



UNIVERSITY OF GOTHENBURG

Health games – healthy in what way?

**A systematic review of the current state of research
in health games for children and adolescents**

CECILIA GARELL

Thesis Work in Learning, Communication and Information Technology

Report No. 2015:131

Thesis work in Learning, Communication and Information Technology

Title: Health games – healthy in what way? A systematic review of the current state of research in health games for children and adolescents

Author: Cecilia Garell

Responsible department: Department of Applied Information Technology, University of Gothenburg

Supervisor: Jonas Linderöth, Professor, Department of Pedagogy, Communication and Learning, University of Gothenburg

Examiner: Urban Nuldén, Associate Professor, Department of Applied Information Technology, University of Gothenburg

Report No: 2015:131

Abstract

Background: Games and gamification for health have become a trending topic. Due to a conceptual confusion about both *health* and *games* it can be difficult to use available knowledge and research about games for health. Researchers may have different conceptions and prior knowledge about health, as well as about games' potential contribution to health.

Objective: The aim of this study was to render a review of perspectives and theories on health and learning in previously conducted studies of health games for children and adolescents.

Methods: A systematic literature review searching in the major knowledge databases ERIC, PubMed and IEEE Xplore resulted in 40 articles published in scientific journals and 15 conference papers. The main key words used were games, theory, evaluation, children and design, all combined with health using Boolean operators.

Results: The perspective of health that is mostly utilized in the studied articles is the pathogenic perspective – a disease-perspective with focus on prevention, rehabilitation, treatment and cure. For instance, the articles were about the desire to, by using games, promote physical activity and healthy eating habits in order to prevent obesity and diabetes. Most of the articles used, or at least discussed the advantages of using, one or more theory/theories in game-based interventions for children and adolescents. Most of the theories were behavioral/psychological theories and communication theories and models.

Conclusions: Although a theory-based intervention for games for health is important, right science may not be enough for a successful intervention. The games have to be, among other things, fun and challenging. The games, and especially the game consoles, may preferably be tailored to fit the player's physical abilities. To empower the children to intrinsic rewards, to increase autonomy and self-efficacy may enable and provide conditions to maintain the changed behavior.

Keywords: children, design, games, health, learning, theory

Sammanfattning

Bakgrund: Spel och spelifierade aktiviteter (*gamification*) har blivit populärt. En begreppslik förvirring av begreppen *hälsa* och *spel* gör att det kan vara svårt att tillgodogöra sig tillgänglig kunskap och forskning om spel för hälsa. Forskare kan ha olika föreställningar och förkunskaper om hälsa likaväl om spels potentiella bidrag till och påverkan på hälsan.

Syfte: Syftet med den här studien var att ge en översikt av perspektiv och teorier på hälsa och lärande i tidigare utförda studier på spel för hälsa för barn och ungdomar.

Metod: En systematisk litteraturstudie med sökningar i de större kunskapsdatabaserna ERIC, PubMed och IEEE Xplore resulterade i 40 artiklar publicerade i vetenskapliga tidskrifter samt 15 konferensbidrag. De främsta nyckelorden vid sökningarna var spel, teori, utvärdering, barn och design alla kombinerade med hälsa med hjälp av booleska operatorer.

Resultat: Det perspektiv på hälsa som främst kunde skönjas i de studerade artiklarna var det patogena perspektivet – ett sjukdomsperspektiv med fokus på prevention, rehabilitering, behandling och att bota sjukdomar. Artiklarna behandlade till exempel spel med syfte att öka spelarens fysiska aktivitet och uppmuntra till hälsosamma kostvanor där det bakomliggande syftet var att undvika fetma och diabetes. De flesta artiklarna använde, eller åtminstone diskuterade fördelarna med att använda, en eller flera teorier i spelbaserade interventioner för barn och ungdomar. De flesta teorierna var beteende- eller psykologiska teorier, samt kommunikationsteorier och modeller.

Slutsatser: Även om det är viktigt med en teoribaserad intervention är det inte säkert att det är tillräckligt med ”right science” för att det ska bli en framgångsrik intervention. Spelen måste bland annat vara roliga och utmanande. Spelen, och särskilt spelkonsolerna, bör med fördel vara speciellt anpassade till att passa barn med fysiska funktionsnedsättningar. Genom att stärka (*empower*) barnen till inre motivation och belöningar, ökad autonomi och tro på sin egen förmåga (*self-efficacy*) kan ett lärande samt förändrat och vidmakthållet beteende möjliggöras.

Nyckelord: barn, design, hälsa, lärande, spel, teori

Contents

Abstract	2
Sammanfattning	3
Introduction	6
Thesis overview	8
Glossary.....	8
Previous research: Literature reviews	10
Theoretical perspectives on health, games and learning	12
Health.....	12
Games, gaming and gamification	14
Games and learning	15
Games for health.....	17
Method	18
Search strategy and data source	19
Inclusion and exclusion criteria	19
Analysis	20
Ethical considerations.....	20
Results	20
Perspectives on health	20
Theories and concepts used in the articles.....	26
Behavioral theories	26
Health communication	29
Collaboration and support.....	31
“Good for the soul”	33
Assumptions about health and learning.....	34
Physical activity	34
Self-management	35
Physiotherapy and rehabilitation.....	36
Understanding health messages	38
Preparing for future medical examinations	39
Learning the social codes	39
Academic achievement	39
Summary and analysis of results	40
Discussion	41

Conclusions	45
References	46
Appendix 1:	56
Appendix 2:	58

Introduction

“So, you have been depressed for a long time? Take two tablets daily and play videogames for 45 minutes three times a week”, suggests Ben Sawyer (Wiborgh, 2012). According to Sawyer, the founder of Games for Health Conference, it is only a question of time before games are prescribed as ordinary care by doctors (ibid.). Individuals and patients are nowadays expected to actively take part in decisions and actions related to their health. In fact, the Swedish government has initiated health accounts for all Swedish citizens in aim at empowering the individuals to engage in their own health (eHälsomyndigheten, 2015). In other words, this puts the responsibility at the individual, rather than the healthcare. Games, gamified activities, and apps are examples of such activities that may encourage more healthy habits or instruct how to manage a chronic disease (Lindström, 2013).

There is no doubt that games have become popular. Playing computer and videogames (henceforth collectively called ‘videogames’) is a popular activity among children. About 93 percent of 6-7 years old children and above 90 percent of all teenagers play videogames (Internetstatistik, 2015). Gaming is a multidimensional activity including aspects of competition, coincidence and chance, pretending and enforcing the feeling of a “kick”. Maroney (2001) defines games as: “A game is a form of play with goals and structure”.

The last couple of years, gamification has become a trending topic. According to Gartner (2011) more than 50 percent of all organizations that manage innovation processes will gamify their processes by 2015. Even then there is little scientific evidence on the efficiency of gamification to improve desired outcomes related to health and health behaviors gamification is becoming a billion dollar industry (Lister, West, Cannon, Sax & Brodegard, 2014).

The definition of gamification, “the use of game design elements in non-game contexts” (Deterding, Dixon, Khaled & Nacke, 2011), is used by several authors (e.g. Cugelman, 2013; Lister et al., 2014; Seaborn & Fels, 2015). A gamified activity is thus not a game, Cugelman (2013) states, but an everyday activity such as taking medication made fun and engaging by adding game elements, for instance earning points for taking the medication. The distinction between these two concepts; games and gamification, is not always manifest in literature.

Games for health can be so-called *serious games*; games with a “higher” purpose more than entertainment (e.g. Starks, 2014). This type of games has a purpose to impact the players beyond the self-contained aim of the game (Mitgutsch & Alvarado, 2012). The player is supposed to learn something from serious games, for instance healthy habits. Learning can be identified as change in knowledge and values. Pedagogical issues are actualized when desired knowledge, values and behaviors not arises spontaneously (Svederberg & Svensson, 2001). Humans are always learning due to shaping and changing in different contexts. The question is *what* we are learning from playing videogames, more than just learning to play the game.

The connection between games and health has been studied from different perspectives. There are several studies of the positive effects of games, which will be described in literature review herein. Promoting physical activity (Brazendale, Chandler, Beets, Weaver, Beighle, Huberty & Moore, 2015) and improving communication between healthcare providers and

hospitalized children (Knutz, Ammentorp & Kofoed, 2015) are two examples of positive outcomes. Other researchers find and focus on the negative effects games may induce (e.g. Morris & Johnson, 2014; Ferguson & Kilburn, 2009). It is, for instance, assumed by some people that the players might be violent by playing too much violent videogames, or obese by the sedentary lifestyle. However, with more knowledge and less fear of the new technology, several positive effects with playing videogames are shown. “Good video games are good for your soul” Gee (2007, p. 7) states. The goodness (or badness) of videogames is like with everything else; dependent of how it is used and in which context.

Previously found literature reviews on similar topic have focused on the results from the studies, i.e. the effects on health. Griffiths, Kuss and Ortiz de Gortari (2013) opened their review with a statement that the most reported effects of videogames allege negative consequences. Different areas of videogames as therapy were examined and one conclusion was the difficulties to evaluate the therapeutic value of videogames as a whole. Considerable success has been found when games are specifically designed to address a particular issue.

Disease prevention by practicing physical activity was the foundation for a systematic review by Peng, Crouse and Lin (2012) with focus on games to increase physical activity among both children and adults. Only one of the intervention studies studied in their review specified a theoretical rationale. The need of specifically designed physical activity promotion videogames was raised. Further, a literature review by Papastergiou (2009) highlighted the question about whether and how the power of videogames could drive children, adolescents and young adults towards adopting a healthier lifestyle and become more physical active. Deduced knowledge from this review comprised the importance of theory-based and iterative design which is informed by the intended target group. As Nutbeam, Harris and Wise (2010) stated, “theories and models can help to bind together our observations and ideas, and make sense of them” (ibid., p. 1).

It is difficult to expose the ways games function. Due to a conceptual confusion about both *health* and *games* it can be difficult to use available knowledge and research about games for health. The state of research is shattered and fragmented. Researchers may have different conceptions and prior knowledge about health, as well as about games’ potential contribution to health. Different conditions are set in different studies. Healthcare and politicians have not been engaged or courageous enough to take the lead in questions about games for health, according to the article of Lindström (2013). For example, there might be a culture gap between experienced players and non-players, such as a fear to try new methods in healthcare and a lack of desire to experiment. The tradition in healthcare is to demand evidence – to use tested methods. A conceptual investigation is therefore important to be able to make use of the previous research.

Regardless of the purpose of the game (i.e. health or learning) a critical examining approach is desirable to distinguish whether arguments are founded by personal experiences or by results from research. As Peterson (2014) claims, although it is difficult and time consuming, it is important forming an opinion about from where different rhetorical claims come from.

Thus, it seems that specifically designed, tailored, videogames for health in theory-based interventions could be successful to improve people's health. However, this assertion needs to be further supported. Nevertheless, to the best of my knowledge, no comprehensive overview of the scientific research and literature on the use of theory for health games for children has been published thus far.

The salutogenic perspective on health, with starting point in health and healthy factors, is the foundation of this thesis. There is a need for a more nuanced picture of health, to explore possibilities for health. In addition, there is a need to understand more than the motivators for physical activity and research for health beyond the combination games and health. In other words, there is a need for a holistic perspective on health. Imagine the risk of inducing poorer health in the children even though they lose weight by playing the game.

Therefore, the overall aim of this study is to render a review of perspectives and theories on health and learning in previously conducted studies of health games for children and adolescents. The goal is to enable a deeper understanding of the health perspectives' and theories' impact on the outcome of games for health. I strive for a salutogenic perspective on health and I am interested in health games for promotion of health. The overall research question for this literature review is:

- What dimensions in the basic assumptions in the interventions for health games need to be changed when embracing a full salutogenic perspective?

The following questions are guiding questions for the data collection and data analysis:

- What health perspective are mostly utilized in studies on health games for children and adolescents?
- What are the underlying theories and concepts used in prior studies on health games for children and adolescents?
- What assumptions, ideas and expectations about health and learning can be seen in studies on health games for children and adolescents?

Thesis overview

After this introduction, a section with explanations and elucidations of concepts used in the forthcoming text will follow. The next section describes the previous research, i.e. literature review studies on the subject games and health. Next, the theoretical perspectives on health, games and learning which are used as the theoretical framework in this report are outlined. Prior to the presentation of the results the method is described. Then a discussion of the findings in relations to the theoretical framework as well as to the previous research follows. Limitations of this study are discussed, and suggestions about further research are given. Lastly, some conclusions are drawn.

Glossary

Autonomy – as a human right, be free and independent.

Avatar – fantasy virtual character.

COTS-games - commercial games that are designed without any specific purpose, more than to entertain, can be bought by anyone and are called COTS – Commercial off-the-shelf entertainment games (Buday, 2015).

Digital natives – persons who have grown up with this new technology, persons that are “native speakers” of the digital language of computers, videogames and Internet¹.

Empowerment – the process by which people, organizations and communities gain mastery over their lives (Labonte, 2010).

Exergames – video games that involve gross motor activity for play.

Gamer mode – the attitude of the player when he/she “plays the game” and does not see the game as a representation of something else with lessons to be learned (Frank, 2012).

Gamification – “the use of game design elements in non-game contexts” (Deterding, Dixon, Khaled & Nacke, 2011).

Health promotion – the process of enabling people to increase control over, and improve their health. The foundation of the health promotion perspective is *The Ottawa Charter for Health Promotion* (WHO, 2015). Health promotion assumes a salutogenic perspective in health work.

Ludification – the phenomenon of “playing the game” instead of learning the lessons and considering the realism and the consequences the behavior would have in the world outside the game (Linderoth, 2014).

Pathogenesis – a process, a change, from healthy to sick. The work that focuses on the cure and prevention of disease emanates from the pathogenesis.

Prevention – to prevent diseases by avoiding and eliminating risk factors to avoid. Assumes a pathogenic perspective and defines health as absence of disease.

Salutogenesis – from Latin *salus* meaning health, a concept coined by Professor Aaron Antonovsky (2005). The salutogenic perspective focuses on health factors, which actively promote health, to be strengthened thru a healthy behavior.

Self-efficacy – the belief in one’s own ability to manage and demonstrate self-control.

Serious games – games with purpose, not only for entertainment.

Social Cognitive Theory (SCT) – a theory that emphasizes reciprocal determinism in the interaction between people and their environment. Self-efficacy is one of the key concepts, which can be categorized as follows: 1) psychological determinants of behavior (e.g. self-efficacy), 2) observational learning, 3) environmental determinants of behavior (e.g. reci-

¹ <http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf>. (2015 August 8).

procal determinism), 4) self-regulation, and 5) moral disengagement (McAlister, Perry & Parcel, 2008).

The Theory of Planned Behavior (TPB) – a theory in which *behavioral intention* is the most important direct determinant of behavior, and direct determinants to individual's behavioral intention are their *attitude* toward performing the behavior, their *subjective norm* associated with the behavior and the *perceived control* over the behavior (Montaño & Kasprzyk, 2008).

The Transtheoretical Model (TTM) – a model that uses stages of change to integrate processes and principles of change across major theories of intervention (Prochaska, Redding & Evers, 2008). The six stages of change are: precontemplation, contemplation, preparation, action, maintenance and termination and can be described as a spiral in which one can “fall” to a lower stage (relapse) and start over again. Self-efficacy is one major concept in this model.

Virtual reality (VR) – a simulated interactive environment.

Previous research: Literature reviews

The literature reviews investigated below have slightly different focus, although all of them examined the results from studies of health games, namely the effects on health from the games. Two of the reviews below are published in *Games for Health Journal*, one in *Computers & Education*, one in *Health Education & Behavior*, and one in *Handbook of Research on ICTs and Management Systems for Improving Efficiency in Healthcare and Social Care*.

The review of the medical and psychological literature by Griffiths et al. (2013) examined the following areas: 1) videogames as physiotherapy and occupational therapy, 2) videogames as distracters in the role of pain management, 3) videogames and cognitive therapy, 4) videogames and development of social and communication skills among learning disabled, 5) videogames and impulsivity/attention deficit disorders, 6) videogames and therapeutic benefits in the elderly, 7) videogames in psychotherapeutic settings, 8) videogames and health care, and 9) videogames and anxiety disorders. The advantages with videogames as a therapeutic setting, Griffiths et al. (2013) argued, is that the participants are allowed to experience novelty and challenge engaging in fictional activities without real life consequences.

Interventions that used active videogames to increase physical activity were evaluated together with laboratory studies by Peng et al. (2012). The background for their review was about the negative consequences of physical inactivity, such as obesity, cancer, heart disease and diabetes. The authors highlighted that the need of moderate physical activity every week is for the prevention of different diseases. The goal of Peng et al.'s (2012) review study was to examine active videogames as potentially fun and engaging platforms to promote healthy active behavior for both children and adults, and to provide a synthesis of the state of knowledge (reviewed studies are published between the years 2002 and 2011).

Papastergiou (2009) joined the researchers (e.g. Gee², Malone³ and Prensky⁴) who claim that digital game-based learning is more effective than traditional learning modes. Their arguments are that this mode of learning can be more enjoyable and more interesting. The results of the studied articles (between the years 2000 and 2008) suggested that videogames present several potential benefits as education tools for health and physical education in such way as improving people's knowledge, skills, attitudes and behaviors in relation to health and physical exercise. Nevertheless, Papastergiou (2009) also expressed that empirical evidence supporting effectiveness of digital games in health and physical education is limited.

Griffiths et al. (2013) argued that in the right context, videogames can have a positive therapeutic effect. To evaluate the therapeutic value of videogames as a whole is difficult; the videogames specifically designed to address a particular problem or to teach a certain skill have however shown considerable success. Peng et al. (2012) assumed that active games specifically designed, in their case to promote physical activity, may be more suitable to be used in interventions of purpose than commercial off-the-shelf entertainment games.

In addition to specifically designed games Peng et al. (2012) claimed the use of health behavior change theories in intervention studies. In their review one intervention study only specified a theoretical rationale. This despite that research has shown that interventions designed and measured using theories are more likely to be successful. Lu, Baranowski, Thompson and Buday (2012) reviewed narrative's role in complementing behavioral change theories. One example of a behavioral change theory is the Theory of Planned behavior (TPB) in which the determinants of individuals' behavioral intention are 1) their attitude toward performing the behavior, 2) their subjective norm associated with the behavior, and 3) their perceived control over the behavior (Montaño & Kasprzyk, 2008). Lu et al. (2012) argued that narrative may induce a more positive attitude toward performing healthy behaviors because of the immersion process. The immersion is about a narrative having the unique ability to engage people, to "transport" players to another world and to change their attitude through the journey-like experience (ibid.). The use of a storyline in games was also pointed out by Buday (2015) as well as Peng et al. (2012) who propose that games with story and plot development might be needed for sustainability.

The overall result from the intervention studies showed low usage of the active videogame after the initial period (Peng et al., 2012). Other studies have also shown that active videogame play can induce light to moderate bouts of physical activity, but that the effect is short lived (Buday, 2015). Buday (2015) concluded that even when the science is right health games may fall short on execution or tediousness. Videogames must be fun, give players the ability to fail and not give too much help (ibid.). The nature of challenge together with the sense of accomplishment and satisfaction also add to a game's therapeutic potential (Griffiths et al., 2013).

² <http://newlearningonline.com/literacies/chapter-2/gee-on-what-video-games-have-to-teach-us-about-learning-and-literacy> (2015 August 5).

³ <http://cci.mit.edu/malone/tm%20study%20144.html> (2015 August 5).

⁴ <http://marcprensky.com/digital-game-based-learning/> (2015 August 5).

The need for future research seen in these reviews is more empirical support on the impact of videogames on their players' health-related knowledge, skills, behavior and learning in comparison with other media (Papastergiou, 2009), the long-term efficacy of the videogames (Peng et al., 2012), and the factors that facilitate therapeutic effects (Griffiths et al., 2013).

Theoretical perspectives on health, games and learning

Health

The World Health Organization (WHO) has in 1948 defined health as “complete physical, mental, and social well-being, and not merely freedom from disease or infirmity” (e.g. Rash, 2010, p. 7). This definition emphasizes the holistic approach. Health is dependent of more than the individual and his/her body. To promote health we need to be able to describe health in positive terms, as a quality or a resource in people's daily life (Hanson, 2004).

Inspired by Hanson (2004), there are three different ways of explaining health: 1) clinical status, 2) functional ability, and 3) well-being. The clinical status is health measurements of the individual's physiology and anatomy. To be able to manage the daily life, participate in society and do the things you want to do determine a person's health in terms of functional ability. Well-being is the individual's overall experience of feeling well or feeling bad. This is a unique experience for every individual *and* every moment.

Two qualitatively different perspectives of health we need to understand more about are *salutogenesis* and *pathogenesis*. Salutogenesis represents a health-perspective, in which factors or circumstances that contribute to health are examined (Antonovsky, 2005). Here, the health work is promotive, to strengthen the good things and to see health as a resource in everyday life. Pathogenesis, on the other hand, represents a disease-perspective and defines health as the absence of disease (Hanson, 2004). The strategies in the pathogenic perspective are to cure, treat and prevent disease, or put differently, to remove the bad things. However, pathogenesis and salutogenesis are complementary processes in people's lives. Health professionals and researchers should see the asset of cooperation of health promotion, prevention and treatment.

Different ways of illustrating the dimensions of health, or the holism of health, are shown in Figures 1-3 below. In Figure 1 the message is that we need balance between the different aspects of health and well-being to function – a ball that is not spherical cannot be rolled or thrown accurately.

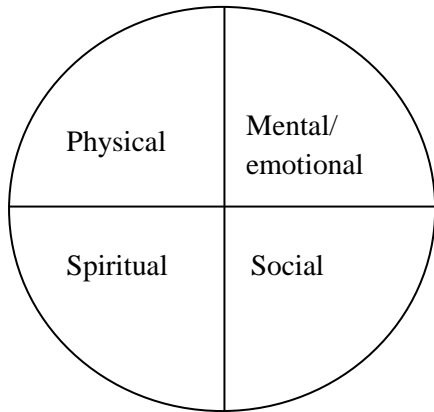


Figure 1. The sphere of health with the four aspects of health and well-being; physical, mental/emotional, social and spiritual health (Rash, 2010).

The four-field diagram in Figure 2 describes health in a coordinate system. In the upper right field a person has both perceived and real health, and in the lower left field the person has a disease and feels ill. Nevertheless, a person with a chronic disease (e.g. diabetes) can feel well and perceive health (upper left field). In the lower right field the person has no ailments but still feels bad. A long-term condition like this may, however, lead to physical disease, Hanson (2004) argues.

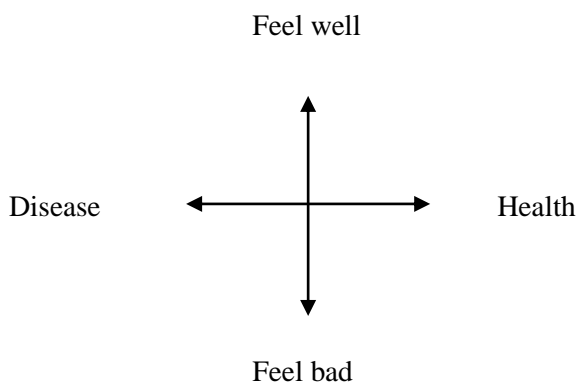


Figure 2. The cross of health (e.g. Hanson, 2004).

The third illustration (Figure 3) is kind of the opposite of the dichotomous approach in which a person is diagnosed as either sick or healthy; as having a disease or having health. Instead at each occasion the person is somewhere on an imaginary line between absolute illness and absolute health. Antonovsky (2005) emphasizes that the salutogenic perspective is not only “the other side of the coin” – the pathogenic perspective seen from a different angle. The salutogenic perspective is more like a complete different and at least as meaningful perspective in which terms of factors that promote a movement towards the health pole are in focus (Figure 3). The point here is that it is often *different* factors (Antonovsky, 2005); movement

towards the health pole is not only accomplished by having low risk factors.

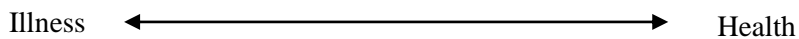


Figure 3. The continuum perspective of the state of health (Antonovsky, 2005).

Games, gaming and gamification

According to the definition of Maroney (2001) a “game is a form of play with goals and structure”. Kapp (2012) assumes a definition from Katie Salen and Eric Zimmerman⁵, which he slightly modified to:

A game is a system in which players engage in an abstract challenge, defined by rules, interactivity, and feedback, that results in a quantifiable outcome often eliciting an emotional reaction (Kapp, 2012, p. 7).

Linderoth (2014) points out that games (digital as well as non-digital) have two discernible dimensions that make them unique; a theme and a system of rules. The theme is what the game portrays, for example family life, e.g. *The Sims* (Electronic Arts Inc., 2015) or a historical period e.g. *Memoir '44* (Days of Wonder, 2015). The rule system sets the conditions for the interaction between the players. No videogame is, however, developed in a cultural vacuum. Like all cultural artifacts, Bogost (2008) claims, videogames bear the biases of their creators.

Two types of games are used for learning and for health, namely serious games and commercial off-the-shelf entertainment (COTS) games. Serious games are games with a purpose, more than entertainment, which instead is the main focus with COTS-games. Serious games are developed for use in different areas like schools and education, military, corporate management and healthcare (Cagatay, Ege, Tokdemir & Cagiltay, 2012). Regardless the purpose of the game and if the game is a serious game or a COTS-game the player may sooner or later be more occupied by playing the game and score to win than reflecting over the purpose and the lessons that can be learned in the game. Linderoth (2014) calls this phenomenon *ludification* and means for that reason that it may be inappropriate to use a game to mold content or convey a message. The message might be forgotten in the gaming experience. The attitude, or the state of the players, when the players “game the game” instead of focusing on their learning goals is called *gamer mode* (Frank, 2012).

Gamified activities lack the interactive components of a full game (e.g. Bittner & Shipper, 2014). The game elements added to the activity are often focused on points, badges and leaderboards (PBLs), Bittner and Shipper (2014) argued. PBLs are tools for the extrinsic motivation⁶. Other game elements may lead to another experience, where the user maybe would have more fun. Gaming theories have produced core mechanisms of games, such as avatars and storylines, which may lead to flow and interaction (Bittner & Shipper, 2014). One

⁵ From the book “Rules of Play: Game Design Fundamentals”, <https://mitpress.mit.edu/books/rules-play> (2015 August 24).

⁶ The motivation to do something comes from external factors; the expected outcome such as rewards or pressure (Bittner & Shipper, 2014).

conclusion from Bittner and Shipper (2014) is that games are popular for other reasons than PBLs, and hence, using (only) PBLs may be insufficient for effective designs.

As Cugelman (2013) points out, developers need a list of game design elements and then they need to integrate these elements into their intervention to apply gamification. In the list below, Cugelman (2013) identified seven core ingredients of gamification:

1. Goal setting
2. Capacity to overcome challenges
3. Providing feedback on performance
4. Reinforcement
5. Compare progress
6. Social connectivity
7. Fun and playfulness

These seven ingredients are similar to Gartner's four principal means of driving engagement using gamification (Gartner, 2011):

1. Accelerated feedback cycles
2. Clear goals and rules of play
3. A compelling narrative
4. Tasks which are challenging but achievable

Used right and under the right circumstances, as other persuasive design patterns, gamification has merit and can work. Let me end this section about gamification with a quote:

One of the chief misconceptions about gamification is that any technology that employs game tactics will be more engaging. The problem with this thinking is that it mistakes superficial game tactics for deeper psychological strategies. For instance, it is risky to believe that badges will motivate users, without considering the persuasive strategies that the game tactics must satisfy, where a badge's value comes from a community that places value on that badge, and where the badge's value is further dependent on whether it transfers anything of value to the person (Cugelman, 2013).

Bogost (2008) argues that videogames are more than artifacts created to distract and amuse, videogames have the power to make arguments, to persuade and to express ideas. However, Bogost (2012) continues, videogames are “not *automatically* rich, sophisticated statements about the world around us” (Bogost, 2012, p. 137). The arguments made and the ideas expressed are not done inevitably.

Games and learning

With the words of Basil Bernstein (1996) I will make it clear that my concept of “pedagogic practice is somewhat wider than the relationships that go on in schools” (Bernstein, 1996, p. 17). The definition of pedagogy I here apply I have borrowed from Umeå University:

Pedagogy is a scientific discipline in which knowledge is formed about the processes by which humans are shaped and changed in different social, cultural and historical contexts (Nilsson, 2005, p. 2, my translation).

There are two key points to discuss, Gee (2007) means, when talking about videogames and learning, namely *content* and *technological determinism*. Unlike in films and novels, in videogames the content has to be separated from game play, although they of course are connected. While the content may involve a specific community, vehicles and different things the game play, however, involves strategic problem solving (ibid.). The elements of content may change without changing the game play. Gee (2007) points out that game critics (I understand it as these critics are against the violence and the crime scenes in the videogames) would need to see that players, especially strategic players, are more focused on the game play instead of the content. However, this ludification (see above) can be a problem when the specific content is meant to teach the player something.

The idea of technological determinism, in which the technology is so powerful that it by itself drives a development that is either completely positive or completely negative, has progressed to be divided into two approaches; hard and soft determinism (de la Cruz Paragas & Lin, 2014). Hard technological determinism is the perception that society is ultimately controlled by changes in society's material structures – that technology is the sufficient or necessary condition for social change (de la Cruz Paragas & Lin, 2014). The soft determinism, on the other hand, understands technology to be a key factor that may facilitate change (ibid.) and to have certain affordances (Gee, 2007). It is not the technology in itself that is good or bad but the effects depending on how the technology is used and in which context (ibid.). (Just as the similar arguments about knives.)

Learning is a basic drive for humans, proclaims Gee (2007), and continues with that pleasure is the basis for learning. Pleasure is given by good videogames. Gee (2007) arguments that this kind of pleasure is connected to control, agency, and meaningfulness, and also that good videogames with problem-solving tasks create deep learning. So to conclude, we learn by playing videogames because the games are fun, and because when something is fun we tend to spend our time on it. So we practice and get skilled. The critical question here is *what* we learn playing videogames, more than just learning to play the game.

One way of learning is to build models that will attempt to persuade their users that the real thing, e.g. a machine, works in a certain way. Bogost (2012) argues that models can be thought of examples of *procedural rhetoric*. This concept, Bogost (2012) suggests, stands for the practice of authoring arguments through processes. As earlier argued, videogames are not mere trifles, meaningless entertainers. Videogames can make claims about our world through processes (ibid.). An example, a player doing the “right” moves and picking the “right” choices in the game is rewarded with points. The “right” choice is decided by the game developers, and can for instance be to pick fruit and vegetables instead of unhealthy snacks.

Gee (2007) means that digital technology add certain features that non-digital games are missing, and these features stimulates learning because they reminiscent how scientists use simulations in learning. Linderoth (2014), on the other hand, highlights that game-based learning is not dependent of the digital technology. Game-based learning is based on games (not gamified activities), whether they are digital, board games or card games. Non-digital

games can sometimes be a better and simpler onset when it comes to be used in a learning situation.

Gee (2007) argues for the importance of videogames as “action-and-goal-directed preparations for, and simulations of, embodied experience” (Gee, 2007, p. 26). The learning principles Gee (2007) is referring to are organized into three sections: 1) empowered learners, 2) problem solving, and 3) understanding. Co-design – the player is more than a consumer, she/he is also a producer – is one example of a learning principle of the first section. The interactivity of the videogame enables the player, as well as the game, to respond to a move in the game. Other principles are about, for instance, identity and roles, pleasantly frustrating (difficult, but doable challenges), sandboxes (a situation that feels like real but with risks and dangers greatly mitigated) and system thinking – when we understand how an experience fits into a larger meaningful whole, the experience is enhanced.

Games for health

“Good video games are good for your soul” Gee (2007, p. 7) states. Gee (2007) means that to nurture our souls we need to feel a sense of control and meaningfulness, we need to feel like heroes in our own life story and that our story make sense, and we need to feel that we matter and that we matter in other people’s life stories.

If the body feeds on food, the soul feeds on agency and meaningfulness. I argue that good video games are, in this sense, food for the soul, particularly appropriate food in modern times. Of course, the hope is that this food will empower the soul to find agency and meaning in other aspects of life (Gee, 2007, p. 10).

Although the soul is important for our being, the body and physical health are perhaps what comes first in mind when discussing games for health. A rough classification of games for health can be: 1) COTS entertainment games with music and dance from the late 1990s and games for different consoles such as Wii™, Xbox™ and Kinect™ – games where you are supposed to actively move your body, and 2) sedentary games with the purpose to change the players behavior through interactive health information (cf. Buday, 2015). The first group of health games can also be called exergames – games for players to exercise more (e.g. Brox, Fernandez-Luque & Tøllefsen, 2011) or virtual reality games that involve physical exercise (Wüest, van de Langenberg & de Bruin, 2014).

Interventions using serious games can be divided into three categories: 1) to support rehabilitation, 2) to promote health behavior, and 3) in training of medical personnel (Graafland, Dankbaar, Mert, Lagro, De Wit-Zuurendonk, Schuit, Schaafstal & Schijven, 2014).

Effective COTS health game titles are still in 2015 few to find, according to Buday (2015), even though Cagatay et al. (2012) refers to studies showing that digital games can provide an interactive environment that can affect learning. “Even when the science is right, health games may stumble on execution, boring or otherwise turning off video-game players who come seeking fun”, Buday (2015) argues. So why do health games meet this limited success? Buday (2015) presents the following statements:

- **The serious intent is made too obvious.**
It is important that the game is fun. The entertainment experience can be disrupted by inserted informational and behavioral messages.
- **The role-playing games are made about ourselves, not the players.**
Videogames are dependent on psychological flow, once disturbed it can be hard to reestablish the flow. A health message, such a “remember to drink water five times a day”, can dilute the player’s self-perception as hero (Buday, 2015, p. 39). Instead Buday (2015) recommends communicating with the players stealthily through, for instance, established characters and by storytelling or engineering opportunities for players to discover the information on their own.
- **The serious games are made too safe.**
A strong ingredient for fun is the ability to frequently and miserably fail, which is possible in role-playing games. As in life at the whole, autonomy matters. We want a sense of independence, including the freedom to fail.
- **The player’s choice is made too prescriptive.**
Players do not want the messages presented first, like in newspapers. Instead game-players enjoy figuring out how cause and effect are related, not having it pointed out to them, and they like the satisfaction when they find out if their judgments and conclusions were right.
- **The serious topic is assumed to interest the players.**
Just like other health interventions designers need to acknowledge that “one size will not fit all”. The Transtheoretical Model (TTM), with the six stages indicating the person’s readiness to behavior change, is useful in the development of health games as well.
- **The games are made too easy or too hard.**
The challenges in the game should be challenging, but doable. Buday’s (2015) experience is that “too much help is a recipe for boredom” (Buday, 2015, p. 41).

The road ahead, according to Buday (2015), is to open up application program interfaces to the world (like Apple and Google) and let developers access the technology to push the development.

Method

How successful a literature review is depends on how well relevant studies are identified and valued (Eriksson Barajas, Forsberg & Wengström, 2013). A critical examination of quantitative research, argue Eriksson Barajas et al. (2013), should include the study’s aim and research questions, study design, selection, instruments of measurements, analysis and interpretation. If the question to be answered in the literature review is about, for instance, which videogame is the best and most efficient to support health randomized controlled trials are expected to be the most suitable study design (ibid.). The number of participants is also important for the quality of the study; a large number of participants enable more reliable conclusions of the results.

Evidence-based practice is about using the best available research results before the decision of interventions and actions (Eriksson Barajas et al., 2013). A systematic review is a scientific method based on previously accomplished and published research, and with the objective of developing new evidence-based knowledge (ibid.). Unlike a more general overview, the sys-

tematic review is based on several criteria, such as: 1) the availability of a sufficient number of studies of good quality, and 2) clearly described criteria and methods for literature search and selection of articles (ibid.). General overviews can be unreliable if a systematic onset is missing, if the author only had access to a limited amount of relevant research, and if the selection is made selectively. Thus, wrong conclusions can be drawn.

For the purpose of this study, a systematic literature search was performed with the aim of identify, analyze and compile relevant research in the field of health games for children in order to map out perspectives of health and in the studies “extract” underlying theories and concepts.

Search strategy and data source

The PICO-method is a structured method to frame the search strategy (Eriksson Barajas et al., 2013). PICO is short for:

- P Population – *here* children
- I Intervention – *here* videogames for health
- C Control – *here* other interventions for health
- O Outcome – *here* health

However, the main purpose with this study was not to evaluate or compare the *outcome* of the interventions and studies in the current literature, but to map out perspectives on health and underlying theories and concepts using health games for children. Therefore I was interested in neither control groups (if any) nor the outcome as such of the game playing. The search strategy used was therefore broader primarily focusing on P (children) and I (videogames for health) above. By the same reasoning, no evaluations of the studies has been performed in this literature review, because the aim of this study was neither to find out studies with the best designs to test hypothesizes and prove effect nor to compare the studied games.

The search was performed in late March and in early May 2015 in major knowledge databases, such as ERIC, PubMed and IEEE Xplore, in Gothenburg university library (GU) and Halmstad university library (HH).

Inclusion and exclusion criteria

The main key words used were games, theory, evaluation, children and design, all combined with health using Boolean operators. In total 323 articles and conference proceedings were identified. Articles about education, teaching, cyber bullying, gambling, robots and wearable systems were excluded. All included articles were peer-reviewed and written in English. Articles published in the latest five years in scientific journals or conference papers were included. After reading abstracts the final exclusion together with removal of doublets resulted in 55 articles and conference papers remaining; 40 articles published in journals and 15 conference papers. Henceforth the resulting research materials are collectively called ‘articles’. The complete search scheme is presented in Appendix 1.

Analysis

First, the articles were divided into two groups by the implicit perspective of health; salutogenic or pathogenic perspective. This was done at the same time as I summed the articles (author, title, aim, sample, research design and major findings briefly described) in Appendix 2. After that I collected theories and concepts from the articles and divided the articles in groups by this.

Ethical considerations

Since this study is a literature review of previous conducted intervention studies I have not made any ethical considerations about the requirements of information to the participants and their consent to participate, confidentiality and use of the study results and findings. The ethical considerations are accounted for in the studied intervention studies respectively.

Results

A compilation of the resulting research material is presented in Appendix 2. The studies have not been evaluated with respect to any variable, such as study design, selection or instrument of measurements (see above). The papers found are of different types; original article, research article, research brief, study protocol, commentary and conference paper. Fifteen of the papers are proceedings from different conferences. In Table 1 below the articles are listed to show the type of publication; conference paper or scientific journal. Three categories of conferences could be discerned: 1) engineering, technology and computing conferences, 2) virtual worlds, serious applications, game and media conferences, and 3) serious games and applications for health conferences.

The scientific journals are also of different types; 1) medical journals in areas such as pediatrics, obesity, nutrition, sport, developmental disabilities, rehabilitation, preventive medicine, public health and health communication, 2) computing, visualization and computer graphics, 3) education and social issues, and 4) technology in medicine/healthcare/rehabilitation, medical Internet research serious games and games for health.

This chapter of results is divided into three sections to mark the different issues in the guiding questions. In the first section the compilation of the perspective of health in the articles (Table 1) take a large space. Some more detailed descriptions of the assumed perspective follows after the table. The second section is divided into sub-sections (behavioral theories, health communication, collaboration and support and “good for the soul” respectively) and even sub-sub-sections (e.g. a specific theory) in order to make it clear for the reader. The last section is divided into sub-sections. Finally, this chapter is ended with a summary and analysis of the results.

Perspectives on health

The perspective of health was not explicitly expressed in the articles; instead it was implicit, often found in the introduction such as the following:

In the recent years, the childhood obesity epidemic has been recognized as a serious public health concern due to its numerous effects on the children's health. [...] Obese

children may also become antisocial and may suffer from depression [...] This leads them to isolate themselves and have activities and/or hobbies that do not require any contact or collaboration with other kids. [...] This resulted in several research attempts to address the obesity epidemic which led to the development of the exergaming concept (Maamar, Boukerche & Petriu, 2012, p. 1079).

In about one quarter of the articles the salutogenic perspective could be observed; the articles had focus on health, not disease, and to strengthen health factors in the children's lives and environment. However, in most of the articles a pathogenic perspective were assumed and the aims for the games was, for example, to be a part in the prevention of diseases, to prevent obesity, to avoid injuries and to be a tool in the physical rehabilitation. See Table 1 below for a compilation of the perspective of health that can be discerned. Some articles, on the other hand, focused on health factors and the purpose of games here was to strengthen healthy behavior such as eating more vegetables and motivate to physical activity.

Table 1. A compilation of the perspective of health assumed in the articles, together with type of publication (C – conference paper and J – scientific journal). Articles with an assumed salutogenic perspective are placed before articles with a pathogenic perspective.

Authors	Perspective of health	Publication
Ceccon Ribeiro & Barbosa Raposo (2014)	Salutogenic – encourage communication (autism)	C: International Conference on Serious Games and Applications for Health (SeGAH)
Finkelstein, Barnes, Wartell & Suma (2013)	Salutogenic – motivation to physical activity (children with Autism Spectrum Disorder (ASD))	C: Workshop on Virtual and Augmented Assistive Technology (VAAT)
Abirached, Yan Zhang, Aggarwal, Tamersoy, Fernandes, Miranda & Orvalho (2011)	Salutogenic – improving communication skills (ASD)	C: International Conference on Serious Games and Applications for Health (SeGAH)
Poole, Eiriksdottir, Miller, Yan Xu, Catrambone & Mynatt (2013)	Salutogenic – promote physical activity	C: International Conference on Pervasive Computing Technologies for Healthcare (PervasiveHealth)
Lwin & Malik (2014)	Salutogenic – influencing beliefs about physical activity	J: Journal of Health Communication
Brazendale, Chandler, Beets, Weaver, Beighle, Huberty & Moore (2015)	Salutogenic – promote moderate-to-vigorous physical activity (MVPA)	J: Preventive Medicine
Larsen, Grønbech Jørgensen, Junge, Juul-Kristensen & Wedderkopp (2014)	Salutogenic – improve balance control in relation to coping with daily activities	J: BMC Pediatrics

Authors	Perspective of health	Publication
Rosa, Ridgers & Barnett (2013)	Salutogenic – promote physical activity	J: Perceptual & Motor Skills: Physical Development & Measurement
Gao, Hannan, Xiang, Stodden & Valdez (2013)	Salutogenic – promote physical fitness and academic achievement	J: American Journal of Preventive Medicine
Straker, Campbell, Jensen, Metcalf, Smith, Abbott, Pollock & Piek (2011)	Salutogenic – promote physical and mental health (developmental coordination disorder)	J: BMC Public Health
Perhamus (2010)	Salutogenic – a child-centered game as a methodological tool for collecting data about how children recontextualize standardized, official health messages into personally meaningful, context-specific health knowledge	J: International Journal of Qualitative Studies in Education
Matsunaga, de Oliveira Moraes, Borges, Matta & Ozelo (2014)	Pathogenic – teach properly behaviors and self-care management (hemophilia)	C: International Conference on Serious Games and Applications for Health (SeGAH)
Burdea, Jain, Rabin, Pellosie, & Golomb (2011)	Pathogenic – hand rehabilitation (children with hemiplegia due to cerebral palsy or traumatic brain injury)	C: International Conference of the IEEE Engineering in Medicine and Biology (EMBS)
Maamar, Boukerche & Petriu (2012)	Pathogenic – preventing childhood obesity	J: IEEE Transactions on Information Technology in Biomedicine
Correa, Cuervo, Perez, & Arias (2014)	Pathogenic – rehabilitation (amblyopia)	C: International Conference on Serious Games and Applications for Health (SeGAH)
Scarle, Dunwell, Bashford-Rogers, Selmanovic, Debattista, Chalmers, Powell & Robertson (2011)	Pathogenic – preventing childhood obesity	C: International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES)
Almonani, Husain, San, Almonani & Al-Betar (2014)	Pathogenic – preventing childhood obesity	C: International Conference on Computer and Information Sciences (ICCOINS)
Macvean (2011)	Pathogenic – preventing childhood obesity	C: International Conference on Pervasive Computing and Communications Workshops (PERCOM Workshops)
Amresh, & Small (2014)	Pathogenic – preventing childhood obesity	C: International Conference on Serious Games and Applications for Health (SeGAH)

Authors	Perspective of health	Publication
McKenzie, Bangay, Barnett, Ridgers & Salmon (2014)	Pathogenic – preventing problems following insufficient physical activity	C: Games Media Entertainment (GEM)
Nixon & Howard (2013)	Pathogenic – rehabilitation (upper extremity)	C: International Conference on Systems, Man, and Cybernetics (SMC)
Hoberman, Gotsis, Sacher, Bolas, Turpin & Varma (2012)	Pathogenic – preparing children for vision controls	C: International Conference on Creating, Connecting and Collaborating through Computing (C5)
Pollak, Gay, Byrne, Wagner, Retelny & Humphreys (2010)	Pathogenic – preventing childhood obesity	J: Pervasive Computing
Fraiwan, Khasawneh, Malkawi, Al-Jarrah, Alsa'di & Al-Momani (2013)	Pathogenic – physiotherapy and rehabilitation	C: International Conference on Innovations in Information Technology (IIT)
Johnsen, Sun Joo Ahn, Moore, Brown, Robertson, Marable & Basu (2014)	Pathogenic – preventing childhood obesity	J: IEEE Transactions on Visualization and Computer Graphics
Kamel Boulos, Gammon, Dixon, MacRury, Fergusson, Rodrigues, Mourinho Baptista & Yang (2015)	Pathogenic – disease management (type 1 and type 2 diabetes)	J: Journal of Medical Internet Research Serious Games
Luna-Olivia, Ortiz-Gutiérrez, Cano-de la Cuerda, Martínez Piédrola, Alguacil-Diego, Sánchez-Camarero & del Carmen Martínez Culebras (2013)	Pathogenic – physical rehabilitation (cerebral palsy)	J: NeuroRehabilitation
Elias, Rajan, McArthur & Dacso (2013)	Pathogenic – disease management (asthma)	J: Medicine 2.0
Staiano & Calvert (2012)	Pathogenic – preventing childhood obesity	J: Social Issues and Policy Review
Sharma, Shegog, Chow, Finley, Pomeroy, Smith & Hoelscher (in press 2015)	Pathogenic – preventing childhood obesity and diet-related chronic diseases through promoting a healthy diet	J: Journal of the Academy of Nutrition and Dietetics.
Lau, Liang, Lau, Choi, Kim & Shin (2015)	Pathogenic – preventing childhood obesity	J: International Journal of Environmental Research and Public Health

Authors	Perspective of health	Publication
Knutz, Ammentorp & Kofoed (2015)	Pathogenic – improve communication between healthcare providers and hospitalized children	J: Health Communication
Radtka, Hone, Brown, Mastick, Melnick & Dowling (2013)	Pathogenic – physical (balance) rehabilitation (cerebral palsy)	J: Games for Health Journal
Panic, Cauberghe & De Pelsmacker (2014)	Pathogenic – promote dental hygiene (threat, information)	J: Journal of Health Communication: International Perspectives
Baranowski, Diep & Baranowski (2013)	Pathogenic – preventing chronic diseases (by promoting fruit and vegetables)	J: Annuals of Nutrition and Metabolism
Mellecker & McManus (2014)	Pathogenic – preventing childhood obesity	J: Journal of Science and Medicine in Sport
Ferguson, Jelsma, Jelsma & Smits-Engelsman (2013)	Pathogenic – physical rehabilitation (developmental coordination disorder)	J: Research in Development Disabilities
Mills, Rosenberg, Stratton, Carter, Spence, Pugh, Green & Naylor (2013)	Pathogenic – preventing vascular functional problems (healthy children)	J: Journal of Pediatrics
Weightman, Preston, Levesley, Bhakta, Holt & Mon-Williams (2014)	Pathogenic – physical rehabilitation (cerebral palsy)	J: Disability and Rehabilitation: Assistive Technology
Tatla, Radomski, Cheung, Maron & Jarus (2014)	Pathogenic – balance therapy (brain injury)	J: Developmental Neurorehabilitation
Ramstrand & Lyngnegård (2012)	Pathogenic – physical rehabilitation (cerebral palsy)	J: Technology and Health Care
Jelsma, Pronk, Ferguson & Jelsma-Smit (2013)	Pathogenic – physical rehabilitation (cerebral palsy)	J: Developmental Neurorehabilitation
Inglés-Camats, Montserrat Presno-Rivas, Antonijoan, García Pañella & Forrest (2012)	Pathogenic – teaching healthy eating and food habits (for reducing the risk of cancer)	J: Studies in Health Technology and Informatics
Baranowski & Frankel (2012)	Pathogenic – preventing childhood obesity	J: Childhood obesity
Howcroft, Klejman, Fehlings, Wright, Zabjek, Andrysek & Biddiss (2012)	Pathogenic – physical rehabilitation (cerebral palsy)	J: Archives of Physical Medicine and Rehabilitation
Christison & Khan (2012)	Pathogenic – preventing childhood obesity	J: Clinical Pediatrics

Authors	Perspective of health	Publication
McGaffey, Abatemarco, Katz Jewell, Fidler & Hughes (2011)	Pathogenic – preventing childhood obesity	J: Journal of the American Board of Family Medicine
Baranowski, Baranowski, Thompson & Buday (2011a)	Pathogenic – preventing childhood obesity	J: Journal of Diabetes Science and Technology
Adamo, Rutherford & Goldfield (2010)	Pathogenic – preventing childhood obesity	J: Applied Physiology, Nutrition, and Metabolism
Baranowski, Baranowski, Thompson, Buday, Jago, Griffith, Islam, Nguyen & Watson (2011b)	Pathogenic – preventing childhood obesity	J: American Journal of Preventive Medicine
Thompson, Baranowski & Buday (2010)	Pathogenic – disease management (diabetes)	J: Journal of Diabetes Science and Technology
Golomb, McDonald, Warden, Yonkman, Saykin, Shirley, Huber, Rabin, AbdelBaky, Nwosu, Barkat-Masih & Burdea (2010)	Pathogenic – physical rehabilitation (cerebral palsy)	J: Archives of Physical Medicine and Rehabilitation
Baranowski, Thompson, Buday, Lu & Baranowski (2014)	Pathogenic – preventing childhood obesity	J: International Journal of Computer Science in Sport
Culp, Bell & Cassady (2010)	Pathogenic – prevent children eating unhealthy food Salutogenic – promote children eating healthy food	J: Journal of Nutrition Education and Behavior
Hansen & Sanders (2010)	Pathogenic – preventing childhood obesity	J: ICHPER-SD Journal of Research

The method of engaging in physical activity for children with autism was applied by Finkelstein et al. (2014) because other modern methods to address behavioral difficulties include elements that stress the child. In this game “Astrojumpers” the participants had fun while they were moving; they controlled the game with their body. The implicit salutogenic perspective appeared in this study in terms of strengthening health factors, such as physical activity. The game allowed the players to project their fantasies during gameplay which encouraged them playing.

Maamar et al. (2012) aimed at tackling the childhood obesity on a first plane and the anti-social aspect on the second plane with the new trend of mobile collaborative exergaming. This type of gaming allows the children as a team to exercise longer and it is therefore, as Maamar et al. (2012) claimed, a significant connection between exergaming and childhood obesity.

Exergames are considered the innovative approach for fighting several health problems such as obesity, where a combination of “exercise” and 3-D “gaming” are proposed to incite kids to exercise as a team (Maamar et al., 2012, p. 1079).

The aim with exercise in this game was to prevent or decrease prevalence of obesity which is a pathogenic perspective, and this applies to several of the studied articles (see Table 1 above). The same Scarle et al. (2011) applied who designed a game where all user interaction for the game was supplied via movement. Scarle et al. (2011) were aware of that players *over-learned* the control system in order to minimize their effort. The children figured out how to play the game without doing the full body movement, as it was intended. Ideally, according to Scarle et al. (2011), the serious (active) games (by others called exergames) should also increase energy expenditure during play, and not be a sedentary activity. Macvean (2011) highlighted the twofold main aim with exergames: 1) to encourage the players to exercise (in the immediate term), and 2) to facilitate behavioral change such that beyond the scope of the game, the players continue to exercise and do not lose motivation (in the long term). The exergames should thus continue to demand exercise.

Another aim with serious/active videogames was to promote change in diabetes risk behaviors in children (e.g. Baranowski et al., 2011a; Baranowski et al., 2011b). The physical activity and the increased knowledge about a healthy diet could of course also be “tools” in a salutogenic perspective – to increase health thru strengthening of positive factors. However, in many of the studied articles in Table 1 the motive is to *prevent* something or *decrease* something, a disease or a bad habit or behavior. Due to this motive of prevention behind the promotion of physical activity and healthy eating behavior or what it can be the perspective of these studies are categorized as assuming a pathogenic perspective.

Theories and concepts used in the articles

Below follows the results of theories and concepts found in the studied articles. As the observant reader soon will notice, several of the concepts will be mentioned in more than one subsection. The authors of the articles might have used the concepts in different contexts and in relationships with different theories, and for that reason I have chosen to write about the same concept and describe the results in more than one section. Initially, some quotes of the importance of using theories in interventions:

The use of theory can help to achieve a better fit between problem and program (Nutbeam, Harris & Wise, 2010, p. ix).

Developers and health practioners trying to influence behavior change and health outcome should consider comprehensive integration of behavioral theory, independent of whether or not games or gamification is used (Lister, West, Cannon, Sax & Brodegard, 2014).

Incorporating theory-based procedures into electronic programs appears to offer the most promise (Baranowski & Frankel, 2012, p. 36).

Behavioral theories

In several of the studies different behavioral theories and models are described in more or less detail. The aim with this study is not to describe every single theory, but to map out theories

and concepts used in the studied articles. Therefore, some of the theories are just mentioned, and the interested reader may search more information about these theories on his/her own.

Models of behavior change

Baranowski et al. (2014) highlighted some models of behavior change and their usefulness in designing active videogames, because, the authors argued, is not sufficient with increased knowledge for behavior change.

Behavior change interventions must be predicated on proven highly predictive and causal models of behavior (Baranowski et al., 2014).

Theories and models from which ideas are incorporated into active video games, described by Baranowski et al. (2014), are Self Determination Theory (SDT), the Elaboration Likelihood Model (ELM), and Social Cognitive Theory (SCT). In SDT the focus are on motivation as the strongest factor driving behavior, and mainly the intrinsic⁷ motivation which according to SDT can be promoted by: 1) competence (similar to self-efficacy), 2) autonomy, and 3) relatedness (agreement to personal values). Behavior that is intrinsically motivated tends to be sustained for a longer time compared to extrinsically controlled behavior. This since the later will require continued reinforcement from outside.

Social cognitive theory (SCT)

The development of InSpire, a fully functional interface between a handheld spirometer⁸ and an interactive game together with an individualized asthma-care instant-messaging system housed on a mobile phone, is built on the social cognitive theory (Elias et al., 2013).

Increasing children's sense of partnership in their care and decreasing the barrier of access to quality, reliable, and personalized health information are necessary goals to achieving improved outcomes for the pediatric asthma population (Elias et al., 2013).

The development of the mobile application InSpire was performed using the Medicine 2.0 principles of participation, cocreation, and information sharing (Elias et al., 2013).

Johnsen et al. (2014) designed and constructed a mixed reality system that allowed children to exercise, play with, and train a virtual pet using their own physical activity as input. Their theoretical framework was grounded in SCT and included three dimensions; individual, social and environmental. The system focused more on intrinsic rewards (e.g. increased self-efficacy, personal satisfaction, positive feeling towards exercise), rather than extrinsic rewards (such as points and prizes) (Johnsen et al., 2014). The game was tested with children on a summer camp and the researchers observed the following results:

the virtual pet succeeded in motivating the treatment group to exercise significantly more than their peers in the control group, who only had activity monitors and the motivation from goal-setting. The effects did

⁷ Intrinsic motivation (from the inside, from myself) in contrast to extrinsic motivation, i.e. external influences (Baranowski et al., 2014).

⁸ A spirometer is an apparatus for measuring the velocity and the volume of air the person is blowing out (<http://www.1177.se/Halland/Fakta-och-rad/Undersokningar/Lungfunktionstest/> 2015 July 25).

not appear to diminish over time, a concern with most innovative technology solutions (Johnsen et al., 2014, p. 529f).

The children at the camp participated in lots of different activities and the study did not take into account the organizational structure of the camp. The study period for this game was 72 hours (Johnsen et al., 2014).

The game *Quest to Lava Mountain*, evaluated by Sharma et al. (2015), targeted nutrition and physical activity for elementary school students. The game was grounded in SCT and Theory of Reasoned Action (TRA) and should help children understand and apply five core concepts: 1) food is fuel, 2) food and physical activity are related, 3) healthy food and beverages such as fruit, vegetables and water provide nutrients for optimal performance and stamina, 4) healthy diet includes consuming a variety of healthy foods in moderation, and 5) a physically active lifestyle helps to maintain optimal health (ibid.).

Game components include mazes, interactive activities, and simulations to integrate nutrition concepts. These are designed to influence psychosocial determinants of knowledge, self-efficacy, behavioral capability, outcome expectancy, perceived norms, and intentions toward healthy eating and physical activity (Sharma et al., 2015).

The children participating in this study did not change their habits of eating fruit and vegetables, but compared to children in control groups these children reported to consume significantly less sugar after playing *Quest to Lava Mountain* (Sharma et al., 2015).

Self-efficacy

Self-efficacy is a concept mentioned in many of the studied articles (e.g. Baranowski et al., 2013; Kamel Boulos et al., 2015; Lwin & Malik, 2014). The combined intervention with exergaming and theory-based health education messages Lwin and Malik (2014) conducted was suggested to conduce children's self-efficacy. Baranowski et al. (2013) argued for selecting appropriate behavior change procedures in the videogame: when characters in the game show how to perform the task and the player is repeatedly exposed to a change task with encouraging feedback the self-efficacy might increase. In a similar way Kamel Boulos et al. (2015) discussed four aspects for building self-efficacy in videogames for persons with diabetes: 1) provide achievements related to diabetes management, 2) create vicarious experience through social features with peer-to-peer sharing of successes and tips of diabetes management, 3) maximize incoming social messages of encouragement, and 4) provide empowering and emphatic messages and narratives.

Transtheoretical model (TTM)

"HealthSeeker" was the first-of-its-kind health game on Facebook, and was also available as an app for Android and iOS devices (Kamel Boulos et al., 2015). The purpose with the game was to help people with diabetes improve their health through lifestyle changes, and TTM was the model used during the design work (ibid.). For every stages of change game elements were strategically employed to motivate the player. A progress from the stage of contemplation to preparation and action of necessary lifestyle changes could be seen by players (ibid.).

Theory of planned behavior (TPB)

In the development of effective intervention strategies to influence behavioral change it is useful with an understanding of behavioral determinants. TPB points out behavioral intention, reflecting a person's plans and motivation to engage in a specific behavior, as the most proximal determinant of behavior (Lwin & Malik, 2014). Lwin and Malik's (2014) findings suggested that exergaming and health message interventions together influenced children's beliefs in physical activity, attitudes, self-efficacy and perceived behavioral control.

Motivation

Just like other researchers (see in "Health messages" below) Radtka et al. (2013) and Tatla et al. (2014) seemed to believe that the videogames in themselves are motivating and can provide the players with practice of different skills.

Computer-based videogames are hypothesized to be effective by creating engaging activities that motivate people to exercise. [...] One of the benefits of videogames is that they can provide a progression of increasingly difficult challenges that help keep players engaged and motivated over extended periods of time (Radtka et al., 2013, p. 223).

VR has been described as an engaging rehabilitation intervention for children and youth, motivating them to repeatedly practice goal-directed tasks thereby potentially improving motor skill performance (Tatla et al., 2014, p. 2).

Since there currently is no valid outcome measure for evaluation motivation for rehabilitation therapy, Tatla et al. (2014) created a Pediatric Motivation Scale (PMS) for their study to be able to assess the children's motivation to participate in their rehabilitation. Four questions should examine both the level of enjoyment and the feeling of confidence in rehabilitation using five smiley faces as the visual analog scale. The reliability and validity of this PMS instrument had, when the article was written, not yet been tested (Tatla et al., 2014). The results from the study showed that the motivation for therapy treatment remained high during the intervention (ibid.).

Almost all exergames has ego-involved goal based systems, according to Macvean (2011), meaning that goals are to be completed to boost the ego of the individual. A task-involved goal, on the other hand, is a goal the player strives to reach because the task itself is interesting, to satisfy his/her own curiosity, or to improve his/her performance in the task, irrespective of their peers (ibid.). This goal context of pervasive exergames and how it will provide motivation to the user will Macvean (2011) investigate in his PhD thesis.

Health communication

Health messages

Lwin and Malik (2014) raised the fact that most studies of assessing the efficacy of exergaming in boosting physical activity lack theoretical framework, instead the studies focus physiological measurements. In their study they integrated exergaming and message interventions. The results of their study supported the potential of health messages grounded in health communication theory to improve children's physical activity beliefs. The messages

framed on the basis of the Protection Motivating Theory's (see below) coping appraisals are especially successful, according to Lwin and Malik (2014).

Pollak et al. (2010) assumed persuasive technology, mobile computing and health games together with teens' frequent use of mobile phones to design "Time to Eat", a mobile-phone-based virtual-pet game intended to improve adolescents' eating behavior. The mobile phone might be "the perfect instrument for delivering persuasive messages", argued Pollak et al. (2010, p. 22) and continued, but "individuals must be adequately motivated before they change their behavior" (Pollak et al., 2010, p. 22). And it is here the game comes into play.

Children must be motivated to make this behavior change, and the existing interactive media systems are a potential motivational mechanism (Johnsen et al., 2014, p. 523).

Just as Johnsen et al. (2014) quoted above, Pollak et al. (2010) seemed to mean that the game itself will motivate the children to healthier food habits. So, what about the game? The pets will send messages to its owner, healthy-eating reminders like "A healthy breakfast is important!" and "Have a glass of water and a healthy snack and send us the picture!". Nutritionists examine the photos and an appropriate message is returned to the player. The feedback can be like "Yesterday's breakfast wasn't great, and neither is two doughnuts. Can you try something healthier tomorrow, like oatmeal with fruit?" (Pollak et al., 2010, p. 23).

According to the authors, the study's findings were conclusive: children who played "Time to Eat" had a healthy breakfast 52 percent of the time, while children who did not play only had a healthy breakfast 20 percent of the time (Pollak, 2010). Notably, no data from pre-measurements about having healthy breakfast were presented in the article. The authors claimed that the children should be motivated to maintain a healthy diet from the satisfaction of raising a happy pet. The solution is, therefore according to Pollak et al. (2013), to design the game to enable strong relationships between children and pets which will lead to motivation to change behavior.

Protection motivating theory (PMT)

This theory is useful in guiding the construction of health messages, Lwin and Malik (2014) argued, because it posits that protection motivation (the intention to protect oneself from negative health conditions) is determined by an individual's threat and coping appraisals. Lwin and Malik (2014) concluded that coping-framed messages are more effective than threat-framed messages in influencing physical activity beliefs, and recommended schools and health authorities to emphasize beliefs that were not previously held by the children.

Processing of commercialized media content (PCMC) model

This is one of the models mentioned in the study of Staiano and Calvert (2012) that are used to explain children's lack of comprehension of commercial intent in advergames⁹. This model is a modern model that responds to the changing marketing landscape (more than television commercials) experienced by youth. The authors argued that with knowledge in marketing, information and persuasion models the development of innovative, effective games that are engaging and fun may lead to a healthier lifestyle among digital natives (ibid.).

⁹ online games that market branded products.

Narrative sequence of emotion

Communication between health care professionals and small children may be complicated by the fact that small children cannot always express and communicate their feelings and needs verbally (Knutz et al., 2014). A question raised by the authors was: “Is it possible to use play and games for measuring and mapping the emotional experiences felt by pediatric patients?” (ibid., p. 2). Theories the researchers used in developing their game; Child Patient Game, were emotion theory together with narrative theory. Emotion theories have offered valuable models and frameworks for observing, registering, and evaluating how people react emotionally to certain situations (Knutz et al., 2014). The including of narrative theory enabled understanding and exploring the concept of fictional emotion; the patient could communicate their emotions through the act of the game play (ibid.). The findings showed that Child Patient Game could function as a system in which children were willing to express their emotions.

Extended Parallel Processing Model (EPPM)

According to this model threat appeals might evoke a danger or a fear control process depending on perceived threat and perceived efficacy (Panic et al., 2014). Only a combination of a strong enough perceived threat and a high perceived efficacy will motivate people to adopt their behavior following the recommendation in the message, argued Panic et al. (2014). Although this effect is well-established, Panic et al. (2014) referenced, it is mainly with adults, and therefore they in their study investigated children’s behavior influenced by threat appeals in combination with videogames.

The findings followed the expectations from EPPM, Panic et al. (2014) observed, however threat appeals integrated in an educational setting should be accompanied with additional course material to provide children with sufficient health-related information.

The main conclusion of this study is that games, pleasant and attention-getting as they may be, may not always be the most effective medium to reinforce a strong threat appeal (Panic et al., 2014, p. 570).

Another conclusion from Panic et al. (2014) is that although videogames possess many motivational stimuli, they might act as a distraction because of the interactivity and the evoked feelings of immersion and absorption.

Collaboration and support

Participatory design

The game described in the work of Matsunaga et al. (2014) is an educational game that is aimed at children with hemophilia and will teach them properly behaviors and self-care management. The game should be motivating and engaging. The authors got the idea of a game from a child with the disease, and the developers identified the need to involve the end users (i.e. children with hemophilia). This project used participatory design and the children participated in workshops for dynamic formation of characters and game scenarios (ibid.).

Even though no complete participatory design was used Baranowski et al. (2014) employed both quantitative (surveys) and qualitative (focus groups) methods to get to understand player

preferences and expectations. Based on the children's preferences games were designed to enable the player to modify diabetes-related lifestyle behaviors (ibid.).

Collaborative exergaming

In the protocol Maamar et al. (2012) proposed a mobile collaborative exergaming application based on peer-to-peer architecture. The intentions for the game are that the children are incited to move inside a large area using for instance head-mounted devices and do physical activities and collaborate with other children (ibid.). Although the collaboration is a "theme" in the game, the first focus for the developers are to tackle the childhood obesity.

Social support

In the game used by Poole et al. (2013) the children wore pedometers and collected steps for their customizable cartoon horses in a race. The horses competed in different teams against other schools. Daily physical activity was moderately increased through the game play, but Poole et al. (2013) emphasized the importance of social support and opportunities for structured group activity in pervasive health games. Of all different angles of social support, Poole et al. (2013) focused on informational support, companionate support and esteem support as well as perceptions of support. For school-aged children the social support from parents is especially important, while the peer-support will take over when the children grow up.

One important aspect of social support is conversations about physical activity. It has been shown that having conversations about when and how to do physical activity can contribute to better health as well as self-efficacy (Poole et al., 2013). Encouragement and praise, as well as reminders (such as "Remember to wear your pedometer"), were given to the students from parents and teachers during the intervention. Social support and encouragement from the family were highlighted also by Burdea et al. (2011) (see p. 37 below). The students in Poole's et al. (2013) study did not, however, perceive their parents as being so encouraging.

Statements from teachers to these "horse-racing" students said that:

the sense of being a part of a team was important motivator for the students, especially ones not otherwise involved in team sport (Poole et al., 2013, p. 165).

This statement supported the author's conclusions. Since parents, teachers, and other adults have at least a bit of control over a child's activities and decision-making, Poole et al. (2013) suggested considering ecosystem of social support received by intervention users. The social support may be given by other people or come from the intervention itself (ibid.).

The social design of the game HealthSeeker was prompted by the primary research insight that a diagnosis of diabetes often is accompanied by a sense of loneliness (Kamel Boulos, 2015). The game had a social design – the players could challenge and share missions with others, and share and celebrate accomplishments – and it was shown that "actively social players solved more missions than players without friends" (Kamel Boulos et al., 2015).

Social comparison theory

According to this theory people are motivated to compare themselves to others (Poole et al., 2013). The results of these comparisons can, however, be both positive and negative; a person

may discover doing quite well compared to peers or doing poorly compared to peers. In the game studied by Poole et al. (2013) the player could see his/her number of steps taken and also the team's position compared to other teams. There was little evidence found that the students engaged in individual comparing in the game, the findings indicated, however, that the students enjoyed the competition aspect and took (at least initially) responsibility for the team's position (ibid.). The authors suggested, given their findings, that there may be benefits to support team-based competitions and comparisons.

“Good for the soul”

Not only physical health benefits come from playing exergames, but evidence is emerging also for socioemotional benefits that might motivate children to continue playing on a regular basis, claimed Staiano and Calvert (2012).

Having fun

Having fun is the main thing with gaming, otherwise we would not play the games. One way to make the game fun, Finkelstein et al. (2013) observed, is to enable the children to project their fantasies during gameplay and to involve their special interests. Another observation made by Finkelstein et al. (2013) was that children feeling not so good at sports compared to their peers chose more solitary activities (e.g. swimming and bowling) over team sports. On the other hand, children with more confidence in their athletic competence participated in team sports. Finkelstein et al. (2013) believed that if the exercising is made fun it might increase a child's confidence in his/her physical ability.

The fun in playing videogames serves as an intrinsic motivator, meant Baranowski et al. (2014) and continued with some explanations of why playing videogames are fun: active involvement (interactivity), overcoming challenges, risk free choosing and observing the consequences, immediate feedback, increasing difficulties (levels), and finally personally relevant stories and characters in meaningful situations.

To prevent the children from being bored in the game the developers are planning to add features to engage and excite them beyond the game's initial appeal (Pollak et al., 2010). The children will be able to make the game more personalized and interact with other players.

Flow theory

Hansen and Sanders (2010) begun by referring to researchers that suggested that students who are intrinsically motivated to perform a task often experience “flow”. The flow theory by Csikszentmihalyi, used to explain the major theme in the article by Hansen and Sanders (2010), consists of nine components:

- Balance between a challenging activity with an individual's skills
- Clear goals
- Immediate feedback
- Merging of action and awareness
- Intense concentration
- Loss of self-consciousness
- Sense of control
- Intrinsically motivated

- Altered sense of time

The major theme found in the study was “persistence to game” (Hansen & Sanders, 2010, p. 35) and was defined as “a natural characteristic of children to voluntarily engage and remain engaged in technology driven physical activities” (ibid.). Hansen and Sanders (2010) argued that their study supported that videogaming is enjoyable and provides motivation to exercise.

Challenges that are in the sweet spot between “too easy and therefore boring” and “hard and therefore frustrating” tend to maximize player engagement (Radtka et al., 2014, p. 223).

Radtka et al. (2014) argued that this “zone”, or flow, is similar to Vygotsky’s concept “Zone of Proximal Development” (ZPD) where learning occurs. The learning in ZPD is enabled, according to Vygotsky (1978), through guidance of peers (or adults).

Incremental rewards

The game “Time to Eat” (Pollak et al., 2010) is mentioned earlier in this essay, and the developers’ argumentation about building a strong relationship between the children and their virtual pets in order to increase the children’s “desire to eat healthily” (Pollak, 2010, p. 25). The recipe for promoting this stronger relationship between the child and the pet is, according to Pollak et al. (2010), to provide incremental rewards. It should, for instance, be possible for the players to have new options in higher levels, and to unlock certain items once the pet reached a specific state (ibid.).

Self-adaptive video game

A self-adaptive videogame can measure a person’s abilities and motivations to then configure the game’s content (Correa et al., 2014). This adaptability is important in rehabilitation games as well as *meaningful play*, *challenge* and *conservative handling of failure* (ibid.). A meaningful game is a game that provides clear, consistent and meaningful feedback in response to the players’ actions. The challenges should be challenging but doable, and in these games also be designed to dynamically adapt the level to the player’s performance.

Assumptions about health and learning

Physical activity

It has been reported, Ferguson et al. (2013) wrote, that children with Developmental Coordination Disorder (DCD) avoid physical activity due to poor self-efficacy, and therefore often fail to develop motor coordination skills, strength and cardiorespiratory fitness. Since Neuro-motor Task Training (NTT) as well as Nintendo Wii Fit Training has shown promising strategies to support children with motor coordination problems, the aim of Ferguson et al.’s (2013) study was to compare these two interventions in improving motor activity. The findings of this study; children in the NTT group showed greater meaningful changes in motor proficiency compared to the Wii group, concur with other findings where larger effect for task oriented intervention approaches were reported (Ferguson et al., 2013). The tasks the NTT group was engaged in were familiar tasks, the Wii group, on the other hand, was largely unfamiliar with the gaming interface. It is commonly understood, Ferguson et al. (2013) argued,

that task specific training leads to improvements in the task practiced. The NTT group showed greater improvements in balance, significant improvements in functional strength, and greater improvements in both aerobic and anaerobic capacity compared to the children in the Wii group (ibid.).

Mills et al. (2013) investigated whether acute bouts of exergaming could elicit changes in cardiovascular function and health in healthy children. The exergaming was performed at either high or low intensity. The data suggested that high intensity exergaming may provide a substrate for beneficial vascular adaptation in children, and since the participants reported similar enjoyment levels between high and low intensity exergaming the children may play at high intensity as well as at low (ibid.).

This has positive implications for compliance with a form of gaming that can potentially elicit beneficial vascular adaptation, without reducing enjoyment. Higher intensity exergaming may be a good form of activity for children to use to gain long-term and sustained health benefits (Mills et al., 2013, p. 809).

The exergaming session in this study was 15 minutes long (or short) and neither of the participating children had an Xbox 360-Kinect at home (Mills et al., 2013). This type of gaming was thus new to them.

Christison and Ali Khan (2012) described a community-based pediatric weight management program using active videogames called Exergaming for Health. Although the mean weight change was -0.19 kg (SD=1.92, P=0.544, n=40) and the fast-food intake, and television watching during meals, did not change during the intervention the authors claimed:

This study adds to a growing but limited body of literature describing the practical application of exergaming to weight management for children (Christison & Ali Khan, 2012, p. 386).

The positive effects of this Exergaming for Health was rather psychological and behavioral, described as “secondary outcomes” in the beginning of the article, than physical. In another study with overweight and obese adolescents a comparison between stationary cycling to music and interactive videogame cycling was evaluated (Adamo et al., 2010). The result showed no differences in exercise modalities between these two exercise conditions, except for a positive advantage for the stationary cycling to music. The cycling to music produced a significant better rate of exercise adherence, more time spent in vigorous physical activity and a greater distance pedaled compared to interactive videogame cycling (Adamo et al., 2010).

Self-management

Thompson et al. (2010) emphasized that entertainment and learning are tightly bound – when the learning is meaningful to the player the learning is fun.

Video games are experimental, creating a platform for active learning. Rather than didactic presentation requiring memorization or assimilation of out-of context facts, video games promote “situated learning” in which players discover and learn through exploration and experimentation (Thompson et al., 2010).

In their Commentary-article they presented a cognitive, motivational, and self-regulatory model for designing videogames with the aim to promote self-management behaviors to adolescents with type 1 diabetes (Thompson et al., 2010). There must be a seamless integration of behavioral features into the entertainment components to create an immersive experience, Thompson et al. (2010) argued, to get a positive behavioral (enhanced self-management) and physiological (glycemic control) outcome.

Physiotherapy and rehabilitation

Several studies were found evaluating the potential of Active Videogames (AVG) for physical activity promotion and rehabilitation therapies in children with cerebral palsy (CP) (see Table 1). This section is introduced by a quote from one of these studies:

While not a replacement for structured exercise and physical therapy regimes, AVGs can offer an enjoyable opportunity for light to moderate physical activity in children with CP and the practice of complex motor activities (Howcroft et al., 2012, p. 1455).

In a study by Luna-Olivia et al. (2013) the usefulness of a low cost video game console (Xbox 360 Kinect™) based on VR technology as a complement to physiotherapy for children with CP was evaluated. The improvements observed in this study may be explained by the high treatment intensity and task-oriented training, and the variable practice allowed by the game in relation to both context and requirements of the task (ibid.). Due to the individual feedback in real time motivation and adherence are benefitted, and motor learning is promoted by recompense (ibid.). The interaction between the child and the avatar in the game allows the child to actively recognize the body's movements and to search for the correct orientation on each virtual scenario. This interaction leads to, argued Luna-Olivia et al. (2013), an increased knowledge of the child's kinematics which is good for the balance training.

Radtka et al. (2013) designed a videogame for therapy for children with CP. The game was to be a part of a home exercise program based on physical therapy task-oriented interventions. Game designers worked through all stages of the project in close collaboration with clinical team members (ibid.). The prototype was modified after each successive formative evaluation. The researchers found the game appealing to the children, and the use of therapeutic videogames in home-based programs may increase compliance and thus lead to improved standing and gait balance in children with CP, argued Radtka et al. (2013).

Unlike Radtka et al. (2013) Ramstrand and Lyngnegård (2012) and Jelsma et al. (2013) evaluated the use of commercial games for Wii balance board as balance training at home for children with CP. The results from Ramstrand and Lyngnegård's (2012) study could not show that using Wii balance board for 30 minutes (as a minimum) per day during five weeks was effective as a balance training tool for children with CP. The study of Jelsma et al. (2013), on the other hand, indicated that a three week period of daily practice with the Wii Fit improved the children's balance, in the absence of conventional physiotherapy.

A study mentioned by Scarle et al. (2011) has evidence of over-learning; the children's physical activity decreased after some time of playing a game using Wii. The children over-learned the control system and did not have to use so much physical movement to control the

avatar as was intended by the developers. “There is an unpleasant feedback between learning and over-learning”, argues Scarle et al. (2011). The dilemma is, according to Scarle et al. (2011) that, on one hand, an accessible and enjoyable game requires an intuitive and easy to learn control system and is therefore highly susceptible to over-learning. On the other hand, a more complex exercise game with particular movements requires a control system harder to learn and is thus more frustrating for the first time player. To minimize the problems with over-learning Scarle et al. (2011) recommends the game developers to have regular play-tests of the game preferably by people completely outside of the development process. Feedback from others may be valuable in the design, development and implementation process.

Previous studies about games for therapy have shown motivation and high interest as key components necessary for compliance (Nixon & Howard, 2013). Nixon and Howard (2013) therefore employed a framework consisting of the following key principles: in-game story, easy to use interface, interactive feedback, encourage exploring, and sense of achievement. One advantage with in-home virtual games for therapy, highlighted by Nixon and Howard (2013), is that the children are able to attempt new movements without feeling embarrassed or having the risks associated with trying in real life scenarios. The findings showed that the children were very engaged in the game-play, which is crucial for an effective therapeutic treatment (ibid.).

Burdea et al. (2011) presented a virtual hand rehabilitation game using a modified PlayStation and a special sensing glove. Results reported by the patient’s mother showed that the child were able to grasp a bottle after four weeks of training/gaming, pick up a pill after ten weeks, and after four months the child could use his hand to brush his teeth (Burdea et al., 2011). As for all rehabilitation the home environment and family’s encouragement play an important role in motivating and supporting the patient (Burdea et al., 2011). Other ways to maintain patient engagement are, according to Burdea et al. (2011), novelty in the therapy by periodically present new games, ensure therapy flexibility, and empower the patient to choose games and level of difficulty. However, a study in which three exergames were examined with respect to intensity levels showed no increase in intensity of stepping and playing through the autonomy to choose (Mellecker & McManus, 2014).

One problem with off-the-shelf games using consoles like Wii or PlayStation is observed by Burdea et al. (2011) – children with severe spasticity have extremely difficulties pushing buttons or even holding the remote in playing energetic games. Hence, the games developed for healthy children are almost impossible for these disabled children to master and win, and may lead to lowering the self-esteem and increase depression (ibid.). Radtka et al. (2013) made the same observation; commercial videogames that are not adapted for children with functional limitations may prevent these children from being successful in playing the games. The games have therefore to be automatically adapted to each child’s diminished function in order to allow these children enjoy this gaming or game-based hand therapy, Burdea et al. (2011) argued. The video games used in the study of Luna-Olivia et al. (2013) were not initially designed with a rehabilitator aim. In future studies videogames specific designed to treatment of motor symptoms in children with CP needs to be developed, the authors claimed. Others did not mention this problem with commercial off-the shelf products. Instead some

authors praised the usability of these products; Xbox Kinect (Fraivan et al., 2013) and Nintendo Wii balance board (Ramstrand & Lyngnegård, 2012) in rehabilitation processes for its low cost and high accessibility.

Tatla et al. (2014) aimed at evaluate the effectiveness of playing Wii compared to traditional balance therapy in improving balance, motivation, and functional ability in children during the acute phase of rehabilitation after brain injury. The results can be summarized in four major findings: 1) Wii is safe and feasible as a balance intervention, 2) results supported principles of motor learning, such as task specificity and repetitive task practice, 3) the appropriateness of Wii balance board for assessment of static balance can be questionable due to unreliable readings, and 4) all participants (n=3) reported high motivation levels throughout the Wii intervention (Tatla et al., 2014). However, the researcher's conclusion is:

Despite multiple impairments, the participants were able to engage in the Wii intervention and demonstrated improvement of dynamic balance (Tatla et al., 2014, p. 13).

The number of participants in this study was few and further research is needed to explore the effectiveness of Wii balance training in this group of children (ibid.).

Straker et al. (2011) raised initially concerns of the negative impact that videogaming may have on gross motor development, because other childhood physical leisure activities may be displaced. Their expectations of their study protocol is that the findings will provide critical information to understand whether playing active videogames, virtual reality games, have a positive impact on the physical as well as mental health of children with poor coordination (Straker et al., 2011).

Understanding health messages

When the elementary school, in which educational researcher Perhamus (2010) have two children, started the work with a "Wellness policy" she had several questions. What is wellness? Says whom? Perhamus (2010) used grounded theory in analyzing how children and adults kinesthetically¹⁰ could recontextualize standardized and official health messages into health knowledge that was meaningful and context-specific to them personally. She developed a child-centered game as a methodological tool in order to create the data. In the semi-structured card game "Tell Me About It" the participants were asked to tell a story from the open-ended features of the game. The card categories aimed to capture the intersection of human experience and official health promotion messages (ibid.).

Finding that kinesthetic experiences are the assemblages through which people conceptualize health suggests that tracing how these assemblages are working in people's everyday lives can help us think about the consequences of its circuitry (Perhamus, 2010, p. 859).

One example of a re-assembling kinesthetic moment is when one participant emotionally experiences her memory of the visceral meaning of food (Perhamus, 2010).

¹⁰ Here used metaphorically to afford a way to analytically trace the social aspects of embodied experience (Perhamus, 2010).

Preparing for future medical examinations

Hoberman et al. (2012) developed a stereoscopic game that utilized the 3D phantogram technique to anamorphically distort projection onto a horizontal surface. When the picture was viewed from an appropriate height and position the virtual objects and characters appeared to stand directly on the tabletop. The children's touches triggered a subtle sparkling particle effect where they had touched the surface and together with the sound effect instant and perceptible feedback for every interaction was provided (Hoberman et al., 2012). Further tests of this game will be done, but so far there was "anecdotal evidence that children who played the game may be better equipped to be tested with the current standard instrument for stereo acuity in children", according to Hoberman et al. (2012, p. 27).

Learning the social codes

The experiential learning cycle of Kolb was used as the pedagogical model in designing a game helping children with autism spectrum disorders (ASD) to recognize emotions through facial expressions (Abirached et al., 2011). Four game modes were designed to match the modes in the experiential learning cycle (ibid.);

1. **Recognize the expression** – the children are encouraged to watch and recognize facial expressions
2. **Build a face** – the children are encouraged to learn by doing, i.e. actively experiment with different possibilities
3. **Become your avatar** – the children are encouraged to recognize, mimic and concretely experience how to make the expression with their own faces
4. **Live a story** – the children are encouraged to generalize or transfer their knowledge of facial expressions to real-life situations

The game was tested with nine children with ASD, and the children responded favorably to the game (Abirached et al., 2011). Parents were discussing the importance of game context, a game included storylines involving social scenarios is interesting. The auditory feedback after the children had chosen one of the six basic emotions was appreciated by the children. Even the wrong-answer feedback was enjoyable, several children deliberately made wrong selections just to hear the wrong-answer feedback (ibid.). The designers might adjust the design to allow customization, such as to alter colors and sounds and also to provide a less engaging wrong-answer response. It is also important for these children to be able to create their avatar with respect to their special interests (Abirached et al., 2011).

Academic achievement

Together with physical fitness, Gao et al. (2013) examined the impact of Dance Dance Revolution-based exercise on academic achievements (reading and math) in Latino children.

Exergaming is considered a fun and entertaining way for children to participate in physical activity and develop healthy habits and a fitness-oriented lifestyle (Gao et al., 2013, p. S241).

The findings showed no effect on the children's BMI¹¹, but there were improvements in cardiorespiratory fitness as the children in the intervention group improved their one mile

¹¹ Body Mass Index.

running (Gao et al., 2013). The authors were careful when they described the effect in reading and in math. The greater improvement of math scores as well as reading scores for the intervention children may be explained, Gao et al. (2013) argued, by factors such as growing up and obtaining more instruction.

Summary and analysis of results

In the following text I summarize the results from the conducted literature review above, where the different sections reflect the three guiding questions. The purpose with the guiding questions was to guide the data collection and data analysis to enable response to the overall research question, which will be discussed in the next chapter – Conclusions.

What health perspective are mostly utilized in studies on health games for children and adolescents?

The perspective of health could more or less implicitly be assumed in the articles through formulations of text in foremost the introduction to the studies. Some examples: With focus on how to encourage communication between people with autism, Ceccon Ribeiro and Barbosa Raposo (2014) developed a collaborative game that utilized and strengthened the children's skills of gestures, short phrases, signs and glances. This strengthening of positive factors is distinctive for the salutogenic perspective.

Matsunaga et al. (2014) described the development of an educational game for children with hemophilia. The aim with the game and the study is to teach the children how to manage their disease – a pathogenic perspective. Another, more implicit, example of a pathogenic perspective could be found in Pollak et al.'s (2010) study of a mobile-phone-based game to encourage healthy eating habits with the purpose to prevent obesity.

The perspective that is mostly utilized in the studied articles is the pathogenic perspective – a disease-perspective with focus on prevention, rehabilitation, treatment and cure.

What are the underlying theories and concepts used in prior studies on health games for children and adolescents?

Most of the articles used, or at least discussed the advantages of using, one or more theory/theories in game-based interventions for children and adolescents. However, there were relatively few pedagogical or learning theories. Most of the theories were behavioral/psychological theories and communication theories and models. Social Cognitive theory (SCT) is one of the behavioral theories mostly used in the studies (e.g. Elias et al., 2013; Johnsen et al., 2014; Sharma et al., 2015). Concepts associated with SCT are, for instance, self-efficacy, participation, reciprocal determinism, and self-regulation. Self-efficacy, as a concept, was discussed in several articles (Baranowski et al., 2013; Kamel Boulos et al., 2015; Lwin & Malik, 2014).

Motivation was discussed in the articles, with main focus on intrinsic motivation and how to promote it. To have fun is one such intrinsic motivator. Finkelstein et al. (2013) believed that if the exercising is made fun it might increase a child's confidence in his/her physical ability. One important motivator for engaging in physical activity, Poole's et al. (2013) results showed, is the sense of being part of a team. The social support was emphasized also by Burdea et al. (2011).

Communication theories, with elements of narrative and emotion theories, were used by Knutz et al. (2014) to promote small children's communication about their needs and feelings when they are patients. The results from their study showed that children expressed their emotions through the act of the game play.

What assumptions, ideas and expectations about health and learning can be seen in studies on health games for children and adolescents?

Promoting physical activity was the main focus in the studied articles. The aim with the physical activity varied; to prevent obesity, to be a part of the physical rehabilitation or to promote a good health. COTS-games, exergames as well as special designed serious games were used in the interventions. Physical activity in the games could be more than a pulse-pounding activity – it could also be physiotherapeutic activities such as balance training (e.g. Radtka et al., 2013) or hand rehabilitation (Burdea et al., 2011).

Another important goal with health games was to promote self-management behavior for children having a chronic disease. Thompson et al. (2010) emphasized the need for a seamless integration of behavioral features into the entertainment components to create an immersive experience.

One classic learning theory; the experimental learning cycle of Kolb, was used by Abirached et al. (2011) in a game for children with autism spectrum disorders to recognize emotions through facial expressions. The children were encouraged to experiment and learn from their experiments.

Discussion

The aim with this study was to map out perspectives on health and underlying theories and concepts in studies of health games for children and adolescents. There are many studies of health games to be found when searching in major knowledge databases. A great part of the articles found evaluated exergames – active videogames that involve body movement for play. The aim with these games was to promote physical activity mainly in order to prevent obesity. Thus, a pathogenic perspective on health – the “medical” way in looking at health.

The salutogenic perspective of health; to promote health by strengthening the good things, is not the other way around or the opposite of the pathogenic perspective. These two approaches to work with health complement each other, and sometimes they are difficult to differentiate. Maybe it is not necessary to distinguish them at all the time either. But it can be important to reflect on which perspective of health that is assumed in different health work. I mean, the perspective of health reflects our perspective on humanity. To be a bit provocative; do we see a patient to be treated or do we see a person in need to be empowered to manage his/her own health? For instance, the talk about “food is fuel” (Sharma et al., 2015) is a way to express the perspective of the body as a machine. A machine can be mended. Mended by someone outside the machine itself. The salutogenic approach would rather be to empower the individual to engage in his/her own health.

The major part of the scientific journals in this study is published in medical journals dealing with, for instance, pediatrics, preventive medicine, rehabilitation and health care. For me, this signals a more pathogenic than salutogenic perspective on health. The perspective of health in the studies was not explicitly expressed in the articles. That was not expected either. But, I think, *if* the perspective of health – pathogenic or salutogenic – was expressed in the articles an interesting discussion and reflection could be induced. More studies with a salutogenic perspective in studies of games for health might enable a more holistic approach to health.

Theories that were discussed in the studied articles were mainly behavioral, motivation and communication theories and models. A theoretical framework including social cognitive theory (SCT) was found in several studies (e.g. Elias et al., 2013; Johnsen et al., 2014) to be appropriate. The three dimensions; individual, social and environment, together with concepts as self-efficacy, participation and cocreation are useful in the developmental work of health games and interventions. These concepts are, however, applied differently in the studied articles. One example is the kind of game used; a COTS-game or a tailored serious game. Burdea et al. (2011) emphasized the importance of customized hardware to the games for disabled children. The holistic perspective of health is neglected if the consequences of playing the game are lowered self-esteem and increased depression as a result of not being able to push the buttons like a child with no functional limitations. And this irrespective of the physical success of playing the game.

One of the “things” with games for health is that games are supposed to be fun (Buday, 2015), and this fun part is expected to motivate players to perform new tasks, to change behavior, to increase the knowledge and to learn new skills (e.g. Finkelstein et al., 2013; Baranowski et al., 2014). In some of the articles a technological determinism saying that “the game is the answer” can be discerned (e.g. Pollak et al., 2010; Radtka et al., 2013). Several of the authors discovered, however, that it is not as simple as that (e.g. Sharma et al., 2015; Scarle et al., 2011; Christison & Ali Khan, 2012; Adamo et al., 2010), when the results were poor or showed in another direction.

However, one problem with games is that they can be *too* fun; the player is more occupied by playing the game and the goal becomes to score and collect points and badges. The player has lost interest in the messages in the game and is not reflecting over the purpose and the lessons that are supposed to be learned. This *ludification* (Linderoth, 2014) will occur sooner or later in game playing and will make it difficult to reach the player with the message. The player has, consciously or not, entered the *gamer mode* and lost sight of the purpose with the game.

When investigating children without previous experience of exergames (Mills et al., 2013), maybe it is not strange that these children found it fun to play in 15 minutes regardless of the intensity of the game. The point, however, should be to create a consisting behavior. As Macvein (2011) pointed out; the game should facilitate behavioral change so that the players maintain the behavior and do not lose motivation. With exergames there is also a possibility to *over-learn* the control system (Scarle et al., 2011). The players circumvent the control system and learn how to play the game without moving the body as it is intended. The

exergame becomes a sedentary activity. From this we can ask two questions; How can the game continue to be fun? How to get the message through and yet make the game fun?

The studied articles have some suggestions of factors that will help a health game continue to attract players to play and thus contribute to (increased) health:

- Use of theories and models in game development and planning of interventions (e.g. Baranowski & Frankel, 2012).
- Continuous renewal in the game (e.g. Burdea et al., 2011).
- Possibility to create the avatar with respect to own special interests (Abirached et al., 2011).
- Feasibility to project own fantasies in games that include special interests (Finkelstein et al., 2013).
- Immediate feedback (Baranowski et al., 2014).

The list above is by no means complete. As the interested reader observes; the list above conforms to the lists of gamification ingredients (cf. Cugelman, 2013; Gartner, 2011) on page 15 above. Nevertheless, despite all these factors and aspects, playing health games not always lead to increased health. Time is, as always, an important factor for changing behavior. Not only enough time to play the game is necessary, but also, as Macvean (2011) highlighted, time and other facilitators to change and maintain the behavior, and not losing motivation is needed. Buday's (2015) list of statements (page 18) may be interesting for game developers. And not only developers, I think, but other professionals as well. To develop a successful health game, with a "perfect" mix of entertainment and health science, we need collaboration between designers and health care professionals, and educators as well.

There are (at least) two ways of "manipulating" the players into the "right" direction. One way is by the processes in the game; to let the player know which the "right" thing to do is by rewarding certain choices. This, that the arguments in the game are shown through processes, is called procedural rhetoric (Bogost, 2012) (see more on page 16). Short messages in the videogames used to give the players feedback, is the other way. The messages are at the same time supposed to teach the players something. For instance, the pets (i.e. nutritionists) in Pollak's et al. (2010) videogame returned messages to the children on photos of what the children had been eating. Messages such as "Yesterday's breakfast wasn't great, and neither is two doughnuts" (cf. page 30) were sent to the children. The results from this intervention were not distinct. Another study with healthy eating habits as focus (Sharma et al., 2015) did not show any positive result either regarding change in habits of eating fruit and vegetables.

Why these two interventions not succeeded is not explicit described, and maybe nobody knows. Presumably, the children entered the gamer mode and got ludified, and lost sight of the message in the game. It did not matter that it was fruit they picked, it could just as well have been balloons. The points and score meant more than the lessons they were expected to learn. Another observation is that technological determinism might be discerned in the study of Pollak et al. (2010) – an idea that the game itself will motivate the players to do the right thing. Maybe the researchers and developers did not put enough effort into the design work of

the game and intervention, but left some of the job to the game itself. In the case with the study of Sharma et al. (2015) it might have been as Buday (2015) states: “Even when the science is right, health games may stumble on execution, boring or otherwise turning off video-game players who come seeking fun” (cf. page 17-18). The game Sharma et al. (2015) evaluated was grounded in Social Cognitive Theory (SCT) and Theory of Reasoned Action (TRA). But, as said, the right science is not always enough for developing a health game.

Learning processes emerge in playing games for health; to experiment and to test new things is one way of learning in the specific situation. Serious games have a certain purpose and the player is supposed to learn something. The studied interventions were about, for instance, learning a healthy eating behavior, change to a more physical active lifestyle or learning to manage a chronic disease. Generally, all serious games for health are about changing behavior. Noteworthy, in the studied interventions very few pedagogical or learning theories were used.

An observation was made about confusion of concepts; the concept *gamification* is easily, but unfortunately, confused with *games* (e.g. Elias et al., 2013; Kamel Boulos et al., 2015). But it is not difficult to understand the confusion – because when will the gamified application turn into a game, when is “too much” of game design and mechanics used and it is still not a game (cf. Seaborn & Fels, 2015)? In order to understand the research, be able to draw conclusions and use the findings there is a need for a mutual understanding of concepts used in the interventions. Games and health are two such concepts, and not least in the combination – games for health, as well as health from playing games. With “help” from games and gamification innovative technological interventions might be useful in persuasive programs to change behavior. At the same time, we cannot be fooled to think that games and gamification are the perfect (or only) solution in this area of behavior change and/or learning.

As with all methods used in research, certain limitations apply. First of all, only three databases were searched in during a short period of time. Second, more and/or other key words might have given a different search result. Moreover, the inclusion and exclusion criteria chosen might have discriminated relevant studies that thus are missed in this study.

This literature review consists of 40 articles and 15 conference papers that have been found from search in three major databases. Several of the articles/conference papers found are about physical activity and obesity, diabetes and healthy eating habits. A kind of saturation in those topics might thus be discerned. This study, with focus on health perspectives and theoretical concepts in the studied interventions, may be an important step to highlight a nuanced picture of health and the healthy aspects of playing videogames. Further research is critical to expanding the knowledge base on how to design effective health games that entertain while promoting health from a holistic perspective.

Conclusions

The guiding questions were meant as tools to enhance the understanding and knowledge of perspectives, theories and concepts in the studied interventions with health games for children and adolescents. Listed below are some conclusions from the analysis of the results:

- The pathogenic perspective of health; to prevent and cure diseases and to rehabilitate injuries, is the perspective mostly utilized in the studied interventions. Nevertheless, intrinsic motivation is valued and assumed as the strongest factor driving behavior change.
- Although a theory-based intervention for games for health is important, right science may not be enough for a successful intervention. Buday's (2015) statement (see page 18) are some aspects to have in mind when developing games for health.
- The games, and especially the game consoles, may preferably be tailored to fit the player's physical abilities. A game console made for children without physical disabilities may be difficult to use for children with physical disabilities. To not be able to win or to score on the same conditions may induce a lower self-esteem and depression. Empowering the children to intrinsic rewards, to increased autonomy and self-efficacy may enable and provide conditions to maintain the changed behavior.

The overall research question for this study was: What dimensions in the basic assumptions in the interventions for health games need to be changed when embracing a full salutogenic perspective? The assumptions found from the results and analysis of the intervention studies conform well to Buday's (2015) statement as well as with the lists from Cugelman (2013) and Gartner (2011), respectively (see page 15):

- a fun game with as few interrupting messages as possible
- a game about the players and their specific situation
- an interesting and compelling narrative
- challenging but achievable tasks
- a game with possibilities to fail (not too safe, cf. Buday, 2015)
- instant feedback
- a theory-based intervention

This conformity is in a way a positive surprise since none of the three authors mentioned the concepts "holistic health" and/or "salutogenic perspective of health". Perhaps these authors are unfamiliar with these concepts? As suggested in the end of the discussion chapter above, this study may be a step to highlight the value of knowledge of these concepts as well as a nuanced picture of health.

My conclusion of this literature review is thus that a holistic perspective of health and an understanding of the context are not just important but also necessary for a successful intervention. The pathogenic perspective of health needs to be complemented with the salutogenic perspective. Health is more than a functioning body. Health is more than a healthy diet and physical activity. An individual's health consists of several aspects and can be described in different dimensions (see Figures 1-3, pages 13-14). So, to promote health the games need to not just be good to the body but also good for the soul.

References

- Abirached, B., Yan Zhang, Aggarwal, J. K., Tamersoy, B., Fernandes, T., Miranda, J. C., & Orvalho, V. (2011). Improving communication skills of children with ASDs through interaction with virtual characters. *Proceedings of IEEE 1st International Conference on Serious Games and Applications for Health*, November 16-18, Braga, Portugal. doi: 10.1109/SeGAH.2011.6165464.
- Adamo, K. B., Rutherford, J. A., & Goldfield, G. S. (2010). Effects of interactive video game cycling on overweight and obese adolescent health. *Applied Physiology, Nutrition, and Metabolism*, 35, 805-815. doi: 10.1139/H10-078.
- Almonani, E., Husain, W., San, O. Y., Almonani, A., & Al-Betar, M. (2014). Mobile game approach to prevent childhood obesity using persuasive technology. *Proceedings of IEEE International Conference on Computer and Information Sciences (ICCOINS)*, June 3-5, Kuala Lumpur, Malaysia. doi: 10.1109/ICCOINS.2014.6868418.
- Amresh, A., & Small, L. (2014). Make your garden grow: designing a physical activity estimation improvement game. *Proceedings of IEEE 3rd International Conference on Serious Games and Applications for Health (SeGAH)*, May 14-16, Rio de Janeiro, Brazil. doi: 10.1109/SeGAH.2014.7067075.
- Antonovsky, A. (2005). *Hälsans mysterium*. Stockholm, Sweden: Natur och Kultur.
- Baranowski, T., Baranowski, J., Thompson, D., & Buday, R. (2011a). Behavioral Science in Video Games for Children's Diet and Physical Activity Change: Key Research Needs. *Journal of Diabetes Science and Technology*, 5, (2), 229-233.
- Baranowski, T., Baranowski, J., Thompson, D., Buday, R., Jago, R., Griffith, M. J., Islam, N., Nguyen, N., & Watson, K. B. (2011b). Video Game Play, Child Diet, and Physical Activity Behavior Change: A Randomized Clinical Trial. *American Journal of Preventive Medicine*, 40, (1), 33-38. doi: 10.1016/j.amepre.2010.09.029.
- Baranowski, T., Diep, C., & Baranowski, J. (2013). Influences on Children's Dietary Behavior, and Innovative Attempts to Change It. *Annals of Nutrition and Metabolism*, 62, (3), 38-46. doi: 10.1159/000351539.
- Baranowski, T., & Frankel, L. (2012). Let's get technical! Gaming and Technology for Weight Control and Health Promotion in Children. *Childhood Obesity*, 8, (1), 34-37. doi: 10.1089/chi.2011.0103.
- Baranowski, T., Thompson, D., Buday, R., Lu, A. S., & Baranowski, J. (2014). Design of Video Games for Children's Diet and Physical Activity Behavior Change. *International Journal of Computer Science in Sport*, 9, (2), 3-17.
- Bernstein, B. (1996). *Pedagogy, Symbolic Control and Identity. Theory, Research, Critique*. London, UK: Taylor & Francis.

- Bittner, J. V., & Shipper, J. (2014). Motivational effects and age differences of gamification in product advertising. *Journal of Consumer Marketing*, 31, (5), 391-400. doi: 10.1108/JCM-04-2014-0945.
- Bogost, I. (2008). The Rhetoric of Video Games. In K. Salen (Ed.). *The Ecology of Games: Connecting Youth, Games, and Learning*. (p. 117-140). Cambridge, MA, USA: MIT Press.
- Brazendale, K., Chandler, J. L., Beets, M. W., Weaver, R. G., Beighle, A., Huberty, J. L., & Moore, J. B. (2015). Maximizing children's physical activity using the LET US Play principles. *Preventive Medicine*, 76, 14-19. doi: 10.1016/j.ypmed.2015.03.012.
- Brox, E., Fernandez-Luque, L., & Tøllefsen (2011). Healthy Gaming – Video Game Design to Promote Health. *Applied Clinical Informatics*, 2, (2), 128-142. doi: 10.4338/ACI-2010-10-R-0060. PMID: 23616865.
- Buday, B. (2015). Games for Health: An Opinion. *Games for Health Journal*, 4, (1), 38-42. doi: 10.1089/g4h.2014.0083.
- Burdea, G. C., Jain, A., Rabin, B., Pellosie, R., & Golomb, M. (2011). Long-Term Hand Tele-Rehabilitation on the PlayStation 3: Benefits and Challenges. *Proceeding of the 33rd Annual International Conference of the IEEE Engineering in Medicine and Biology (EMBS)*, August 30 – September 3, Boston, Massachusetts, USA. doi: 10.1109/IEMBS.2011.6090522.
- Cagatay, M., Ege, P., Tokdemir, G., & Cagiltay, N. E. (2012). A serious game for speech disorder children therapy. *Proceedings of the 7th International Symposium on Health Informatics and Bioinformatics*, IEEE, April 19-22, Cappadocia, Turkey.
- Ceccon Ribeiro, P., & Barbosa Raposo, A. (2014). ComFIM: a game for multitouch devices to encourage communication between people with autism. *Proceedings of the 3rd International Conference on Serious Games and Applications for Health (SeGAH)*, May 14-16, Rio de Janeiro, Brazil. doi: 10.1109/SeGAH.2014.7067074.
- Christison, A., & Khan, H. A. (2012). Exergaming for Health: A Community-Based Pediatric Weight Management Program Using Active Video Gaming. *Clinical Pediatrics*, 51, (4), 382-388. doi: 10.1177/0009922811429480.
- Correa, O., Cuervo, C., Perez, P., & Arias, A. (2014). A new approach for self adaptive video game for rehabilitation – Experiences in the amblyopia treatment. *Proceedings of IEEE 3rd International Conference on Serious Games and Applications for Health (SeGAH)*, May 14-16, Rio de Janeiro, Brazil. doi: 10.1109/SeGAH.2014.7067102.
- Cugelman, B. (2013). Gamification: What It Is and Why It Matters to Digital Health Behavior Change Developers. *Journal of Medical Internet Research Serious Games*, 1, (1), e3. doi: 10.2196/games.3139.
- Culp, J., Bell, R. A., & Cassady, D. (2010). Characteristics of Food Industry Web Sites and “Advergaming” Targeting Children. *Journal of Nutrition Education and Behavior*, 42, (3), 197-201. doi: 10.1016/j.jneb.2009.07.008.

Days of Wonder (2015). *Memoir '44*. URL: <http://www.daysofwonder.com/memoir44/en/> (2015 May 16).

de la Cruz Paragas, F., & Lin, T. T. C. (2014). Organizing and reframing technological determinism. *New Media & Society*, 1-19. doi: 10.1177/1461444814562156.

Deterding, S., Dixon, D., Khaled, R., Nacke, L. (2011). From game design elements to gamefulness: defining “gamification”. *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments*. ACM, September 28-30, Tampere, Finland.

eHälsomyndigheten (2015). *HälsaFörMig*. URL: <https://projektet.halsaformig.se/om-halsa-for-mig/> (2015 August 21).

Electronic Arts Inc. (2015). *The Sims*. URL: <http://www.thesims.com/> (2015 May 16).

Elias, P., Rajan, N. O., McArthur, K., & Dacso, C. C. (2013). InSpire to Promote Lung Assessment in Youth: Evolving the Self-Management Paradigms of Young People With Asthma. *Medicine 2.0*, 2, (1), e1. doi: 10.2196/med20.2014.

Eriksson Barajas, K., Forsberg, C., & Wengström Y. (2013). *Systematiska litteraturstudier i utbildningsvetenskap. Vägledning vid examensarbeten och vetenskapliga artiklar*. Stockholm, Sweden: Natur & Kultur.

Ferguson, G. D., Jelsma, D., Jelsma, J., & Smits-Engelsman, B. C. M. (2013). The efficacy of two task-oriented interventions for children with Development Coordination Disorder: Neuromotor Task Training and Nintendo Wii Fit training. *Research in Development Disabilities*, 34, 2449-2461. doi: 10.1016/j.ridd.2013.05.007.

Ferguson, C. J., & Kilburn, J. (2009). The Public Health Risk of Media Violence: A Meta-Analytic Review. *Journal of Pediatrics*, 154, (5), 759-763.

Finkelstein, S., Barnes, T., Wartell, Z., & Suma, E. A. (2013). Evaluation of the Exertion and Motivation Factors of a Virtual Reality Exercise Game for Children with Autism. *Proceedings of Workshop on Virtual and Augmented Assistive Technology (VAAT), March 17, Lake Buena Vista, FL, USA*. doi: 10.1109/VAAT.2013.6786186.

Fraiwan, M. A., Khasawneh, N., Malkawi, A., Al-Jarrah, M., Alsa'di, R., & Al-Momani, S. (2013). Therapy central: On the development of computer games for physiotherapy. *Proceedings of IEEE 9th International Conference on Innovations in Information Technology (IIT)*, March 17-19, Abu Dhabi, United Arab Emirates. doi: 10.1109/Innovations.2013.6544388.

Frank, A. (2012). Gaming the Game: A Study of the Gamer Mode in Educational Wargaming. *Simulation & Gaming*, 43, (1), 118-132. doi: 10.1177/1046878111408796.

Gao, Z., Hannan, P., Xiang, P., Stodden, D. F., & Valdez, V. E. (2013). Video Game-Based Exercise, Latino Children's Physical Health, and Academic Achievement. *American Journal of Preventive Medicine*, 44, (3S3), S240-S246. doi: 10.1016/j.amepre.2012.11.023.

Gartner (2011). *Gartner Says By 2015, More Than 50 Percent of Organizations That Manage Innovation Processes Will Gamify Those Processes*. Egham, UK, April 12.

URL: <http://www.gartner.com/newsroom/id/1629214> (2015 July 25).

Gee, J. P. (2007). *Good video games + good learning: collected essays on video games, learning and literacy*. New York, N. Y. USA: Peter Lang Publishing, Inc.

Golomb, M. R., McDonald, B. C., Warden, S. J., Yonkman, J., Saykin, A. J., Shirley, B., Huber, M., Rabin, B., AbdelBaky, M., Nwosu, M. E., Barkat-Masih, M., & Burdea, G. C. (2010). In-Home Virtual Reality Videogame Telerehabilitation in Adolescents With Hemiplegic Cerebral Palsy. *Archives of Physical Medicine and Rehabilitation*, 91. doi: 10.1016/j.apmr.2009.08.153.

Graafland, M., Dankbaar, M., Mert, A., Lagro, J., De Wit-Zuurendonk, L., Schuit, S., Schaafstal, A., & Schijven, M. (2014). How to Systematically Assess Serious Games Applied to Health Care. *Journal of Medical Internet Research Serious Games*, 2, (2), e11. doi: 10.2196/games.3825.

Griffiths, M. D., Kuss, D. J., & Ortiz de Gortari, A. B. (2013). Videogames as Therapy: A Review of the Medical and Psychological Literature. In M. M. Cruz-Cunha, I. M. Miranda, & P. Gonçalves (Eds.). *Handbook of Research on ICT and Management Systems for Improving Efficiency in Healthcare and Social Care*. (p. 43-68). Hershey PA, USA: Medical Information Science Reference (an imprint of IGI Global).

Hansen, L., & Sanders, S. (2010). Fifth Grade Students' Experiences Participating in Active Gaming in Physical Education: The Persistence to Game. *ICHPER-SD Journal of Research*, 5, (2), 33-40.

Hanson, A. (2004). *Hälsopromotion i arbetslivet*. Lund, Sweden: Studentlitteratur.

Hoberman, P., Gotsis, M., Sacher, A., Bolas, M., Turpin, D., & Varma, R. (2012). Using the Phantogram Technique for a Collaborative Stereoscopic Multitouch Tabletop Game. *Proceedings of IEEE 10th International Conference on Creating, Connecting and Collaborating through Computing (C5)*, January 18-20, Playa Vista, CA, USA. doi: 10.1109/C5.2012.18.

Howcroft, J., Klejman, S., Fehlings, D., Wright, V., Zabjek, K., Andrysek, J., & Biddiss, E., (2012). Active Video Game Play in Children With Cerebral Palsy: Potential for Physical Activity Promotion and Rehabilitation Therapies. *Archives of Physical Medicine and Rehabilitation*, 93, 1448-1456. doi: 10.1016/j.apmr.2012.02.033.

Inglés-Camats, G., Montserrat Presno-Rivas, M., Antonijoan, M., García Pañella, O., & Forrest, T. (2012). Yummy Tricks: A serious game for learning healthy eating habits. *Studies in Health Technology and Informatics*, 172, 185-190.

Internetstatistik (2015). *Svenskarna och internet 2014. En årlig studie av svenska folkets internetvanor*. URL: <http://www.soi2014.se/barn-och-ungdomar/spel-och-video/> (2015 May 18).

Jelsma, J., Pronk, M., Ferguson, G., & Jelsma-Smit, D. (2013). The effect of the Nintendo Wii Fit on balance control and gross motor function of children with spastic hemiplegic cerebral palsy. *Developmental Neurorehabilitation*, 16, (1), 27-37. doi: 10.3109/17518423.2012.711781.

Johnsen, K., Sun Joo Ahn, Moore, J., Brown, S., Robertson, T. P., Marable, A., & Basu, A. (2014). Mixed Reality Virtual Pets to Reduce Childhood Obesity. *IEEE Transactions on Visualization and Computer Graphics*, 20, (4), 523-530. doi: 10.1109/TVCG.2014.33.

Kamel Boulos, M. N., Gammon, S., Dixon, M. C., MacRury, S. M., Fergusson, M. J., Rodrigues, F. M., Mourinho Baptista, T., & Yang, S. P. (2015). Digital Games for Type 1 and Type 2 Diabetes: Underpinning Theory With Three Illustrative Examples. *Journal of Medical Internet Research Serious Games*, 3, (1), e3. doi: 10.2196/games.3930.

Kapp, K. M. (2012). *The Gamification of Learning and Instruction. Game-based Methods and Strategies for training and Education*. San Francisco, CA, USA: Pfeiffer.

Knutz, E., Ammentorp, J., & Kofoed, P.-E. (2015). Why Health Care Needs Design Research: Broadening the Perspective on Communication in Pediatric Care Through Play. *Health Communication*, 1-14. doi: 10.1080/10410236.2014.917220.

Labonte, R. (2010). Health Promotion and Empowerment: Reflections on Professional Practice. In J. M. Black, S. Furney, H. M. Graf & A. E. Nolte (Eds.). *Philosophical Foundations of Health Education*. (p. 179-195). San Francisco, CA, USA: Jossey-Bass.

Larsen, L. R., Grønbech Jørgensen, M., Junge, T., Juul-Kristensen, B., & Wedderkopp, N. (2014). Field assessment of balance in 10 to 14 year old children, reproducibility and validity of the Nintendo Wii board. *BMC Pediatrics*, 14, 144. doi: 10.1186/1471-2431-14-144.

Lau, P. W. C., Liang, Y., Lau, E. Y., Choi, C.-R., Kim, C.-G., & Shin, M.-S. (2015). Evaluating Physical and Perceptual Responses to Exergames in Chinese Children. *International Journal of Environmental Research and Public Health*, 12, 4018-4030. doi: 10.3390/ijerph120404018.

Linderöth, J. (2014). Spel i skolan: Det regelstyrda lärandets möjligheter. In A. Lantz-Andersson & R. Säljö (Eds.). *Lärare i den uppkopplade skolan*. (p. 173-195). Malmö, Sweden: Gleerups.

- Lindström, K. (2013). Spel vill få en plats i vården. *Computer Sweden*, 2013-08-23. URL: <http://computersweden.idg.se/2.2683/1.519064/spel-vill-fa-en-plats-i-varden?queryText=spel%20f%F6r%20h%E4lsa> (2015 April 19).
- Lister, C., West, J. H., Cannon, B., Sax, T., & Brodegard, D. (2014). Just a fad? Gamification in health and fitness apps. *Journal of Medical Internet Research Serious Games*, 2, (2), e9. doi: 10.2196/games.3413. PMID: 25654660.
- Lu, A.S., Baranowski, T., Thompson, D., & Buday, R. (2012). Story Immersion of Videogames for Youth Health Promotion: A Review of Literature. *Games for Health Journal*, 1, (3), 199-204. PMID: 24416639.
- Luna-Olivia, L., Ortiz-Gutiérrez, R. M., Cano-de la Cuerda, R., Martínez Piédrola, R., Alguacil-Diego, I. M., Sánchez-Camarero, C., & del Carmen Martínez Culebras, M. (2013). Kinect Xbox 360 as a therapeutic modality for children with cerebral palsy in a school environment: A preliminary study. *NeuroRehabilitation*, 33, 513-521. doi: 10.3233/NRE-131001.
- Lwin, M. O., & Malik, S. (2014). Can Exergames Impart Health Messages? Game Play, Framing, and Drivers of Physical Activity Among Children. *Journal of Health Communication*, 19, (2), 136-151. doi: 10.1080/10810730.2013.798372. PMID: 24191779.
- Maamar, H. R., Boukerche, A., & Petriu, E. M. (2012). 3-D Streaming Supplying Partner Protocols for Mobile Collaborative Exergaming for Health. *IEEE Transactions on Information Technology in Biomedicine*, 16, (6), 1079-1095. doi: 10.1109/TITB.2012.2206116.
- Macvean, A. P. (2011). Task-Involved Versus Ego-Involved: Motivating Children to Exercise In a Pervasive Exergame. *Proceedings of IEEE International Conference on Pervasive Computing and Communications Workshops (PERCOM Workshops)*, March 21-25, Seattle, WA, USA. doi: 10.1109/PERCOMW.2011.5766922.
- Maroney, K. (2001). My Entire Waking Life. *The Games Journal*. URL: <http://www.thegamesjournal.com/articles/MyEntireWakingLife.shtml> (2015 May 16).
- Matsunaga, R. M., de Oliveira Moraes, R. L., Borges, M. A. F., Matta, M. A. P., & Ozelo, M. C. (2014). Development of a serious game for children with hemophilia. *Proceedings of IEEE 3rd International Conference on Serious Games and Applications for Health (SeGAH)*, May 14-16, Rio de Janeiro, Brazil. doi: 10.1109/SeGAH.2014.7067082.
- McAlister, A. L., Perry, C. L., & Parcel, G. S. (2008). How Individuals, Environment, and Health Behaviors Interact. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.). *Health Behavior and Health Education. Theory, Research, and Practice*. (p. 169-188). San Francisco, CA, USA: Jossey-Bass.

- McGaffey, A. L., Abatemarco, D. J., Katz Jewell, I., Fidler, S. K., & Hughes, K. (2011). Fitwits MD™: An Office-Based Tool and Games for Conversations about Obesity with 9- to 12-Year-Old Children. *Journal of the American Board of Family Medicine*, 24, (6), 768-771. doi: 10.3122/jabfm.2011.06.100278.
- McKenzie, S., Bangay, S., Barnett, L. M., Ridgers, N. D., & Salmon, J. (2014). Encouraging organized active game play in primary school children. *Proceedings of IEEE Games Media Entertainment (GEM)*, October 22-24, Toronto, ON, Canada. doi: 10.1109/GEM.2014.7047972.
- Mellecker, R. R., & McManus, A. M. (2014). Active video games and physical activity recommendations: A comparison of the Gamercize Stepper, XBOX Kinect and XaviX J-Mat. *Journal of Science and Medicine in Sport*, 17, 288-292. doi: 10.1016/j.jsams.2013.05.008.
- Mills, A., Rosenberg, M., Stratton, G., Carter, H. H., Spence, A. L., Pugh, C. J. A., Green, D. J., & Naylor, L. H. (2013). The Effect of Exergaming on Vascular Function in Children. *Journal of Pediatrics*, 163, (3), 806-810. doi: 10.1016/j.jpeds.2013.03.076.
- Mitgutsch, K., & Alvarado, N. (2012). Purposeful by Design? A Serious Game Design Assessment Framework. *Proceedings of the International Conference on the Foundations of Digital Games (FDG'12)*, May 29-June 1, Raleigh, NC, USA.
- Montaño, D. E., & Kasprzyk, D. (2008). Theory of Reasoned Action, Theory of Planned Behavior, and the Integrated Behavioral Model. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.). *Health Behavior and Health Education. Theory, Research, and Practice*. (p. 67-96). San Francisco, CA, USA: Jossey-Bass.
- Morris, R. G., & Johnson, M. C. (2014). Sedentary Activities, Peer Behavior, and Delinquency Among American Youth. *Crime & Delinquency*, 60, (6), 939-968. doi: 10.1177/0011128710386205.
- Nilsson, P. (2005). *Vad är pedagogik? Några tankar om pedagogikämnet i ett jämförande perspektiv*. Pedagogiska institutionen, Umeå universitet, Sweden. URL: http://www.sprak.umu.se/digitalAssets/19/19763_vadarpedagogik.pdf (2015 May 30).
- Nixon, M. E., & Howard, A. M. (2013). Applying Gaming Principles to Virtual Environments for Upper Extremity Therapy Games. *Proceedings of IEEE International Conference on Systems, Man, and Cybernetics (SMC)*, October 13-16, Manchester, UK. doi: 10.1109/SMC.2013.585.
- Nutbeam, D., Harris, E., & Wise, M. (2010). *Theory in a nutshell. A practical guide to health promotion theories*. North Ryde, NSW, Australia: McGraw-Hill.
- Panic, K., Cauberghe, V., & De Pelsmacker, P. (2014). Promoting Dental Hygiene to Children: Comparing Traditional and Interactive Media Following Threat Appeals. *Journal of Health Communication: International Perspectives*, 19, (5), 561-576. doi: 10.1080/10810730.2013.821551.

- Papastergiou, M. (2009). Exploring the potential of computer and video games for health and physical education: A literature review. *Computers & Education, 53*, 603-622.
- Peng, W., Crouse, J. C., & Lin, J.-H. (2012). Using Active Video Games for Physical Activity Promotion: A Systematic Review of the Current State of Research. *Health Education & Behavior, 40*, (2), 171-192. doi: 10.1177/1090198112444956.
- Perhamus, L. M. (2010). 'But your body would rather have this...': conceptualizing health through kinesthetic experience. *International Journal of Qualitative Studies in Education, 23*, (7), 845-868. doi: 10.1080/09518398.2010.529470.
- Peterson, L. (2014). Vikten av ett kritiskt granskande förhållningssätt. In A. Lantz-Andersson & R. Säljö (Eds.). *Lärare i den uppkopplade skolan*. (p. 197-227). Malmö, Sweden: Gleerups.
- Pollak, J., Gay, G., Byrne, S., Wagner, E., Retelny, D., & Humphreys, L. (2010). It's Time to Eat! Using Mobile Games to Promote Healthy Eating. *Pervasive Computing, 9*, (3), 21-27. doi: 10.1109/MPRV.2010.41.
- Poole, E. S., Eiriksdottir E., Miller, A. D., Yan Xu, Catrambone, R., & Mynatt, E.D. (2013). Designing for spectators and coaches: Social support in pervasive health games for youth. *Proceedings of 7th International Conference on Pervasive Computing Technologies for Healthcare (PervasiveHealth)*, May 5-8, Venice, Italy.
- Prochaska, J. O., Redding, C. A., & Evers, K. E. (2008). The Transtheoretical Model and Stages of Change. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.). *Health Behavior and Health Education. Theory, Research, and Practice*. (p. 97-121). San Francisco, CA, USA: Jossey-Bass.
- Radtka, S., Hone, R., Brown, C., Mastick, J., Melnick, M. E., & Dowling, G. A. (2013). Feasibility of Computer-Based Videogame Therapy for Children with Cerebral Palsy. *Games for Health Journal, 2*, (4), 222-228. doi: 10.1089/g4h.2012.0071.
- Ramstrand, N., & Lyngnegård, F. (2012). Can balance in children with cerebral palsy improve through use of an activity promoting computer game? *Technology and Health Care, 20*, 531-540. doi: 10.3233/THC-2012-0696.
- Rash, J. K. (2010). Philosophical Bases for Health Education. In J. M. Black, S. Furney, H. M. Graf, & A. E. Nolte (Eds.). *Philosophical Foundations of Health Education*. (p. 7-10). San Francisco, CA, USA: Jossey-Bass.
- Rosa, R. L., Ridgers, N. D., & Barnett, L. M. (2013). Development and use of an observation tool for active gaming and movement (OTAGM) to measure children's movement skill components during active video game play. *Perceptual & Motor Skills: Physical Development & Measurement, 117*, (3), 935-949. doi: 10.2466/03.25.PMS.117x28z4.
- Scarle, S., Dunwell, I., Bashford-Rogers, T., Selmanovic, E., Debattista, K., Chalmers, A., Powell, J., & Robertson, W. (2011). Complete Motion Control of a Serious Game against Obesity in Children. *Proceedings of IEEE 3rd International Conference on Games and Virtual*

Worlds for Serious Applications (VS-GAMES), May 4-6, Athens, Greece.
doi: 10.1109/VS-GAMES.2011.48.

Seaborn, K., & Fels, D. I. (2015). Gamification in theory and action: A survey. *International Journal of Human-Computer Studies*, 74, 14-31. doi: 10.1016/j.ijhcs.2014.09.006.

Sharma, S. V., Shegog, R., Chow, J., Finley, C., Pomeroy, M., Smith, C., & Hoelscher, D. M. (in press 2015). Effects of the *Quest to Lava Mountain* Computer Game on Dietary and Physical Activity Behaviors of Elementary School Children: A Pilot Group-Randomized Controlled Trial. *Journal of the Academy of Nutrition and Dietetics*.

Staiano, A. E., & Calvert, S. L. (2012). Digital Gaming and Pediatric Obesity: At the Intersection of Science and Social Policy. *Social Issues and Policy Review*, 6, (1), 54-81.
doi: 10.1111/j.1751-2409.2011.01035.x. PMID: 22545068.

Starks, K. (2014). Cognitive behavioral game design: a unified model for designing serious games. *Frontiers in Psychology*, 3, (5), 28. PMID: 24550858.

Straker, L. M., Campbell, A. C., Jensen, L. M., Metcalf, D. R., Smith, A. J., Abbott, R. A., Pollock, C. M., & Piek, J. P. (2011). Rationale, design and methods for a randomised and controlled trial of the impact of virtual reality games on motor competence, physical activity, and mental health in children with developmental coordination disorder. *BMC Public Health*, 11, 654. doi: 10.1186/1471-2458-11-654.

Svederberg, E., & Svensson, L. (2001). Ett folkhälso pedagogiskt synsätt. In E. Svederberg, L. Svensson & T. Kindeberg (Eds.). *Pedagogik i hälsofrämjande arbete*. (p. 17-34). Lund, Sweden: Kurslitteratur.

Tatla, S. K., Radomski, A., Cheung, J., Maron, M., & Jarus, T. (2014). Wii-habilitation as balance therapy for children with acquired brain injury. *Developmental Neurorehabilitation*, 17, (1), 1-15. doi: 10.3109/17518423.2012.740508.

Thompson, D., Baranowski, T., & Buday, R. (2010). Conceptual Model for the Design of a Serious Video Game Promoting Self-Management among Youth with Type 1 Diabetes. *Journal of Diabetes Science and Technology*, 4, (3), 744-749.

Vygotsky, L. S. (1978). *Mind and Society: The Development of Higher Psychological Processes*. Cambridge, MA, USA: Harvard University Press.

Weightman, A., Preston, N., Levesley, M., Bhakta, B., Holt, R., & Mon-Williams, M. (2014). The nature of arm movement in children with cerebral palsy when using computer-generated exercise games. *Disability and Rehabilitation: Assistive Technology*, 9, (3), 219-225.
doi: 10.3109/17483107.2013.782576.

WHO (2015). URL: <http://www.who.int/healthpromotion/conferences/previous/ottawa/en/> (2015 April 21).

Wiborgh, T. (2012). Spelet om vår hälsa. *Dagens Nyheter*, published 2012 August 1.
URL: <http://www.dn.se/spel/spel-hem/spelet-om-var-halsa/> (2015 May 30).

Wüest, S., van de Langenberg, R., & de Bruin, E. D. (2014). Design considerations for a theory-driven exergame-based rehabilitation program to improve walking of persons with stroke. *European Review of Aging and Physical Activity*, *11*, 119-129.
doi: 10.1007/s11556-013-0136-6. PMID: 25309631.

Appendix 1

Date	Database	Key words	Limitations	Results	Excluded	Abstracts	Abstracts corrected for doublets
2015-04-29, 13:04	IEEE Xplore, HH	health AND games AND evaluation AND children	Metadata	14	robots, diet advisory system, teaching and training skills, for public engagement and awareness, preventing injury	5	5
2015-04-29, 13:15	IEEE Xplore, HH	health AND games AND theory AND children	Metadata	4	smoking	1	1
2015-05-04, 21:43	IEEE Xplore, HH	health AND games AND design AND children	Metadata	31	robots, health record application, game addiction, integrated and personalized diabetes coach, information board, wearable systems, healthcare professionals adopting, studies older than 5 years	16	12
2015-05-04, 23:17	PubMed, GU	health AND games AND theory AND children NOT violence NOT gambling NOT bullying NOT weapon NOT television NOT violent	All fields	29	escapism, eHealth, telephone nurse case management, youth sport specialization, vaccination, school nurses' role, pathological use of Internet games, HIV prevention education program, teaching, parenting practices, studies older than 5 years, physical therapists' experiences, therapists' perceptions	9	4
2015-04-29, 13:39	PubMed, GU	health AND games AND design AND children	All fields	214			
2015-05-04, 23:54	PubMed, GU	health AND games AND design AND children AND theory NOT violence NOT gambling NOT bullying NOT weapon NOT television NOT violent	All fields	7	parenting practices, studies older than 5 years	4	0

Date	Database	Key words	Limitations	Results	Excluded	Abstracts	Abstracts corrected for doublets
2015-04-29, 13:47	PubMed, GU	health AND games AND design AND children NOT violence NOT gambling NOT bullying NOT weapon NOT television NOT violent	All fields	134			
2015-04-29, 13:47	PubMed, GU	health AND games AND design AND children NOT violence NOT gambling NOT bullying NOT weapon NOT television NOT violent	All fields, 2000-01-01-present	121	risk factors of overweight and obesity, robots, low back pain factors, prediction of activity type, IGF-I receptor, pathological internet use, stroke knowledge, parental modelling, teaching, ICT in general, online support (no game), websites (no game), studies older than 5 years, not an article, review article	32	30
2015-04-29, 14:21	ERIC, ProQuest, GU	health AND games AND children AND (theory OR design)	Peer reviewed	31	hearing-loss, handwashing programme, screen-related sedentary behaviors, no video game, education, cyberbullying, studies older than 5 years	5	3
<i>Articles and conference papers:</i>						72	55

The table (p. 58-75) below is a compilation of the studied articles. The texts in the columns are more or less copied from respective article.

Appendix 2

No.	Author, Title	Aim	Sample	Research Design	Major Findings
1	Burdea, G. C. (2011) Long-term hand tele-rehabilitation on the playstation 3: Benefits and challenges	To determine whether 14 months and 6 months respectively long therapy cost and effort is justified in terms of positive outcomes, and whether there is good retention of gains.	Two pediatric patients with hemiplegia	Practiced virtual hand rehabilitation games using a modified PlayStation 3 and 5DT sensing gloves.	Based on reports from the patient's mother, by week 4 the patient used his impaired hand to grasp a bottle. By week 10 he picked up a fork and a pill by pinching thumb and index. After four months of training in the home he used his hand to brush his teeth.
2	Finkelstein et al. (2013) Evaluation of the exertion and motivation factors of a virtual reality exercise game for children with autism	To report a study of physical activity and motivation level for children with autism as they played Astrojumper. To explore the application of immersive exergames for children with autism in terms of both motivational and physiological effectiveness.	Ten participants 8-20 years (majority 8-13 years).	Pre-experiment questionnaire, two lab sessions and post-experiment questionnaire.	The most children, including non-verbal participants, were able to achieve vigorous activity levels, with several of them maintaining very high levels of exertion. The children who projected their fantasies into the game world reported higher levels of enjoyment.
3	Matsunaga, R. M. et al. (2014) Development of a serious game for children with hemophilia	To describe the development process of the interface of an educational game that is aimed at children with hemophilia.	Ten children in two groups; five children between 9-13 years and five children between 5-8 years.	Participatory Design	The experience of using dynamics involving children with hemophilia during the development of the game was positive. The use of three dynamic, in the same project, was an original proposal of this work. The results were interesting, and may be adopted as a framework for other development projects of educational games for children with various diseases.
4	Ceccon Ribeiro, P. et al. (2014) ComFiM: a game for multitouch devices to encourage communication between people with autism	To present the development and evaluation of ComFiM, exposing design decisions and results.	Four children (two 5 years and two 11 years) with a severe degree of autism which attend an specialized institute that collaborated with this present research.	The study procedure with the players comprised three steps, which were a pre-interview, the tests with the players itself and a post-interview. The pre and post interviews were both made with the therapist which assists the children.	We observed that ComFiM allowed the generation of stimuli to communicative intentions, such as gestures, short phrases, signs and glances between the players. They also gradually understood the different roles in each level of the game, both of the tutor and of themselves. So, after a few sessions, they have differed when the tutor was a partner and when he was just a mediator in the game.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
5	Maamar, H. R. et al. (2012) 3-D Streaming supplying partner protocols for mobile collaborative exergaming for health	To propose a new trend of mobile collaborative exergaming applications that is based on the peer-to-peer architecture, as well as two supplying partner selection protocols that aim at selecting the suitable source responsible for streaming the relevant 3-D data. Application that aim at tackling health problems such as the childhood obesity issue.	Simulator for simulation experiments for performance evaluation of protocols.	An extensive set of simulation experiments. Each simulation run was repeated several times with a confidence of interval of 95%.	Having an application that does not suffer from networking issues, such as delay, is very important to achieve. A new trend of mobile collaborative exergaming based on class of applications that aims at tackling the childhood obesity issue on a first plan and the antisocial aspect on the second plan was proposed.
6	Correa, O. et al. (2014) A new approach for self adaptive video game for rehabilitation - Experiences in the amblyopia treatment	To get a balance level between the game and the therapies protocol of Amblyopia working about Meaningful Play, Challenge and Conservative Handling of Failure.	Nine amblyopic children between 5 to 7 years old.	They played 30 minutes and the system was prepared for each age. The children played alone without healthcare professional intervention. These used the patch to playing following classic ophthalmology rules. After 21 session the visual acuity was improved 2-3 levels following the Snellen Test.	The rehabilitation achievement with games have two important aspects, these are game desing and clinic protocol. The balance between both is complex and needs to work on Meaningful Play, Conservative Handling of Failure and Challenge. DDA-Help approach is a novel point of view for creating therapies with an interesting Conservative Handling of Failure and a major number of feedbacks. DDA-Help helps to decrease the failure without the user lost his control during the therapy. Moreover the Challenge is proposed in an increasing order always and this is important for maintain patient's attention. DDA-Help was effective in Amblyopia treatment and assisted the creation of a satisfactory Meaningful Play for Meteorix Game.
7	Scarle, S. (2011) Complete motion control of a serious game against obesity in children	To produce a demonstration serious game designed to combat childhood obesity.	Description of the game.	Game design: to conform to the idea of boosting physical activity all input was carried out through movement. Pedagogical decision of non-violence.	Discussion about the near instinctive way that players over-learn the control system in order to use minimum effort.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
8	Almonani, E. et al. (2014) Mobile game approach to prevent childhood obesity using persuasive technology	To identify the most suitable persuasive technology to be applied in mobile game approach to prevent childhood obesity (MACO). To identify the user requirements of MACO. To propose the framework for MACO. To design the prototype of MACO that matches the needs and preferences of users.	Two components of the system prototype are persuasive mobile courseware and persuasive mobile game.	-	Based on the study on the persuasive mobile game technology and the response from the potential users, MACO is developed to provide services and to assist children to apply healthy eating habits, as well as to encourage them to be physically active. Applying persuasive mobile game technology in the learning courseware will encourage children to practice healthy lifestyles. As a result, the total number of overweight and obese children can be reduced.
9	Macvean, A. P. (2011) Task-involved versus Ego-involved: Motivating children to exercise in a pervasive exergame	To present current work on a pervasive health and fitness game (exergame), designed to motivate children to reach their recommended daily exercise goals and facilitate long term behavioural change.	The paper is describing proposed research	A location-aware pervasive exergame will be developed which will contain two primary version. 1.) With competitive elements to encourage an Ego-Involved goal context. 2.) Played with Task-Involved goals with no sharing of performance between players.	The problem with exergames choosing Ego-Involved goals, such as competition, is that research has shown individuals at the lower end of the performance spectrum will become demotivated, as their poorer performance is assessed in comparison to their peers. In a Task-Involved goal context, individuals of all standards have been shown to flourish with those at both ends of the spectrum motivated to improve on previous performances.
10	Abirached, B. et al. (2011) Improving communication skills of children with ASDs through interaction with virtual characters	To present the LIFEisGAME project, a serious game that will help children with ASDs to recognize and express emotions through facial expressions.	Nine participants, seven boys and two girls, ranging from four to eleven years old, with ASDs, participated in the study. Their ASD diagnoses varied. Six were identified as having high-functioning autism or Asperger's syndrome. Two were in the middle of the spectrum.	The game play sessions were video recorded, and the interviews were audio recorded. Interviews with parents after playing the game.	The game design needs to take into consideration the individuality of each child, allowing them to customize settings such as characters, color and sounds. The need for customization is echoed by the results of our survey with psychologists, parents, and therapists, who suggested that children would like to create their own avatars and usually have very specific, but changing, interests (e.g. football, dinosaurs). The user study also suggested that, in addition to human avatars, children want to play with different types of avatars. This result is consistent with our survey with psychologists, parents, and therapists, who suggested that acceptable characters could be humans, animals, or aliens. Furthermore, the animals and aliens should be cartoonish, while the human characters may be either cartoonish or realistic. This is due to the fact that children with ASDs have difficulty recognizing boundaries between the real and the virtual worlds.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
11	Amresh, A. et al. (2014) Make your garden grow: designing a physical activity estimation improvement game	To present a novel game and virtual world based application that is aimed at improving the physical activity estimation skills of parents.	Five students and two obesity researchers have tested the design.	Because young children do not carry cell phones, we have designed "Make Your Garden Grow" (MYGG) so that children wear a small Fitbit accelerometer, which transmits the PA data to the provided computer screen. In MYGG's garden scene, the plant will flourish when the game interprets the accelerometer data. In addition to the plant representing the child's actual activity level, there will be a plant to represent the parent's estimate of the child's activity.	The design for a game that helps parents with improving their PA estimation skills and over continued use of the game, achieve several long term childhood obesity prevention goals was presented.
12	McKenzie, S. et al. (2014) Encouraging organized active game play in primary school children	To present a mobile video game designed to encourage physical activity in children in an organized outdoor setting	14 children (9 boys and 5 girls aged 5-11 years) in an after-school care program at a primary school in Victoria, Australia.	The game was played in a total of four afterschool sessions which occurred from approximately 4.30pm to 5.30pm on the outdoor school playground	Video game elements introduce appeal and variety while still encouraging a shared physical play experience with implicit and explicit physical activities. Clue activities encourage continual movement and exploration of the complete game map, ensuring that the explicit physical activities placed at key locations are triggered. The game design of the M-AVG combines technology based video gaming with organized play activities associated with a child care setting. Annotating the physical world with cones and QR codes ensures that the physical environment is part of the game. Technical limitations of consumer level devices have been overcome by developing a robust solution that identifies game locations using code scanning and provides a generic solution to activity level monitoring.
13	Nixon, M. E. et al. (2013) Applying gaming principles to virtual environments for upper extremity therapy games	To discuss a system that utilizes game design principles to develop a therapy game for upper extremity rehabilitation. We provide an overview of the system and show evidence based on assessments from adults and children using our virtual environment.	19 adults (6 females and 13 male between 18 and 32 years old) and 7 children.	Interaction with the virtual rehabilitation system at least four times per participant. Each interaction was timed to at least 40 seconds. At the conclusion of the set of interactions, participants were given survey questions to evaluate their experience.	Judging our game implementation using the principles defined, we see that the adult game effectively implements the in-game story, provides useful visual feedback, encourages exploration, and offers a sense of achievement. However, this implementation yielded conflicting results on ease of use. From the results from the child surveys and considering the data only with the least deviation, we can glean the following main points from the data. Again we see support of our in-game story in the children's survey results as well as the visual feedback. From the survey data, the game interface is thought to be easy to use and understand. Based on the children's self-assessment of movement difficulty we believe that our game encourages movement exploration.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
14	Hoberman, P. et al. (2012) Using the phantogram technique for a collaborative stereoscopic multitouch tabletop game	To outline the development of astereoscopic game included in the design of a pilot transmediastorytelling campaign for health promotion and communication of basic concepts about vision and perception for a target audience of children under six and their families in a research clinic setting.	The Microsoft Surface is a table-sized multi-touch, multiuser platform that uses a built-in rear-projection system to display a 1024 x 768 image on a 30" horizontal screen surface.	The game design team developed and presented a number of scenarios, most of which foregrounded the pleasure and utility of stereoscopic vision. These were playtested with the team internally and informally tested with kids ages 3-6 at the clinic.	An informal assessment of the game's conceptual effectiveness and technical robustness by observing its use on site in the MEPEDS clinic was conducted in Alhambra with custom-sized anaglyph glasses for children. The authors plan to conduct a formal on-site usability/playability evaluation, revise the garden game and then implement and test the indoor scenario. Ultimately, the game and the STRANS campaign as a whole has to be tested within the MEPEDS study. There was anecdotal evidence that children who played the game may be better equipped to be tested with the current standard instrument for stereo acuity in children.
15	Poole, E. S. et al. (2013) Designing for spectators and coaches: Social support in pervasive health games for youth	To provide guidelines that can assist intervention and technology developers in creating compelling pervasive health game user experiences, by explicitly considering social support in the design process.	1,377 students started in the first round (Spring 2009) and 1,743 students participated in at least one of the three rounds. Most students were in 6th grade (age 10-11) when they began the Challenge and in 7th grade (age 12-13) when the Challenge ended.	During the competition, each child wore a small, unobtrusive shoe-mounted pedometer with a wireless transmitter during the competition. Step data were available on the game website within eight hours. Students could use the web game interface to check their steps, see their classmates' characters and status, purchase items for their avatars, and see their school's total compared to other schools.	The program led to moderate increases in daily physical activity as compared to a baseline data collection period. At school, 50% of the respondents discussed exercise with their facilitating teachers at least once; this is notable given that in many cases, the teachers were not physical education or health educators, but rather teachers of subjects such as mathematics, history, or social studies. With respect to Challenge-specific discussions, 77% of respondents talked about aspects of the Challenge with their teachers at least once.
16	Pollak, J. et al. (2010) It's Time to Eat! Using mobile games to promote healthy eating	To identify how a mobile phone game's motivational features support and encourage healthy eating habits.	53 seventh and eighth graders at a rural middle school in upstate New York	The children played the game "Time to Eat" for one month.	Kids who played Time to Eat ate a healthy breakfast more frequently than those who didn't. Children playing the game ate a healthy breakfast 52 percent of the time; kids who didn't play it ate a healthy breakfast approximately only 20 percent of the time. They also found that kids needed to receive both negative and positive feedback from their pet, suggesting that emotional and social realism were key to their experience and the game's motivational abilities. Interestingly, they found no significant gender effects.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
17	Fraiwan, M. A. et al. (2013) Therapy central: On the development of computer games for physiotherapy	To demonstrate the use of commercially available technology (i.e., Xbox Kinect) in the development of serious games. This paper will focus on rehabilitation of CP through simple home exercise programs, which will be delivered by serious gaming. To tackle the boredom aspect of the rehabilitation process wherein we develop a therapy system that uses computer games to emulate the therapeutic activities. We describe, in some details, the issues involved in the development process.	The system architecture for data acquisition, processing, and integration in computer games is described.	A complete system for game design for physiotherapy using commercial of the shelf (COTS) gaming consoles is proposed.	These games will serve the purpose of physiotherapy and rehabilitation of individuals suffering from various disabilities and disorders. The main idea is to design games such that gaming motions will emulate physiotherapy motions. The development process and the system architecture were described to some degree of details. This area of research is challenging yet promising, as technology is increasingly becoming more pervasive and more user-friendly.
18	Johnsen, K. et al. (2014) Mixed reality virtual pets to reduce childhood obesity	To describe the application as aligned with our theoretical framework (Social Cognitive Theory [7]) as well as the detailed mixed reality system design. We additionally report the encouraging results of an initial user study, which involved young children enrolled at a local camp using the application over the course of a week. The innovation in our work was in the use of a tightly coupled mixed reality system designed to promote increased activity and in incorporating the interactive experience into an authentic, active space. Additionally, it focused more on intrinsic rewards for exercise (e.g. increased self-efficacy, personal satisfaction, positive feelings towards exercise), rather than extrinsic rewards (e.g. points, prizes).	We partnered with a popular local summer camp. On average, each week over the summer the camp hosts 600 children from around the region. We had the capacity to support up to 70 children in the study, which was limited by the number of activity monitors on hand, and we recruited with the intended target of 60 participants for the possibility of the activity monitors being lost or broken.	Two similar kiosks (one had a 55 inch television, the other a 60 inch television, but were otherwise identical) were deployed at the camp in a central assembly building, but located in different hallways to prevent speech recognition interference. Two kiosks were used to allow for increased user throughput during the course of the experiment. These kiosks were to be used exclusively by participants in the treatment condition. Additionally, two desktop computers were deployed in the same building (in a third hallway) for use by participants in the control condition. Participants in the control condition were restricted by the software from using the virtual pet kiosks (nothing would happen when the activity monitor was inserted). Similarly, participants in the treatment group were restricted from using the control condition computers. However, we could not absolutely restrict participants in either group from observing participants in the other, as the kiosks and computers were purposefully located in public areas to promote frequent use.	Our results show a 60% increase in physical activity in the treatment condition relative to the control condition. While we expected an increase, we did not expect that the difference would be so large. First, the camp environment is a place of already high activity. Children are outside for a large portion of the day, and travel between areas of the camp frequently. Thus, we questioned whether the camp environment would cause a ceiling effect on our results. What we found was that the camp environment provided additional possibilities for exercise that were not expected. For example, on the first day of the study, one of the counsellors provided an anecdote to us that she was going to take her cabin to another area of the camp by van, but that the children stopped her that were part of the study and asked if they could walk instead: so that their pets would get the exercise! These anecdotes continued throughout the study.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
19	Kamel Boulos, M. N. et al. (2015) Digital games for type 1 and type 2 diabetes: Underpinning theory with three illustrative examples	To provide examples of games; game apps and platforms, to support the discussion of the potential of gamification and digital game mechanics as adherence tools in the management of diabetes, and how these mechanics might work, including the underpinning psychological mechanisms for behavior change.	The paper serves as a taster of a few of the game genres on offer today for both types of diabetes.	Provide examples of mobile and desktop game apps, games and platforms for type 1 and type 2 diabetes to support the discussion of the potential of gamification and digital game mechanics as adherence tools in the management of diabetes, and how these mechanisms might work, including the underpinning psychological mechanisms for behavior change.	Self-efficacy is an important concept to understand when building tools that support people with diabetes in managing their disease. Designs for people with diabetes should build on self-efficacy by (1) providing a series of progressive, small successes or achievements related to diabetes management, (2) creating vicarious experience through social features that allow peer-to-peer sharing, (3) maximizing incoming social messages of encouragement, and (4) providing empowering and empathic messages and narratives.
20	Lwin, M. O. et al. (2014) Can exergames impart health messages? Game play, framing, and drivers of physical activity among children	To examine the effectiveness of incorporating exergaming into physical education lessons as a platform for imparting health education messages and influencing children's beliefs about and attitudes toward physical activity.	398 (initial 454) 5th-grade school children in Singapore, 6-week intervention program using Nintendo Wii games	Four classes were selected within each of the three participating schools, with each class randomly assigned to one experimental condition. A 2 x 2 factorial design was used.	Significant effects of the combined intervention on children's attitudes, self-efficacy, and perceived behavioral control, thus suggesting the efficacy of using more than one intervention component. Significant differences in attitudes, self-efficacy, and perceived behavioral control between children in the Wii and non-Wii conditions, but only among those exposed to health messages with threat frames.
21	Luna-Oliva, L. et al. (2013) Kinect Xbox 360 as a therapeutic modality for children with cerebral palsy in a school environment: A preliminary study	To evaluate the usefulness of a videogame system based on non-immersive virtual reality technology (Xbox 360 Kinect) to support conventional rehabilitation treatment of children with cerebral palsy. To objectify changes in psychomotor status of children with cerebral palsy after receiving rehabilitation treatment in addition with this last generation game console.	11 children with cerebral palsy.	A baseline, a post-treatment and a follow-up assessment related to motor and process skills. Eight weeks of videogame treatment added to their conventional physiotherapy treatment.	Significant functional improvements in relation with motor global function and performance capacity in ADL (activities of daily living) were shown. Results showed a significant improvement on sample functional status, which was maintained eight weeks after intervention.
22	Elias, P. et al. (2013) InSpire to promote lung assessment in youth: Evolving the self-management paradigms of young people with asthma	To develop and pilot test InSpire, a fully functional interface between a handheld spirometer and an interactive game and individualized asthma-cera instant-messaging system housed on a mobile phone.	200 children played InSpire and 9 children aged 7 to 14 with asthma more intensively tested the system.	The feasibility of the game was tested via consultation with children. The likability of the graphical user interface (GUI) was tested as well as young people's interest in the incentivizing system at a health fair.	Nearly all of the children with asthma surveyed said they would play games like those in the InSpire system if they involved breathing into a spirometer. 2/3 said they would prefer the InSpire system over the spirometer alone, whereas 1/3 would prefer having both. None of the children preferred a conventional spirometer over the InSpire system.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
23	Staiano, A. E. et al. (2012) Digital gaming and pediatric obesity: At the intersection of science and social policy	To provide an analysis of the negative and positive health impacts of digital gaming as they relate specifically to overweight and obesity outcomes for children and adolescents.	Literature review.	-	Social cognitive theory and mediators explain how children and adolescents who play exergames increase in self-efficacy, self-esteem, and friendship quality, which can promote sustained interest in gameplay. The melding of electronic games with the health of children and adolescents is an intersection of science and social policy, gathering social scientists, game developers, and policy makers who can develop innovative, effective games that are engaging and fun to the many digital natives that are in great need of a much healthier lifestyle.
24	Sharma, S. V. et al. (2015) Effects of the Quest to Lava Mountain computer game on dietary and physical activity behaviors of elementary school children: A pilot group-randomized controlled trial	To evaluate the feasibility, acceptability, and effects of the Quest to Lava Mountain (QTLM) computer game on dietary behaviors, physical activity behaviors, and psychosocial factors among ethnically diverse children in Texas.	A total of 107 children in fourth and fifth grade consented. There was an attrition rate of 8.8% with a final sample size of 44 children in three intervention schools, and a sample of 50 children in three comparison schools.	Quasi-experimental group-randomized controlled trial conducted during the 2012-2013 school year.	QTLM has some promising acceptability and initial effects on diet and physical activity behaviors among children in elementary school.
25	Lau, P. W. C. et al. (2015) Evaluating physical and perceptual responses to exergames in Chinese children	To examine whether exergames could help children reach the recommendations for PA and cardiorespiratory fitness regarding exercise intensity.	Twenty-one children (age: 10.45 ± 0.88).	The children were assessed for EE, VO ₂ and HR during rest, in a maximal treadmill test, and while playing different exergames. Ratings of perceived exertion (RPE) (category range: 0 to 10) were also measured during exergaming. Three types of exergames were examined: running, table tennis, and dancing.	Exergames could provide alternative opportunities to enhance children's physical activity. They could be used as light-to-moderate PA, and with exergames, children can even reach the recommended intensity for developing and maintaining cardiorespiratory fitness.
26	Brazendale et al. (2015) Maximizing children's physical activity using the LET US Play principles	To compare the moderate-to-vigorous physical activity (MVPA) children accumulate during commonly played games delivered in their traditional format versus games modified according to the LET US Play principles.	Children (K-5th) participated in 1-hour PA sessions delivered on non-consecutive days (summer 2014).	Using a randomized, counterbalanced design, one of the six games was played for 20min using either traditional rules or LET US Play followed by the other strategy with a 10min break in between. Physical activity was measured via accelerometry. Repeated-measures, mixed-effects regression models were used to estimate differences in percent of time spent sedentary and in MVPA.	LET US Play led to greater accumulation of MVPA for boys and girls, and can increase the percent of children attaining the 50% of time in MVPA standard

No.	Author, Title	Aim	Sample	Research Design	Major Findings
27	Knutz, E. et al. (2014) Why health care needs design research: Broadening the perspective on communication in pediatric care through play	To introduce a new design-oriented method of gathering information about the emotional state of pediatric patients using an experimental computer game called the Child Patient game (CPgame).	Twelve patients (age 4-6 years) recruited when hospitalized. Twelve non-patients (age 4-6 years).	Qualitative study one part at a Danish hospital and the other part in a Danish kindergarten.	The first comparative analysis of this study concludes that the relationship between felt emotions and fictional emotions takes various forms; sometimes the fictional emotion relates strongly to the real emotion and sometimes the fictional emotion hardly relates to the real emotion at all. The second comparative analysis found that the patients played the CPgame in a radically different manner than the nonpatients in terms of adding emotions and secret powers to the fictive character in the game.
28	Larsen, L. R. et al. (2014) Field assessment of balance in 10 to 14 year children, reproducibility and validity of the Nintendo Wii board (NWB)	To investigate reproducibility of the NWB and a laboratory force platform (AMTI) in a field setting, and to explore the concurrent validity of the NWB when compared to the AMTI, in a field setting to test bilateral and unilateral balance in a random selection of children and adolescents.	Fifty-four 10–14 year-olds from the CHAMPS-Study DK.	Four different balance tests: bilateral stance with eyes open (1), unilateral stance on dominant (2) and non-dominant leg (3) with eyes open, and bilateral stance with eyes closed (4). Three rounds of the four tests were completed with the NWB and with a force platform (AMTI). To assess reproducibility, an intra-day test-retest design was applied with a two-hour break between sessions.	Both NWB and AMTI have satisfactory reproducibility for testing static balance in a population of children. Concurrent validity of NWB compared with AMTI was satisfactory. Furthermore, the results from the concurrent validity study were comparable to the reproducibility results of the NWB and the AMTI. Thus, NWB has the potential to replace the AMTI in field settings in studies including children.
29	Radtka, S. et al. (2013) Feasibility of computer-based videogame therapy for children with cerebral palsy	To demonstrate the technical feasibility, ease of use, appeal, and safety of a computer-based videogame program designed to improve balance in children with CP.	Subjects were recruited from the California Children Services Medical Therapy Units. Fourteen subjects participated: four in the preliminary clinic evaluation and 10 in the in-home feasibility and safety testing.	To determine subjective assessment of physical activity intensity during game play, the Borg Rating of Perceived Exertion Scale (RPE) was administered upon completion of the training trial. Safety was determined by the number of potential and actual falls that occurred during testing, and ease of use was assessed by a modified Short Feedback Questionnaire Pediatric Version (SFQP). Subjects responded to the following questions by indicating stars on a Likert scale.	A computer-based videogame incorporating therapeutic movements to improve gait and balance in children with CP was appealing and feasible for home use.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
30	Rosa, R. L. et al. (2013) Development and use of an observation tool for active gaming and movement (OTAGM) to measure children's movement skill components during active video game play	To observe skill components and body movements during Nintendo Wii @ game play during a free play context. For that purpose, the Observation Tool of Active Gaming and Movement (OTAGM) was developed.	Eighteen children (12 boys, 6 girls) ages 5–8 years participated in the study. These children were typically developing children who were in the first three years of elementary school (8 children in Grade Prep, 5 in Grade 1 and 5 in Grade 2).	The Observation Tool of Active Gaming and Movement (OTAGM) is a direct observation instrument, developed by the authors, which was designed to simultaneously observe and record children's movement skills during active video game play. The tool is based on momentary-time sampling techniques (i.e., 10 sec. observation period followed by a 10 sec. recording period) in which systematic and periodic snapshots are made to document children's object control skills, body movement and task engagement during active video game play. Each observation period lasted 10 min., and 30 observations were analyzed.	Most of the observations were of playing striking games (32% of observations), followed by rolling games (28% of observations) and throwing games (28% of observations). The remaining 12% of observations were 'other' games or not playing any games when observed (e.g., selecting a game from the menu). Out of the 18 children, 16 played rolling games, 15 played striking games, and 15 children played throwing games during the six-week period. During the Nintendo Wii @ game play, children were engaged in 98% of the observations. Sixty-two percent of observations showed children exhibiting no movement, 17% little to some movement, 9% arm movement, 7% leg movement, and 5% whole body movement.
31	Panic, K. et al. (2014) Promoting dental hygiene to children: comparing traditional and interactive media following threats appeals	To investigate whether computer games can be used to enhance the effectiveness of health messages, and whether this new medium can be equally or more effective than the traditional teaching materials used today.	Respondents (190 children, 7-9-year-old) were recruited from 10 different primary schools in Belgium. Only third-grade students were selected, each randomly assigned to one of the experimental conditions or to the control group.	To test the hypotheses, we used a 2 (weak vs. strong threat) × 3 (medium to convey additional health information: computer game, information brochure, narrative story) between-subjects factorial design. For the interactive game condition, we use a computer game that was developed to teach children the importance of dental hygiene through interactive game play.	Results showed no difference in prior brushing behavior, nor in previous behavior concerning their visits to the dentist. Furthermore, the results of the manipulation check in the main study confirm that the perceived threat was significantly higher in the strong threat condition than in the weak threat condition.
32	Baranowski, T. et al. (2013) Influences on children's dietary behavior, and innovative attempts to change it	To briefly review the influences on fruit and vegetables (FV) intake, which provide the foundation for intervention, and summarize the findings evaluating a highly innovative approach to changing dietary behaviors: serious video games, which offer a method that appears promising for obtaining dietary change.	Families of three ethnic groups.	Qualitative research with children and parents	Child-reported home FV availability, parent modeling of FV intake, and parenting control were positively correlated with FV intake, while peer normative beliefs were negatively correlated with child FV intake, and parent-reported negative parenting practices and barriers were negatively correlated with child FV intake, but a number of parent-reported parenting practices were not. To our surprise, few ethnic group differences were detected in the child- or parent-reported parenting practices.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
33	Mellecker, R. R. et al. (2014) Active video games and physical activity recommendations: a comparison of the gamercize Stepper, XBOX Kinect and XaviX J-Mat	To evaluate the intensity levels of three exergames and determine the association with physical activity recommendations that correspond to specific outcomes. The variation in cardiovascular responses between the three exergames was also examined.	Eighteen Hong Kong Chinese girls (8-9 years) were recruited through a local government primary school. 11 (61%) of the girls were considered over-weight and 7 (39%) were normal weight.	Following the initial baseline assessments, the girls attended three active gaming sessions on separate days in the primary school. At the beginning of each active gaming session the girls were fitted with a Polar heart rate monitor (Polar E600). Heart rate was assessed continuously for 5-min and the average heart rate from the 5-min of active game play was used to determine the cardiovascular effort for each session. We asked the girls to sit quietly for 5 min to ensure heart rates were at resting levels prior to the active video gaming sessions. Due to limited time period during lunch recess and to reduce the burden on the school the active video gaming sessions were limited to 5-min each.	When comparing the three exergame conditions, we found XaviX J-Mat play was equivalent to moderate intensity levels, levels commensurate with body composition changes. Although heart rates were elevated above resting and sitting heart rates, most of the girls did not step and game using Gamercize or play the Kinect River Rush at moderate intensity levels.
34	Ferguson, G. D. (2013) The efficacy of two task-oriented interventions for children with developmental coordination disorder: Neuromotor task training and Nintendo Wii Fit training	To compare the efficacy of NTT and Nintendo Wii Fit training in two groups of children with DCD attending schools in a low socioeconomic area.	Children were eligible for the intervention study if they were between the ages of six to ten years old and in grades one to four.	A pragmatic, single blinded, quasi-experimental design was used to compare the effect of two intervention programmes. Cluster sampling was used to select three mainstream primary schools. The NTT (Neuromotor Task Training) program was implemented for nine weeks, with two sessions per week each lasting between 45 and 60 min. Children engaged in 30 min of gaming on the Nintendo Wii Fit balance board, three times a week for a period of six weeks under the supervision and guidance of two qualified therapists.	Both interventions seem useful in improving motor and anaerobic performance from baseline to post measurement. This study provides evidence for effective interventions that can be implemented in schools to improve functional motor and fitness outcomes for children with DCD. This study demonstrates that the NTT approach is an efficacious and effective approach to address motor coordination, functional strength and cardiorespiratory fitness in children with DCD when used in a group format. It is encouraging to note that improvements were seen not only in tasks that were practiced. Although the Wii training intervention did not result in significant improvement in motor proficiency, the fact that children improved their anaerobic capacity lends support to the use of this approach in situations where opportunities to develop cardiorespiratory fitness is limited.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
35	Mills, A. et al. (2013) The effect of exergaming on vascular function in children	To assess whether exergaming can induce measurable changes in heart rate (HR), energy expenditure (EE), and flow-mediated dilation (FMD) arterial function in healthy children.	Fifteen children (8 males, 10 years, body mass index 17.9 kg.m ²)	A graded exercise test and 2*15 minute exergaming sessions (Xbox 360–Kinect); high intensity exergaming (HiE, KinectSports–200 m Hurdles) and low intensity exergaming (LoE, Kinect Sports–Ten Pin Bowling). Brachial artery FMD, a measure of endothelial function and arterial health, was measured before and immediately after each exergaming intervention. ActiHearts were used to measure EE and HR during game play and a physical activity enjoyment scale assessed enjoyment.	HiE, but not LoE, induced large HR and EE responses that were associated with effects on vascular function. This study suggests that an acute bout of HiE exergaming may provide a substrate for beneficial arterial adaptations in children.
36	Weightman, A. et al. (2014) The nature of arm movement in children with cerebral palsy when using computer-generated exercise games	To compare upper limb kinematics of children with spastic cerebral palsy (CP) using a passive rehabilitation joystick with those of adults and able-bodied children, to better understand the design requirements of computer-based rehabilitation devices.	Seven children with spastic CP, nine able-bodied adults and nine able-bodied children	A blocked comparative study involving seven children with spastic CP, nine able-bodied adults and nine able-bodied children, using a joystick system to play a computer game whilst the kinematics of their upper limb were recorded. The translational kinematics of the joystick's end point and the participant's shoulder movement (protraction/retraction) and elbow rotational kinematics (flexion/extension) were analysed for each group.	Children with spastic CP matched their able-bodied peers in the time taken to complete the computer task, but this was due to a failure to adhere to the task instructions of travelling along a prescribed straight line when moving between targets. The spastic CP group took longer to initiate the first movement, which showed jerkier trajectories and demonstrated qualitatively different movement patterns when using the joystick, with shoulder movements that were significantly of greater magnitude than the able-bodied participants. Children with spastic CP generate large shoulder and hence trunk movements when using a joystick to undertake computer-generated arm exercises. This finding has implications for the development and use of assistive technologies to encourage exercise and the instructions given to users of such systems.
37	Gao, Z. (et al. (2013) Video game-based exercise, Latino children's physical health, and academic achievement	To examine the impact of Dance Dance Revolution [DDR]–based exercise on Latino children's physical fitness and academic achievement.	208 Latino school children	A repeated-measures crossover design was used. In Year 1, Grade-4 students were assigned to the intervention group and offered 30 minutes of exercise (DDR, aerobic dance) three times per week. Grade-3 and Grade-5 students made up the comparison group and were offered no structured exercise at school. In Year 2, the Grade-4 students were again assigned to the intervention, whereas Grade-5 and Grade-6 students were in the comparison group.	The DDR-based exercise intervention improved children's cardiorespiratory endurance and math scores over time. Professionals should consider integrating exergaming at schools to achieve the goals of promoting a physically active lifestyle and enhancing academic success among Latino children.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
38	Tatla, S. K. et al. (2014) Wii-habilitation as balance therapy for children with acquired brain injury	To evaluate the effectiveness of the Nintendo Wii compared to traditional balance therapy in improving balance, motivation, and functional ability in children undergoing acute rehabilitation after brain injury.	Two boys aged 12 and 13 and one girl 14 years.	A non-concurrent, randomized multiple baseline single-subject research design was used with three participants. Data were analyzed by visual inspection of trend lines.	Daily Wii balance training was equally motivating to traditional balance therapy for two participants and more motivating for one participant. While improvements in dynamic balance were observed, the results for static balance remain inconclusive. All participants demonstrated improvements in functional ability. Wii balance therapy is a safe, feasible, and motivating intervention for children undergoing acute rehabilitation after an acquired brain injury. Further research to examine the effectiveness of Wii balance therapy in this population is warranted.
39	Ramstrand, N. et al. (2012) Can balance in children with cerebral palsy improve through use of an activity promoting computer game?	To evaluate if use of an activity promoting computer game, used in the home (Nintendo Wii Fit), could influence balance related outcome measures in children with cerebral palsy.	The sample included 8 males and 10 females (8-17 years). Participants were recruited on the basis that they had a diagnosis of cerebral palsy (hemiplegia or diplegia).	A randomised cross-over design was used with children tested at baseline, after five weeks of playing Wii Fit games and after five weeks without any intervention. Outcome measures of interest included: performance on the modified sensory organisation test, reactive balance test and rhythmic weight shift test.	No significant difference was observed between testing occasions for any of the balance measures investigated. Our results suggest that use of a Nintendo Wii balance board and Wii Fit software for a minimum of thirty minutes per day in the patient's own home, over a five week period, is not effective as a balance training tool in children with cerebral palsy.
40	Jelsma, J. et al. (2013) The effect of the Nintendo Wii Fit on balance control and gross motor function of children with spastic hemiplegic cerebral palsy	To study the impact of training using the Nintendo Wii Fit in 14 children with spastic hemiplegic cerebral palsy.	Fourteen 7–14-year-old children participated in the study.	A single-subject single blinded design with multiple subjects and baselines was utilised. Interactive video gaming (IVG) in lieu of regular physiotherapy was given for 3 weeks. Outcome measures included modified balance and running speed and agility (RSA) scales of the Bruininks–Oserestky test of Motor Performance 2 and the timed up and down stairs (TUDS).	Balances score improved significantly. Changes over time in the RSA and the TUDS were not significant. Ten children preferred the intervention to conventional physiotherapy. Most children preferred the IVG but as the effect did not carry over into function, IVG should not be used in place of conventional therapy.
41	Inglés-Camats, G. et al. (2012) Yummy tricks: a serious game for learning healthy eating habits	To present and test the application "Yummy Tricks" which consists of two (so far) mini-games. The objective of the games is to teach children healthy eating habits while having a good time playing.	Three children have tested the application during different stages of the game.	-	Preliminary results show that the proposed application successfully engages children on playing while learning healthy food habits. Being a game helps motivation for playing it over and over again. Initial observations show that children understand and remember the lessons for each game.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
42	Baranowski, T. et al. (2012) Let's get technical! Gaming and technology for weight control and health promotion in children	To describe the primary characteristics of different technological methods, to present the strengths and weaknesses of each in meeting children of different ages. To emphasize that we are in the earliest stages of knowing how best to design these systems, including selecting the optimal requisite behavioral change theories, and identify high-priority research issues.	Different electronic procedures for behavior change classified into five general categories: (1) Web-based educational/therapeutic programs (ET), (2) tailored message (TM) systems, (3) data monitoring and feedback (DMF) systems, (4) active video games (AVG), and (5) interactive multimedia involving games (IMG).	-	Technology for children needs to be developmentally appropriate. Incorporating theory-based procedures into electronic programs appears to offer the most promise to change behavior.
43	Howcroft, J. et al. (2012) Active video game play in children with cerebral palsy: potential for physical activity promotion and rehabilitation therapies	To evaluate the potential of active video game (AVG) play for physical activity promotion and rehabilitation therapies in children with cerebral palsy (CP) through a quantitative exploration of energy expenditure, muscle activation, and quality of movement.	Seventeen 9-year-old children with CP.	Single-group, experimental study. Human movement laboratory in an urban rehabilitation hospital. Participants played 4 AVGs (bowling, tennis, boxing, and a dance game).	Moderate levels of physical activity were achieved during the dance (metabolic equivalent for task and boxing games. AVG play via a low-cost, commercially available system can offer an enjoyable opportunity for light to moderate physical activity in children with CP. While all games may encourage motor learning to some extent, AVGs can be strategically selected to address specific therapeutic goals (eg, targeted joints, bilateral limb use). Future research is needed to address the challenge of individual variability in movement patterns/play styles. Likewise, further study exploring home use of AVGs for physical activity promotion and rehabilitation therapies, and its functional outcomes, is warranted.
44	Christison, A. et al. (2012) Exergaming for health: a community-based pediatric weight management program using active video gaming	To evaluate the efficacy and feasibility of a multifaceted, community-based weight intervention program for children using exergaming technology (activity-promoting video gaming).	Forty-eight children, between the ages of 8 and 16 years, who are overweight or obese, enrolled in Exergaming for Health, a multidisciplinary weight management program, which used active video gaming.	A prospective observational pilot study.	Most children (n = 40, 83%) completed the program and participated in outcome evaluations. The average BMI change was -0.48 kg/m ² . The average Global Self-Worth score improved, screen time and soda intake reduced, and exercise hours per week increased. Conclusions. The Exergaming for Health program may be an effective weight management intervention that is feasible with high participation rates.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
45	McGaffey, A. L. et al. (2011) Fitwits MD(TM): an office-based tool and games for conversations about obesity with 9- to 12-year-old children	Physician feelings of ineffectiveness and family-related barriers hamper childhood obesity discussions. Physicians desire appealing, time-efficient tools to frame and sensitively address obesity, body mass index, physical activity, nutrition, and portion size. Our university design-led coalition codeveloped tools and games for this purpose.	33 physicians and 93 preadolescents (9-12 years) and families.	In this feasibility study, physician-level counseling of 9- to 12-year-old children and their parents/caretakers using Fitwits MD (Carnegie Mellon University School of Design, Pittsburgh, PA), were evaluated. A brief, structured intervention with flashcards and take-home games. Residency-based physicians in three low- to mid-level socioeconomic urban offices provided self-report data over 8 months through surveys, comment cards, and interviews.	Child-centered key messages resulted in 7-minute conversations, on average. For those physicians who used Fitwits MD, 96% felt improved comfort and competence and 78% noted barrier reduction. Fitwits MD improved residency-based physician self-efficacy and emphasized important health education topics regarding office-based childhood obesity discussions with preadolescents and parents/caretakers.
46	Straker, L. M. et al. (2011) Rationale, design and methods for a randomized and controlled trial of the impact of virtual reality games on motor competence, physical activity, and mental health in children with developmental coordination disorder	To examine whether motor coordination is enhanced by access to active electronic games and whether daily activity, attitudes to physical activity and mental health are enhanced.	Thirty children aged 10-12 years with poor motor coordination	Cross-over randomised and controlled trial (study protocol)	(Study protocol)
47	Baranowski, T. et al. (2011a) Behavioral science in video games for children's diet and physical activity change: Key research needs	To address the relationship of intervention procedures as incorporated in video games to change mediating variables. Many of the previous intervention programs for preventing obesity, changing diet, or enhancing physical activity have not been successful among children. Within the context of the MMVM and video game interventions, the primary focus of this article is to explain that lack of effect is the linkage from the video game implementation of intervention procedures to desired mediating variable change. Attracting and maintaining a child's attention may be the biggest contribution of video games to health-related behavior change, but this has not been demonstrated.	-	-	We are in the earliest stages of understanding how serious video games can influence health-related behaviors. Because video games are attractive to children, they hold the promise of engaging children in behaviorchange- promoting activities. Extensive research is needed to understand when and how these change procedures influence mediating variables and, in turn, behavior. The results will facilitate the design of ensuing serious video games for behavior change for large public health benefits.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
48	Adamo, K. B. et al. (2010) Effects of interactive video game cycling on overweight and obese adolescent health	To comparatively examine the effects of an innovative interactive video game cycling program using the GameBike with stationary cycling to music (comparison condition) on adherence, duration, intensity of exercise, submaximal aerobic fitness, metabolic parameters, and body composition using a randomized controlled trial design in overweight and obese teens.	Thirty overweight (with at least 1 metabolic complication) or obese adolescents aged 12–17 years were stratified by gender and randomized to video game or music condition, with 4 participants (2 per group) failing to complete the twice weekly 60 min sessions of the 10-week trial.	Although outcome assessors were not blinded to group membership, the outcome measures were objectively measured, thus reducing the likelihood of bias.	The researchers found that stationary cycling to music produced a significantly better rate of exercise adherence and more time spent in vigorous PA and distance pedaled compared with interactive video game cycling in overweight and obese adolescents. Despite these advantages for music, no other differences between exercise modalities were found. Both exercise conditions increased aerobic fitness and when combined, reduced body fat and total cholesterol in overweight and obese teenagers, demonstrating that cycling to music or to video games twice weekly whereby participants self-select their attendance, volume, and intensity of exercise may provide health benefits to overweight and obese teens at risk of chronic disease.
49	Baranowski, T. et al. (2011b) Video game play, child diet, and physical activity behavior change a randomized clinical trial	To evaluate outcome from playing “Escape from Diab” (Diab) and “Nanoswarm: Invasion from Inner Space” (Nano) video games on children’s diet, physical activity and adiposity.	133 children aged 10–12 years, initially between 50 percentile and 95 percentile BMI.	Two-group RCT; assessments occurred at baseline (B), immediately after Diab (P1), immediately after Nano (P2) and 2 months later (P3). Data were collected in 2008–2009, and analyses conducted in 2009–2010. Treatment group played Diab and Nano in sequence. Control Group played diet and physical activity knowledge-based games on popular websites.	Children playing these video games increased fruit and vegetable consumption by about .67 servings per day, but not water, moderate-to-vigorous physical activity, or body composition.
50	Thompson, D. et al. (2010) Conceptual model for the design of a serious video game promoting self-management among youth with type 1 diabetes	To present a conceptual model of how to develop effective serious video games for health.	-	-	Serious video games offer promise as an engaging and entertaining method for promoting self-management among youth with diabetes, particularly when guided by a conceptual model informed by behavioral theory.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
51	Golomb, M.R. et al. (2010) In-home virtual reality videogame telerehabilitation in adolescents with hemiplegic cerebral palsy	To investigate whether in-home remotely monitored virtual reality videogame-based telerehabilitation in adolescents with hemiplegic cerebral palsy can improve hand function and forearm bone health, and demonstrate alterations in motor circuitry activation.	Three adolescents with severe hemiplegic cerebral palsy.	A 3-month proof-of-concept pilot study. Virtual reality videogame-based rehabilitation systems were installed in the homes of 3 participants and networked via secure Internet connections to the collaborating engineering school and children's hospital. Participants were asked to exercise the plegic hand 30 minutes a day, 5 days a week using a sensor glove fitted to the plegic hand and attached to a remotely monitored videogame console installed in their home. Games were custom developed, focused on finger movement, and included a screen avatar of the hand.	All 3 adolescents showed improved function of the plegic hand on occupational therapy testing, including increased ability to lift objects, and improved finger ROM based on remote measurements. Use of remotely monitored virtual reality videogame telerehabilitation appears to produce improved hand function and forearm bone health (as measured by DXA and pQCT) in adolescents with chronic disability who practice regularly. Improved hand function appears to be reflected in functional brain changes.
52	Baranowski, T. et al (2010) Design of video games for children's diet and physical activity behavior change	To describe the need of models of behavior change in interventions with serious video games.	-	-	Intervention research in general needs strong tests of models of behavior, behavior change and of the efficacy and effectiveness of the touted behavior change procedures (Baranowski et al., 2009). VG interventions need this as well. From a research design perspective a VG is a perfect purveyor of behavior change research because once programmed, it provides a constant stimulus. That is, in contrast to program delivery by humans, VG just delivers what was programmed in exactly the same way every time. Thus, it is not affected by how the deliverer felt that morning, whether they were experiencing a need to control or humiliate others, or other human frailties. In this way the VG is a perfect instrument for designing behavior change experiments.
53	Perhamus, L. M. (2010) "But your body would rather have this...": Conceptualizing health through kinesthetic experience	To explore kinesthetic ways that people recontextualize standardized health messages into personally meaningful, context-specific health knowledge and meaning.	Children, school-based adults and families.	Semi-structured interviews with adult participants and the methodological tool "Tell Me About It" in child-centered visits.	Health narratives in this study demonstrate that individual conceptions of health emerge through kinesthetic experiences that create assemblages. When "Tell Me About It" game cards prompted children to create stories that incorporated health curriculum concepts, though, children demonstrated a keen capacity to sort knowledge.

No.	Author, Title	Aim	Sample	Research Design	Major Findings
54	Culp, J. et al. (2010) Characteristics of food industry web sites and "advergames" targeting children	To assess the content of food industry Web sites targeting children by describing strategies used to prolong their visits and foster brand loyalty; and to document health-promoting messages on these Web sites.	-	A content analysis was conducted of Web sites advertised on 2 children's networks, Cartoon Network and Nickelodeon. A total of 290 Web pages and 247 unique games on 19 Internet sites were examined.	Games, found on 81% of Web sites, were the most predominant promotion strategy used. All games had at least 1 brand identifier, with logos being most frequently used. On average Web sites contained 1 "healthful" message for every 45 exposures to brand identifiers. Food companies use Web sites to extend their television advertising to promote brand loyalty among children. These sites almost exclusively promoted food items high in sugar and fat. Health professionals need to monitor food industry marketing practices used in "new media."
55	Hansen, L. et al. (2010) Fifth grade students' experiences participating in active gaming in physical education: The persistence to game	To explore children's experiences as they participated in active gaming during physical education classes.	Six students from a fifth-grade class. Purposeful sampling in order to select diverse, information-rich participants.	Nine game stations. Study based on phenomenological case study methods. Physical education classes for eight weeks. Observational fieldnotes, formal and informal interviews and journal entries resulted in triangulation of data.	Seven elements of persistence to play games: (1) fun, (2) opportunities for choice, (3) peer interaction, (4) peer and independent learning, (5) perceptual movement, (6) interest is unremitting, and (7) video game play motivation.