|
| (18) providing knowledge as an impact factor | | Yawn et al., 2000 | Thompson et al., 2007; Thompson et al., 2008; Bartholomew et al, 2000; Aoki et al., 2004; Rubin et al., 1986; Brown et al., 1997 |
| (19) releasing updates for the health game as an impact factor | | | Baranowski et al., 2003; Bartholomew et al, 2000; McPherson et al., 2006; Pollak et al., 2010 |
| (20) retention as an impact factor | | | Macvean, 2012; Brown et al., 1997; McPherson et al., 2006; Fawkner et al., 2010 |
| (21) social gameplay as an impact factor | | | Brown et al., 1997; Lieberman, 2001; Paez et al., 2009; Epstein et al., 2007; Maloney et al, 2008; Simons et al., 2014; Fawkner et al., 2010 |
| (22) tutorial as an impact factor | | | Thompson et al., 2007; Biddiss & Irwin, 2010 |
| (23) use of recent technology as an impact factor | | | Paw et al., 2008; Johnsen et al., 2014; Brown et al., 1997 |
| (24) video game design elements as an impact factor | Huss et al., 2003; Paw et al., 2008 | | Lieberman, 2001; Bartholomew et al, 2000; Huss et al., 2003; Thompson et al., 2007; Brown et al., 1997; Fuchslocher, Niesenhaus & Krämer, 2011; Paez et al., 2009 |

## 4.3 Health Game Elements of Positive Impact

In the previous section, as the second task of our study, we have outlined the elements of children's health games regardless if they are positive, negative, or neutral on impact. During the description of these elements, we also observed their impact nature for the main purpose of our study; finding the elements of children's health games that have a positive impact on children's health promotion (Q1).

Table 10 lists all the impact factors with their nature of impact according to our analysis. The qualitative analysis of our study is based on the academic works of numerous research teams and their researches on children's health games. During their researches, nearly in every case, research teams evaluate or discuss the effect of the health game by either comparing it to other treatment or intervention methods, or using definitive cases. Through these evaluations, they also provide their observational results on certain elements that make the health game effective based on their own measurement techniques. However, not each impact factor takes part in every case. In addition to this, there are cases where the same impact factors show different impact or in some cases, they do not have any impact. Therefore, the aggregate results for the concluding impact of each factor is descriptive due to cases where the same factors impose different impact based on its use. Thus, the results show that, while 13 of all the impact factors have a definite positive impact on children's health, 11 out of the 24 may have different impacts. With that result, we can accept all the impact factors that we have listed are positive in their nature. As we discussed the positive nature of all the impact factors in the previous section (4.2 health

game elements of impact), here, it is more beneficial to clarify when these impact factors have negative impact or have no impact.

- "*Additional, easy-to-reach apparatus as an impact factor*" induces negative impact when the apparatus is an expensive device or not commercial enough (Selmanovic, 2010).
- "*Awareness about the target population as an impact factor*" induces negative impact in cases when the production team does not know enough about the preferences of the target population in means of video game elements (Thompson et al., 2007; Fuchslocher et al., 2011).
- Different from other factors, "*characteristics of the target population as an impact factor*" can induce either negative or no impact at all. One important point about this factor is that characteristic defines the gender, age, and/or race of the target population. As we discussed before, the consideration of these characteristics during production is important for the impact, yet there are cases when a health game achieves its purpose on female children more successfully than male (Graves, Ridgers & Stratton, 2008a). In addition to this, there are cases even when the production team of the health game considers the characteristics of the target population, it does not leads to positive impact or the impact does not vary according to the characteristics of the target population (McPherson, et al., 2006). The only negative case is when a game was disliked by the target population regardless of the production made according to the demographics (Fuchslocher et al., 2011).
- "*Competition as an impact factor*" induces negative impact in cases when the competition between pairs demotivates one of the pairs due to the defeat from other(s) which leads to loss of engagement or in cases quitting the game (Fawkner et al., 2010).
- "*Entertainment as an impact factor*" induces negative impact when the critical balance between the fun content and the health promotive content in a health game is not adjusted well enough (Aoki et al.,2004; Paw et al., 2008).
- "*Providing knowledge as an impact factor*" induces no impact when the knowledge about the health affair offered to players through the health game is not sufficient. We have also observed that in some cases, the knowledge provided through the health game has no extra value then the knowledge provided through other methods like traditional classroom education or parental education.
- "*In-game challenge for player as an impact factor*" induces negative impact when the in-game challenges within the health game are too hard of too easy for the target population; and in some cases, they are not designed well enough to be entertaining (Kauhanen et al., 2014; Thompson et al., 2007).

- "*In-game character as an impact factor*" induces negative impact when the in-game character is not likeable or irrelevant for the target population. In cases when the main in-game character lacks affinity for the player, prevents the player from building the necessary empathy for the in-game character and leads them to lose interest or obscures the point of focus that needed to be delivered to the targeted player.
- We have observed that in one case "*parents' involvement as an impact factor*" has no significant effect on the impact of the health game (Paez et al., 2009) although in the other three cases parents' involvement is a positive impact factor of the children's health games.
- We have observed that in several cases "*play as an impact factor*" has no significant effect on the impact of the health game. In these cases, play as the activity used for intervention or treatment of a health affair shows no significant difference from the traditional methods used for intervention or treatment (Huss et al., 2003).
- "*Video game design elements as an impact factor*" induces negative impact when the audial or visual elements are not likeable or inadequate for the target population (Huss et al., 2003; Paw et al., 2008).

## 4.4 Theoretical Coding and a Pragmatic Proposal through Theoretical Integration

With the axial coding, it is recommended to have one or two core categories for the theoretical coding (Glaser, 1978; Charmaz, 2006; Urquhart, 2012). However, as we stated in before (4.1 Structure of Health Games) the axial coding stage completed with nine different categories. In order to carry on with the theoretical coding, we have refined these axial codes with their relationships and created three coherent core categories.


**Figure 8 Theoretical Coding**

In Figure 8, we have illustrated the theoretical coding with the core categories we generated. "Health Game" as the first core category is more close to what we defined as the internal structure; including the categories as "Health Game Production", "Health Game Components", and "Physical Activities in Health Games" with the "Health Game Impact Factors" and "Health Game Limitation and Capabilities". "Consumer's Health" as the second core category is formed out of three categories as "Consumer", "Health Affair",

and “Health Promotion”. These two categories are a constant influence to one another. Consumers as the target population, influence health games with the health affairs that they are subject to and with that influence health games are produced; produced health game influence consumers since they are produced based on consumer’s health, in order to promote it. Thus, the last core category “Health Game-Specific Impact” becomes observable on the consumer, which is the same of the former category “Health Game Impact Result”.

A point worth to mention at this point is out of 56 different cases we looked at (Table 7), we found a negative impact of a health game only in one study. In the study of Azevedo et al. (2014), they have observed a negative impact of an exergame on the intervention group where light physical activity decreases instead of an expected increase. However, they only mentioned about this negative impact as an unexpected result that they cannot interpret in a meaningful manner. Rest of all the cases we have studied results with a positive impact of health games (if the case studies the impact of health game).

Regardless of this point, the result of our theoretical coding remains as an objectivist grounded theory; as we looked into many cases with and objectively rendered them the result reflects only the objective reality of children’s health games. However, as we stated in the third task of our study, we formulated a pragmatic proposal for better children's health games (T3).

For this proposal, we have benefited from the theoretical sampling work that we have carried through the theoretical coding stage. Through this theoretical sampling work, we observed that the consumption continuum of children’s health games is similar with the consumption continuum of video games. Therefore, we chose to use the synthesized model of the MDA framework and elemental tetrad (Figure 3) as a ground to compare children’s health games consumption continuum.

The difference between the children’s health game and regular video game starts with the producer. The producer cluster in MDA framework represents a regular game production team that includes team members as game artists (i.e. audio artist, sound artist, animation artists, creative writers) game developers (technical engineers, game programmers) when it is a small team; when it is a bigger team, members like marketing professionals, management professionals, musicians, monetization designers and even psychologist (Schell, 2014). However, regardless of the team’s size, in the case of health game production, in every case we observed that healthcare professionals who are well equipped with the focused health affair and health promotion are involved with the production. Since the main purpose of health game is to improve individual or collective health, a regular game production team would not be equipped enough on a sensitive matter as health improvement.

After the producer cluster, in our synthetize we described the four structural elements of the video games in a cluster as technology, mechanics, story, and aesthetics. However,

with the involvement of healthcare professionals, for the children's health game consumption continuum the "health promotion components" draws in. In our study, we observed that with the contribution of healthcare professionals and with the focal change in game production from entertainment-centric to health promotion-centric, an altering occurs with every video game element in this cluster. This alteration happens through the health promotion components that healthcare professional brought to the production team. In a sense, all the elements become polished with a sandpaper of health promotion. For example, technology usage changes in a way more suitable to increase feedbacks or using additional apparatus that regular games do not use; different technology alters the mechanics for presenting health affair related spaces, skills or in-game rules; aesthetics becomes more suitable for the age range and story narrates the subject including the health affair.

This chain of changes affects dynamics as well. The run-time behavior of the elements in the former cluster we described becomes augmented, in a way to improve health by nearly every interaction made with the player. In this sense, an important point to mention is that the cases we studied uses players who are subject to the specific health affairs. Therefore, we can consider the player cluster in the synthesized model represents a broader group yet every individual in that group can play health games regardless of them being subject to a health affair. However, another difference of children's health game is that players directly influence the production. This is because the health promotion-centric production of health games leads production team to focus on a specific target group and consider their health needs with requirements.

Lastly, in the children's health games, because of all these changes, players who exposed to augmented dynamics exhibits health game-specific impact along with the game-specific entertainment.

Thus, similar with the purpose of synthesized model, in order to analyze the children's health games through the player-producer interaction and eventually improve the results of the health game through this analysis, we propose Health Game Endeavor Framework (Figure 9). With this proposal, we conclude the final task (T3) of our research.

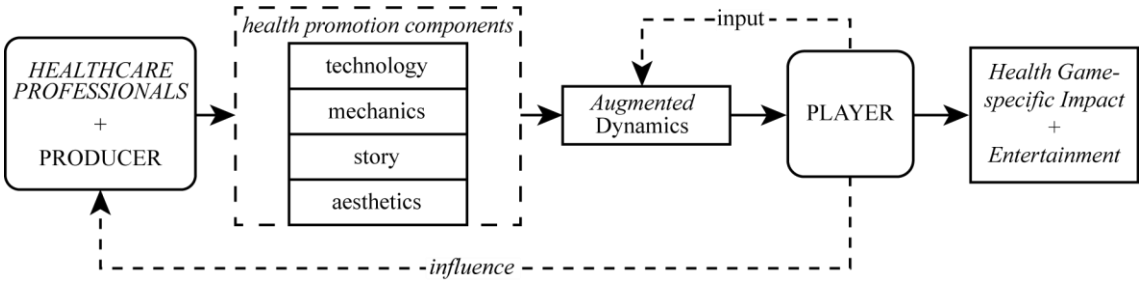


**Figure 9 Health Game Endeavor Framework (HGE)**

# 5 DISCUSSION OF THE FINDINGS

## 5.1 Conclusion on the Findings

This study set out to explore children's health games for the elements that make them work, in means of inducing health promotion to their target population as they are staged to do. During this exploration process, we have sought for the roots of health games, discussed how they evolved into their current state from video games with the use of health promotion concepts, and we have identified the elements of impact through their structure with their nature of the impact. Health games for children have been developed and used since 1980's[12], however, the general literature on their operative structure and specifically in the context of impact elements of children's health games are inconclusive on several questions. Our study sought to answer two of these questions:

1- What elements of health games have an impact on children's health promotion?
2- What elements of health games have a *positive* impact on children's health promotion?

The main empirical findings of our study are chapter specific and given within the respective chapters (4.2 Health Game Elements of Impact, 4.3 Health Game Elements of Positive Impact). Here, we synthesize the findings of our study in order to reach to conclusive answers for our questions. In order to reach to those answers, we have described and explained the structure of health games. Within the respective chapter (4.1 Structure of Health Games), we have provided an illustrated model of the structure of health games that deals with both the internal and operational elements of health games.

Regarding the first question given above, our analysis resulted with 24 different elements as the impact factors in children's health games. All these impact factors arrive through both the operational and the internal structure of health games in order to act as the elements of impact. However, when these impact factors act as an agent in a health game, they act in a co-dependent manner; they are often affected from each other and they are dependent to each other. This co-dependent nature of the impact factors and their courses of action within the health games are discussed within the respective chapter (4.2 Health Game Elements of Impact).

An important point considering the impact factors of children's health games is that we have found a counterpart for every health game component within the list of health game impact factors except for the component named as "scientific theories as a part of health game". Although all the other health game components are described and furtherly

[12] The earliest example for a health video game for children that we found is mentioned in the work of Rubin et al. (1986).

evaluated within the studies that we have covered, scientific theories used in the production of health games as a component were not considered for their direct contribution on to the impact results of the health games. For this reason, although previous studies dwell highly on the health promotion theories as a part of health games that leads to the induction of health promotion, our study is inconclusive in means of their nature of the impact.

Regarding the second question given above which is also the main question of our research, we concluded that none of the impact factors we listed is an element solely altering the success of the children's health games. Our results show that the 13 of all the impact factors are absolute positive impact factors in means of inducing health promotion and the 11 of them positive impact factors based on their use (Table 10). However, in order to conclude on their positivity in a sound manner, each factor should be measured in an extricated form from the interrelated elements that are also the impact factors for children's health games. For example, in a case where the game is mobile, the consumer may get the relevant feedback comparably easy to cases where the playing activity happens through a stationary device. In such cases, it may also be expected from the mobility of the game to increase the retention of the player due to its convenience of use and retention ensuring features mobile games (Fields, 2014). While those arguments would be valid in means of a better health game, the fact of mobility of the game itself as an impact factor does not make it a positive impact factor. Therefore, although 13 of the impact factors pointed out as absolute positive impact factors based on all the cases they were used, the co-dependent nature of each impact factor renders them unstable for the nature of their impact. Thus, we believe it is not possible to draw conclusions on impact factors that are applicable to all the different kinds of children's health games without evaluating the production variables of these children's health game (i.e. targeted health affair, targeted population, and production budget).

Based on these two answers, we have also proposed a pragmatic framework (Figure 9) as Health Game Endeavor (HGE). Similar to MDA's purpose (Hunicke, LeBlanc & Zubek, 2004) with HGE we believe designing, studying, or decomposing the health games will be easier for both researchers and developers.

## 5.2 Theoretical Implication

Regarding of these results, the previous cases for children's health games therefore needs to be revisited to understand the offered frameworks on the design of successful children's health games and how the application of these models can be made more sustainable.

The offered theoretical models suggest that the design of a successful children's health game derives from a theory-based approach (Lieberman, 2001; Thompson et al., 2008). While these models acknowledge the involvement of the iterative design, development

and the traditional production structure of video games, their main focus remains on the use of health promotion and, therefore, on the behavioral change theories during the design of children's health games. It is, however, noted from our study that while health promotion theories used during the design carries strong importance, their visibility on the health game's impact result is rather inconclusive. Considering those theoretical models (Lieberman, 2001; Thompson et al., 2008) deals only with the design of children's health games but not with the whole cycle of consumption (including design, development, production, and usage of the end product) of children's health games, the perspective they provide remains rather exclusive.

This inconclusive visibility is consistent in various cases (Bartholomew et al, 2000; Fuchslocher, Niesenhaus & Krämer, 2011; Simons et al., 2014) as well, in addition to the need for the models of pathways of effect for children's health games (Baranowski et al., 2008). In this sense, we offer a rather extensive look to those pathways of effect by providing the positive impact factors of children's health games; to our knowledge, it has not been offered before. This being said, the list of impact factors that we provide is not confined with the number of elements we gave and open to expansion through further studies. In addition to this, with HGE, we offer a shifting from the theory-based design to impact-based design, which also provides an expansive perspective that considers both the player group and production group of the children's health games.

## 5.3 Limitations of the Study and Recommendation for Future Research

Our study has offered a list of taxonomy on the positive impact factors of the children's health games and a pragmatic yet generic framework on the health game endeavor. In order to do so we have conducted a qualitative research on children's health games focused on specific health affairs with a set of data sampled through a meta-study. Consequently, we encountered a number of limitations that need to be considered.

With the acknowledgment of the applicable areas of health games, our study is limited with the health games developed aiming children as the target population. Therefore, the viability of the cases that we studied only valid for the effects of health games on children. Due to this fact, the applicability of our results for the health games aiming elderly people or any other target population is open to discussion. In order to validate this applicability, a future research on the health games for other target population than children can be considered.

Regarding the choice of children's health games, our study is also limited with the health affairs that those games deal with. While we acknowledge that the focus of children's health games reaches out to a larger number of health affairs (such as physical

disabilities, mental health (see e.g. Parisod et al., 2014), we kept our research exclusive to five, rather ubiquitous health affairs (asthma, cancer, diabetes, obesity, and nutrition). Regardless of our research's exclusivity, we believe that our results retain their importance for the field. In order to curtail this exclusivity, for a future research, children's health games dealing with other health affairs can be included to analysis and extend the results.

Another recommendation for a future research would be the experimental use of our results (both the list of positive impact factors and HGE). Despite their theoretical nature, we believe it is possible to benefit from them during the development of a children's health game. One of the most practical ways of developing an experimental children health game as such can be periodically organized game jams, where all necessary parties for the development would be present. Such trials can be scientifically experimented after the development in order to validate the applicability and even for the observation of a children's health game production phase (Kultima, 2015)

For our research, we adopted the GTM for both data collection and the analysis of the collected data. In that manner, we conducted the analysis of the data effectively according to the GTM. However, during the data collection, attempts of access to relevant interviewees were not possible due to the exclusive research topic and a lack of practitioners in the field within reach. In addition to this, the absence of ongoing children's health game project within reach during the time of our research precluded the possibility of conducting an observation on a relevant field. Regardless of these limitations, our meta-study enabled us to use academic documentation as data, which the majority of the collected material gives an important reflection on the applications of children's health games along with their scientific results after their use. We acknowledge this lack of the great deal of first-hand data as a limitation for our research. However, the collected material strengthens the results of our research with the extensive (in means of reaching to numerous types of game productions and rich variety of target populations with different demographics as age, race, and gender) data they are based on. That being said, for the future endeavors, it is advisable to conduct an empirical research on the relevant field, which would enable first-hand observations and reports based on these observations along with possible interviews or questionnaires with the respective parties.

Regarding the scientific articles that we used as data, their quality evaluation is not included to our study.

We reached to one of our results as the list of impact factors during the substantive coding stage of our analysis of our data. Regarding this, we believe it is important to point out that we disregarded the frequency of substantive codes under the health game impact factors category. Since all the data we analyzed are scientific studies on health games for children, we believe all the impact factors that we have determined are important regardless of how often they appear. However, for a future research, the frequency of these listed

impact factors can be considered as an indicator of their relevance within the type of health games they are used and their level of impact instead of the nature of impact.

## 5.4 Final Words

In the beginning of this study, we stated that we acknowledge the interdisciplinary nature of the children's health games. With this study, we acquired a better understanding on the different parties are involved with the children's health games and we observed how often health games are researched by the parties from the health fields. As the central purpose of children's health games is to promote health, the crucial contributions of the healthcare professional along with the researchers and the scholars of health fields are incontrovertible. In spite of this, the involvement of the other parties as game developers, producers, designers and likely is still standing. Therefore, with this study, we – as the scholars of a mediator field, information systems – believe that we have provided an important perspective to children's health games, their viability and to their elements of impact. Thus, while we acknowledge the purpose of children's health games is to promote the health of the children in the most medically accurate manner possible, the video game roots and, therefore, the entertainment roots entails a meticulous balance in between the serious and the fun.

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