Enhancing Healthy Habits Among Overweight and Obese Children Through Serious Games: Technological Comparison

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Abstract

Obesity that already manifests in childhood results in excess adult mortality estimated at between 50 and 80%. The medical community has developed an understanding of obesity as a chronic condition that must be managed on a continually basis. An integrated system based on ICT, including games adapted to the age and profile of the children, can support them and their families in the prevention of obesity and the acquisition of healthy habits.
In this paper several serious games will be analyzed according to different technological criteria that define a price range of the game.. It is important to point out the potential of games to foster desirable health-related behaviors through motivational reinforcement, personalized teaching approaches, and social networking, as well as more effective utilization of obesity-related nutrition and lifestyle information.

Keywords: *Enhancing healthy habits, Interactivity, Obesity, Serious Games*

1. Introduction

The increasing prevalence of childhood obesity in many countries is now being recognized as an epidemic with multiple consequences for the individuals, the public health, and the society as a whole. Several authors have explained obesity as an economic phenomenon and have highlighted technological change as a key driver of the epidemic. Obesogenic' products, such as energy dense foods, passive entertainment products, cars, and labor-saving devices are widely available and heavily promoted. Since they are highly consumed and very profitable, obesity becomes the inevitable consequence of their commercial successes.

In recent years, "serious games" have become the key tool for e-health solutions. Electronic games, representing a significant part of the youths' daily media usage [1], create innovative portals, often including online games that market branded products and expose youth to foods and beverages that are typically high in calories and low in nutritional values [2]. In addition, videogames often involve sedentary media experiences that might lead to overweight issues [3]. However, the same kinds of gaming experiences can be modified to market healthier foods and beverages as well as promote healthier active lifestyles.

Advergames, for instance, can be adapted to encourage consumption of healthy foods and beverages, which can lead to healthy snack consumption [4], whereas exergames, digital video games that involve gross motor activity, can be used for promoting energy expenditure [5]. Specifically, exergames can promote caloric expenditure at moderate to vigorous levels of physical activity [6], increase heart rate to levels of cardiovascular fitness [7], and improve coordination and balance skills potentially being transferable to other sports and physical activities [8]. Health e-games cover a broad spectrum, from casual brain games like Nintendo's Brain Age to serious games like Pulse!!, a PC-based virtual training simulation for medical students. The most effective games in this genre are simultaneously fun and healthy [9].

Some exergaming applications supporting obese and overweight patients have been developed. Gobel et al. [10] developed three serious games for health purposes -1) ErgoActive uses the physical activity of the player by riding a bicycle to control a film. 2) SunSports Go is a multiplayer game in which the player can run toward or shoot at target, and 3) Y-Move is a multi-player racing game

which uses head-tracking technology as input so that the player can control the game by moving his/her head. The same authors also proposed a context-aware serious game framework for sports and health to select appropriate exergaming based on users' current context [11]. The Wit Fit from Nintendo [12] is probably the most well-known commercial example of exergaming platform providing a series of games, such as golf, dance and football. Dance Dance Revolution [13], Guitar Hero [14], Feeding Yoshi [15] and RTChess [16] are other examples of exergames. Selmanovic et al. in [17] produces a serious game for children using Wii Controller and Wii Balancing Board. Play Mate! [18] is a game which motivates users to perform physical activities leading to changes in the game's difficulty level according to the user's performance during the game play. Exertion Interfaces [19] aims at increasing the physical activity of computer users stating that persuasive physical activity intervention will contribute to overall well-being. In this article, technological aspects are analyzed for different serious games to enhance healthy habits among overweight and obese children. The analyzed games were divided into categories: those developed for specific educational purposes and commercial games also useful for developing skills relevant to medical personnel. Pooling of data was not performed owing to the heterogeneity of study designs and serious games.

2. Technological Comparison of Serious Games

There are several types of "learning" or educational serious games. Different technological aspects, such as device used, platform, interactivity and amongst others, should be taken into consideration in the classification of games, as shown in Table 1. These technological aspects define a price range of the product.

Table 1. Technological Aspects

Aspect	Users
Device	Mobile, tablets, PCs
Platform	Windows, android, Linux
SaaS	Yes/No
Content quality	Subjective evaluation about realistic environments. Good content quality is very important to make user really involved in the game. (from 0 to 9)
Interactivity	ICT device to be used for enhancing user experience.
Associated Hardware complexity	subjective evaluation of the required hardware and the way to be used (both at installation and playing time) (from 0 to 9)
Gaming experience	Subjective evaluation of the overall playing time. (from 0 to 9)

Table 2 provides information on and a comparison of several serious games using the technological aspects mention in Table 1. One kind of serious games is represented by the cases where a serious content put into a serious framework which looks like a game. Examples of such games are Bariagame or Fatworld (see Table 2). A different kind of games provides an increase of physical activity. In this category we have games originally created as games for fun: Wii-Fit, Konami's Dance Dance Revolution, AR Quake, and then adapted for the weight loss programs.

A third kind of games is games designed specifically for weight loss like Neat-O-Game or Zamzee. These games use competition as the driving motivational tool. Studies on the long term attractiveness, which is very important for this type of games, show that the "fun" component is very important to keep games attractive on a long term. Furthermore, the overall impression is that games involving physical activity are more engaging. Might be that the immediate pleasure provided by this type of games contributes to keep motivation longer. In addition, all these games use award systems as motivational tool. The most successful game in this category is Konami's Dance Dance Revolution, which is also the game that can be played on most devices.

Table 2. Comparison of different existing games against overweight

	Technological Criteria						
Product	**Device**	**Platform**	**SaaS**	**Content quality**	**Interactivity**	**Gaming experience**	**Associated Hardware complexity**
Bariagame	PC	Windows	Yes	7	None	6	---
Fatworld	Pc	Windows	No	6	No	5	0
Wii-Fit	Wii		No	8	Through Nintendo interaction device	7	7
Konami's Dance Dance Revolution	Wii, PS2, PS3, Xbox 360, & PC	Windows	No	8	Dance Platform + associate devices	8	7
AR Quake	PC	Windows	No	8	Head mounted display, mobile computer, head tracker, and GPS system	7	8
Neat-0-Game	Mobile		No	6	tri-axel accelerometer	6	9
Zamzee (HopeLab):	PC	Windows	No	6	Accelerometer to measure movement	6	5
Play,Mate!	PC	Windows	Yes	6	Wii technology (Wii Controller and Wii Balancing Board	5	7
Playnormous	PC	Windows	No	6	None	6	---
Red Hungry Planet	PC	Windows	No	7	No	6	0
Incredible Adventures of the Amazing Food Detective	PC	Windows, Mac	No	8	None	8	---

A key to this games success is probably based on that fact that it provides the possibility to create new social relations between players. To learn a new dance, to have fun together and to dance together can help children to build social links and eases social integration. The third category we can find is the games that associate the educational module and the physical activity module – e.g. Play,Mate! or Playnormous - with interactive links between the user and the interface. The main motivational tools are the award system and the network playing. These games use an interactive link between the player and the interface. Commercial systems such as Konami's Dance Dance Revolution, Wii-Fit and Red Hungry Planet provide activity evaluation and activity tracking. Moreover, these games target already physically active people, who often do not require recommendation or evaluation of their activity, nor any special motivation, as they can handle all these factors on their own. Other games such as: Incredible Adventures of the Amazing Food Detective teaches players the importance of healthy eating and getting ample amounts of exercise.

3. Conclusion

The analysis of different games genre and different games indicate that elements like awards system, network playing and a good dosage of fun make a serious game more efficient. The power

of serious games to not only provoke behavior changes, but also create new social links should not be underestimated, especially in the case of children and adolescents. However, our investigation also revealed that there are no studies evaluating long-term motivation of playing a game more than six months. Furthermore, we did not find any longitudinal studies on serious video games destined to obese or overweight children. The necessity to associate good eating habits and physical activity for making serious game efficient and fun seems evident. Our findings lead to our hypothesis that the pleasure of moving and being fit is highly influencing both the health and the socialization of a child. Furthermore, even though the educational module might be directed to/targeting the child, it seems be more efficient when it is used by the child's parents. Consequently, serious games will be research to remark its potential for fostering desirable health-related behaviours through motivational reinforcement, personalized teaching approaches, and social networking as well as more effective utilization of obesity-related nutrition and lifestyle information.

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