

## Promotion of Healthy Food Choices and Eating Habits among School Children using Video Games

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### Abstract

Global shift in food choices and dietary pattern of children is leading to overweight and micronutrient deficiencies among them. There is a need for innovative nutrition interventions targeted at young school-going children to make them aware of healthy food choices in order to combat increased risk of non-communicable diseases early in life. Video games on nutrition offer innovative, exciting and motivating opportunities for effective delivery of messages related to healthy eating behaviour. This review examines fourteen video games for their use in promotion of healthy food choices and eating habits among school children. Most games have demonstrated positive outcomes in knowledge and/or behaviour related to healthy food choices post-gaming sessions. However, there is a need for further research on the retention of knowledge and translation into long-term behaviour change.

**Keywords:** *Adolescent hypertension, Hypotension, Adolescent blood pressure, Family history, Anthropometry*

### Introduction

Over the years, the ongoing global nutrition transition has impacted the eating patterns of children, with a shift towards an increased consumption of processed foods, sugar-sweetened beverages, diets poor in fruit and vegetable, a decline in breakfast intake and reduced physical activity, contributing to the increased prevalence of obesity, non-communicable diseases and micronutrient deficiencies (Popkin, Adair, & Ng, 2012; UNICEF, 2010). Evidence reveals that increased exposure to unhealthy diet and physical inactivity are contributing to the early onset of chronic diseases (de Oliveira Otto et al., 2016; Miszkurka et al., 2012). Aggressive promotion/marketing, easy availability and access to fast foods is majorly responsible for this dietary change (Hawkes, 2006).

The eating habits and behaviours that are acquired in the early years of life continue into adulthood and become more engrained and resistant to change (Chitra & Reddy, 2007; Lucas, BL; Feucht, 2008; Srivastava, Mahmood, Srivastava, Shrotriya, & Kumar, 2012).

Therefore, it is essential to create conditions that will promote the development of healthy eating practices among children. Nutrition-related educational interventions targeted towards school children have the potential to improve their knowledge and habits (Manios & Kafatos, 1999; Pérez-Rodrigo & Aranceta, 2003). Besides family, schools serve as a good avenue for encouraging children to learn and adapt to healthy eating behaviours and lifestyles (Eatwell, 2011; Pérez-Rodrigo & Aranceta, 2003).

Games play an inevitable role in children's life and offer an engaging environment that can lead to effective learning. It is well-established that 'play' is essential to a child's cognitive, social, physical and emotional development and well-being (Frost, Wortham, & Reifel, 2012). Children often lack interest in learning via conventional teaching methods, therefore captivating their attention by innovative play-way methods that involve active participation can be effective in improving their nutrition knowledge (Bober, 2010). The main purpose of games is entertainment. A variety of behaviour change theories, approaches and techniques can be employed by educators and designers to

develop educational games. Video games that are based on behaviour change theories are promising as they motivate children to learn healthy behaviours. Design strategies including role-playing, narratives, challenges and interactive choices within the game help in engaging children (Dickey, 2005).

### **Video Games for promotion of healthy eating**

Video games have built-in features that are engaging, enjoyable and encourage repeated play by children as they provide competitive interaction. Games have rules, goals, challenges, scores and criteria for winning or losing, and may also have game characters, animation, storyline, role play, simulation, reinforcing messages, levels and multiplayer features (Prensky, 2003). Video games are very popular among children as they are exciting, innovative and highly motivating, and, therefore, are potentially a very effective channel for delivery of important health and nutrition messages (Rideout, Ulla, Foehr, & Roberts, 2010).

Studies have observed that learning by doing i.e. action is more effective than learning through explanation (Oblinger, 2004; Papastergiou, 2009). Educational video games offer learning by virtually doing action. These have the purpose of edutainment, intended to be educational as well as entertaining (Griffiths, 2002; Šakić & Varga, 2015). Video games have demonstrated to be more effective than traditional teaching methods in terms of learning as well as retention (Bahrami, Rahimi Chegini, Kianzadeh, Emami, & Abdi, 2012; Wouters, van Nimwegen, van Oostendorp, & van der Spek, 2013).

Table 1 summarises details about fourteen nutrition video games reviewed in this article. Video games on promotion of healthy food choices teach about food groups, food pyramid, balanced meals, nutrient content of food, portion sizes, selecting nutritious food, energy balance, healthy and unhealthy food, processed food, importance of meals and functions of food (Table 2). These games have levels, challenges, scores and rewards which make learning interesting and effortless. Some games have a game character whose level of health depends on the food choices made by the player (Chagas, Pontes e Silva, Reffatti, Botelho, & Toral, 2018; Moore et al., 2009; Schneider et al., 2012). The players are required to follow the guidelines of

healthy eating in order to maintain health of the game character and to score well and win the game. Healthy food choices are rewarded with scores, level ups or improvement in the level of health (Schneider et al., 2012) which motivate the player to play for a longer duration and reach the game goal. Game platforms used for these games are mainly computers, mobiles, tablets and consoles. There are educational video games where players are required to sit and play, but Exergames or Active video games are a newer generation of video games where game-play happens with the players' movement, thereby encouraging physical activity among them (Hermans et al., 2018; Johnson-Glenberg & Hekler, 2013; Alice Rosi et al., 2015).

### **Description of games**

Fourteen video games developed for the promotion of healthy food choices and eating are described below:

*Alimentary my dear Joe* (Turnin et al., 2001) is a set of 4 games (*Store, Guess Who, Granny Smith, The Restaurant*) based on healthy food choices, focusing on the food groups, nutritional properties of foods, balanced meals and selection of healthy ingredients for meals and snacks. *The Restaurant* teaches about balanced meals. In this game, children are supposed to catch 3D cartoon-animated foods that jump out of the refrigerator and then put these foods in the right plates. Children are required to ensure that the food in the plate includes all food groups ensuring balance. Apart from these games, *Alimentary my dear Joe* includes a calculator which provides composition of different foods with their nutrient content.

*Squire's Quest! I* (Baranowski et al., 2003; Cullen, Watson, Baranowski, Baranowski, & Zakeri, 2005) is an interactive game with 10 sessions on fruit and vegetable consumption. The game focusses on portion size, substitutions for fruits and vegetables based on availability and time. The game has a wizard to mentor the player through challenges and earn dragon-scale points. Virtual kitchen is one interesting component of this game, which gives the players a chance to virtually select ingredients and cook healthy food.

*Blast-off Game*, part of *Color My Pyramid* nutrition programme (Moore et al., 2009), is based on USDA guidelines. In this game,

children are supposed to choose foods and physical activities from options available to them and drag and drop them on a rocket ship. They could then click on the ‘Blast-Off’ button to see if the energy balance (i.e. balance between food intake and energy expenditure through physical activity) was appropriate. The game is aimed at improving children’s self-efficacy in choosing foods and activities to meet their daily food group requirement while maintaining calorie balance (including three meals and a snack, avoiding high fat and sugar foods and incorporating 60 minutes of physical activity in their daily schedule).

*Escape from DIAB (DIAB) and Nanoswarm (NANO)* (Baranowski et al., 2011; Ledoux et al., 2016; Wang, Baranowski, Lau, Buday, & Gao, 2017) are aimed at prevention of Type II diabetes among children by promoting more fruits and vegetable intake, water intake and increased physical activity. These contain mini-games on physical activity, nutrition and energy balance aimed at improving the self-efficacy of players towards the energy balance concepts. These games include distinguishing between healthy and unhealthy desserts, snacks and beverages, identifying nutritious food based on nutrition fact labels, recognising appropriate portion sizes of fruits and vegetables. The game design is such that the players can progress to the next game only when the minimum criteria of knowledge and mastery is met.

*Fitter Critters* (Schneider et al., 2012) is another game based on USDA guidelines. In this game the player is responsible for the health of a pet *Critters*. Healthy foods are to be chosen while considering fat, sugar and calorie requirements of the pet for ensuring its health. When the pet becomes healthier, it wins more sport games, earns more points, gets sick less and goes to work to earn money. The game has 17 quests, meters indicating health level, food that can be purchased at the grocery or restaurant or harvested for free at the garden, sports games for Critter’s to play, virtual cooking games to create healthy recipes for Critters.

*Squire’s Quest! II: Saving the Kingdom of Fivealot* (Cullen, Liu, & Thompson, 2016; Thompson et al., 2012) is a narrative video game which promotes fruit and vegetable consumption among children. This game is the sequel to *Squire’s Quest! I*. In this game, the character,

*Squire*, is required to acquire knowledge and skills of the Fivealot Knights. This involves goal-setting techniques that encourage children to involve parents in order to improve the availability of fruits and vegetables at home.

*YummyTricks* (Inglés-Camats, Presno-Rivas, Antonijoan, Garcia-Panella, & Forrest, 2012) is a set of several games focused on healthy eating habits. The first game aims at teaching categorisation of foods as per the food pyramid. The player has to collect falling foods from a single food group into a basket. This game focuses on teaching about food groups, balanced diet, importance of meals and amount of foods to be consumed for different meals.

*ETIOBE Mates* (Baños, Cebolla, Oliver, Alcañiz, & Botella, 2013) is an educational website that includes serious games designed to prevent and treat childhood obesity with the aim of improving self-control mechanisms, maintenance of body weight and treatment adherence among children. The content included was nutritional terms, dietary recommendations, nutrient content of foods, food choices and diet-disease association. *Healthy Plate* is one of the games where the player is required to categorise different foods according to food groups in the food pyramid and select their correct nutritional property. *SUPER Etiobe* is another game where the players are supposed to help detectives solve cases of children with unhealthy eating habits and sedentary lifestyles by improving food choices and physical activity pattern.

*Alien Health Game* (Hermans et al., 2018; Johnson-Glenberg & Hekler, 2013) is a Kinetic Sensor game where motion capture technology is used. The player is required to provide appropriate foods to the game character in order to make it feel better. The game has several levels focused on teaching about healthy food choices and reasons for the choice. In the final level of the game, the player is required to drag individual food items into a tray to create a healthy and balanced lunch for the Alien and press the ‘Eat’ button.

*Healthy Foodie Friends* (Kohli & Chadha, 2014) is a bilingual (English and Hindi) computer game set comprising 5 games and 8 animations, targeted towards 7–9 years old primary school children attending private schools in India. The game set is based on key messages formulated on the basis of preliminary data gathered on

existing food choices, knowledge and game choices of the target group, in addition to the existing Dietary Guidelines for Indians. The games require the player to use the keyboard and mouse to select healthy foods/ meal wisely and then earn points and receive applause with positive words. Important features of the game include game character, storyline, animations, reinforcing messages, challenges and scoring.

“5 a day” game (Alice Rosi et al., 2015), consists of a two different games that are used as a part of a nutrition education programme in order to reinforce the knowledge provided to them. *Jummmppyfive* is the game character which was designed to help children learn. In the first game, *Menu Composer*, the player is supposed to select fruits and vegetables and drop them into the appropriate dish. The scoring of the game is based on Five Rules of Well-being and total antioxidant capacity of the fruits and vegetables selected during the game. The time allotted to the player for *Jump Mania game* is proportional to their score of the first game. *Jump Mania game* is a jumping and dancing game based on music and a balance-board where the right combination of arrows has to be achieved in order to score well. The players are provided with a daily menu of complete meals based on the fruits and vegetables selected by them in the first game and even given recipes in the case of complex dishes.

*Healthy Food Champion* (Deol & Chadha, 2015) comprises 6 games and 10 animations for 11-14 years old children studying in Government schools of India. These games are primarily in the Hindi language along with some English words, keeping in mind the ease in comprehension. The games focus on the functions of food, food pyramid, balanced diet, importance of fruits and vegetables, selecting healthy foods and hand washing.

*Quest to Lava Mountain* (Sharma et al., 2015) is a 3D web based action-adventure video game in which children are required to make correct food choices in order to progress in the game. This is another role-playing game where selecting healthy food, cooking and consuming healthy food improves the character’s health.

*Rango Cards* (Chagas et al., 2018) is a mobile card game including coloured cards for foods and meals, healthy habits and characters aimed at improving food knowledge and self-efficacy

of children in the adoption of healthy food behaviour. The game uses a traffic light categorisation of foods as green card for healthy foods/ should be consumed regularly; yellow cards represents foods that should be moderately consumed; and red cards representing foods that should be avoided (based on recommendations of Dietary Guidelines for the Brazilian Population). The game also has a character that has a health score accompanied by sodium, sugar and fat content meters which are based on the player’s selection of processed foods.

### **Effectiveness of video games on healthy food choices**

All video games that have been tested for their effectiveness with respect to healthy eating have shown improvement in knowledge and/ or behaviour post-gaming session. Six out of eleven studies tested the effectiveness of video games on knowledge of healthy food choices, among which five studies (Baños et al., 2013; Hermans et al., 2018; Johnson-Glenberg & Hekler, 2013; Kohli & Chadha, 2014; Schneider et al., 2012; Turnin et al., 2001) demonstrated an improvement in knowledge, whereas there was no change in the case of one study (Moore et al., 2009). There is limited information on aspects of nutrition knowledge which showed improvement. Some studies showed that children were able to identify healthier food items (Hermans et al., 2018; Kohli & Chadha, 2014), food items rich in various nutrients (Kohli & Chadha, 2014; Turnin et al., 2001) and different categories of food (Turnin et al., 2001) after the gaming session. Although *Blast-Off Game*, which was a part of a nutrition education course *Color My Pyramid*, demonstrated no significant increase in nutrition knowledge post-intervention, there was a significant improvement in physical activity time and a decrease in systolic blood pressure (Moore et al., 2009). A study on *Alien Health*, motion sensor game, found that though nutrition knowledge improved immediately post-gaming session, it could not be retained at a 2 week follow up (Hermans et al., 2018). However, more evidence is needed on knowledge retention over time.

Apart from knowledge, playing video games on nutrition has been observed to improve eating habits of children by decreasing their sugar intake (Sharma et al., 2015) and fat intake (Turnin et al., 2001), changing their snacking

pattern (Turnin et al., 2001) and improving their fruit and vegetable consumption (Baranowski et al., 2003, 2011, Cullen et al., 2016, 2005; Ledoux et al., 2016; Alice Rosi et al., 2015; Thompson et al., 2012, 2015). Further, playing these games has also resulted in an increased intake of dietary fibre and calcium (Turnin et al., 2001) among children. Positive change has also been observed in the attitude and self-efficacy towards healthy eating and physical activity (Moore et al., 2009; Schneider et al., 2012; Sharma et al., 2015).

Irrespective of the varied game features and components of these video games, it's interesting to note that all of them resulted in enhanced knowledge and/ or eating habits. Some of the video games also had additional components such as educational video clips, animations, recipe cookbooks and websites.

## Conclusion

Our review indicates that video games can be an effective tool for the promotion of healthy eating habits among children. Playing these games can lead to improved nutrition knowledge, enhanced self-efficacy and attitude towards healthy eating and healthier eating behaviour among children. Video games are exciting and captivating which makes them a potential platform for effective learning. However, there is need for further research on the long term effectiveness of video games on retention of healthy eating habits and knowledge among children. Game features are an important aspect that can affect the players' gaming experience and, consequently, the effectiveness of the game. Video games can be designed to include variety by occasionally modifying and adding more features, game levels, targets, tasks and activities along with rewards in order to reinforce same nutrition messages several times. Future research that focuses on examining which features of video games support learning would be beneficial.

**Table 1.** Educational Video games on Healthy Food Choices (n=14)

S. No.	Game title	Platform	Locale	Setting	Sample size (n), Age Group	Study Design	Theory	Measures	Duration	Game elements	Effectiveness
1.	<i>Alimentary my dear Joe</i> (Turnin et al., 2001)	PC	Spain	School	1876 students, 7 – 12 years	RCT	-	- Nutrition knowledge - Dietary intake and habits	1 hour/ twice a week for 5 weeks	Scoring, Calculator	Effective
2.	<i>Squire's Quest I</i> (Baranowski et al., 2003; Cullen et al., 2005)	PC	United States	School	1578 students, Grade 4 <sup>th</sup>	RCT	Social Cognitive	- Fruit servings, 100% juice and vegetable consumption - Dietary intake	25 minutes/ session for 10 sessions	Virtual kitchen, cooking, goal setting, points, wizard mentoring through challenges	Effective
3.	<i>Blast-off Game</i> (Moore et al., 2009)	PC	United States	School	126 students, Grades 4 <sup>th</sup> & 5 <sup>th</sup>	Two group, pre- post- quasi-experimental	Self-care deficit nursing	- Nutrition knowledge and behaviour - Physical activity - Anthropometric measures	3 months nutrition programme including the video game	Nutrition and physical activity meter	Effective (not in knowledge)
4.	<i>Escape from DIAB (DIAB) and Nanoswarm (NANO)</i> (Baranowski et al., 2011; Ledoux et al., 2016)	PC	United States	-	153 students, 10-12 years	Two-group RCT	Social Cognitive and Mastery Learning	- Fruit, vegetable and water servings - Minutes of moderate to vigorous PA - Anthropometric measures	-	Goal setting	Effective (only in fruit and vegetable consumption)
5.	<i>Fitter Critters</i> (Schneider et al., 2012)	PC	Central Massachusetts	School	97 students, 8 – 12 years, Grade 5 <sup>th</sup>	Single group pre- & post- quasi-experimental		Knowledge, self-efficacy, attitude, game acceptability	5 consecutive days	Role play game 17 quests, health and diet meters, food grocery, restaurant and harvesting, cooking, sports game, work and decorations	Effective
6.	<i>Squire's Quest! II</i> (Cullen et al., 2016; Thompson et al., 2012, 2015)	PC	United States	Home or Community	400 parent/ child dyads, 9 – 11 years, Grades 4 <sup>th</sup> & 5 <sup>th</sup>	Four-group, randomized design	Social Cognitive	- Fruit and vegetable intake	3 months, 10-episode video game	Game character, goal setting	Effective
7.	<i>YummyTricks</i> (Inglés-Camats et al., 2012)	PC	Spain	-	7 – 10 years	-	-	-	-	Dragging virtual objects	Not tested

8.	<i>Alien Health Game</i> (Hermans et al., 2018; Johnson-Glenberg & Hekler, 2013)	Mixed reality platform	United States	School	20 children, Grade 4 <sup>th</sup> – 12 <sup>th</sup>	RCT	Learning	- Nutrition Knowledge	45 minutes	Story, levels, exergame using Kinect sensor	Partly Effective (only in immediate knowledge but no effect on long term knowledge or behaviour)
9.	<i>ETIOBE Mates</i> (Baños et al., 2013)	PC	France	-	228 students, Grades 4 <sup>th</sup> – 6 <sup>th</sup>	RCT	-	- Nutrition knowledge - Game acceptability	Educational website including game	Story, healthy plate, memory game, scoring	Effective
10.	<i>Healthy Foodie Friends</i> (Kohli & Chadha, 2014)	PC	India	School	33 students, 7 – 9 years	Single group pre- post- quasi-experimental	-	- Nutrition knowledge - Game acceptability	1 gaming session along with educational animations	Game character, scores, goals, reinforcing positive words, animation, bilingual	Effective
11.	<i>"5 a day" game</i> (Alice Rosti et al., 2015)	PC	Parma and Milano, Italy	School	76 students, 8 – 10 years	Single-group pre- & post-test	-	- Dietary intakes of fruits, vegetables, juices - Dietary total antioxidant capacity (TAC)	3-month nutritional programme including lessons and educational video games	Dragging-dropping, Jumping and dancing, game character, goal setting	Effective
12.	<i>Healthy Food Champion</i> (Deol & Chadha, 2015)	PC	India	School	11 – 14 years	-	-	-	-	Game character, scores, goals, reinforcing positive words, animation, bilingual	Not tested
13.	<i>Quest to Lava Mountain</i> (Beasley et al., 2012; Sharma et al., 2015)	PC	United States	School	94 students, 8 – 12 years, Grades 4 <sup>th</sup> & 5 <sup>th</sup>	Group RCT	Social Cognitive Theory, Theory of Reasoned Action	- Dietary intake - Physical activity - Psychosocial factors	6 weeks	Quests, game strategies (mazes, interactive activities and simulations), avatars, traverse virtual environments, color-coding to categorize foods w.r.t. nutrient density and caloric content, coin rewards, recipes, foods in game from ethnically diverse backgrounds	Effective (in terms of sugar consumption and nutrition/ physical activity attitudes)
14.	<i>Rango Cards</i> (Chagas et al., 2018)	Mobile/ Tablet	Federal District, Brazil	Private schools	13 – 24 years	-	-	-	-	coloured cards for foods and meals, healthy habits and characters, health score, sodium, sugar, fat content meter	Not tested

**Table 2.** Educational content of video games on promotion of healthy food choices

S. No.	Video Games	Selection of nutritious food	Food group	Food pyramid	Balanced meal	Nutrient content	Portion size	Moderation & variety	Energy balance	Functions of food	Selection of ingredients for recipes	Physical Activity
1.	<i>Alimentary my dear Joe</i>	✓	✓		✓	✓						
2.	<i>Squire's Quest I</i>	✓					✓				✓	
3.	<i>Blast-off Game</i>	✓	✓	✓			✓	✓	✓			✓
4.	<i>Escape from DIAB and NANO</i>	✓					✓		✓			✓
5.	<i>Fitter Critters</i>	✓	✓		✓	✓						✓
6.	<i>Squire's Quest! II</i>	✓					✓				✓	
7.	<i>YummyTricks</i>		✓	✓	✓		✓					
8.	<i>Alien Health Game</i>	✓	✓		✓							
9.	<i>ETIOBE Mates</i>	✓		✓		✓						✓
10.	<i>Healthy Foodie Friends</i>	✓	✓	✓	✓			✓		✓		
11.	<i>"5 a day" game</i>	✓			✓		✓	✓			✓	
12.	<i>Healthy Food Champion</i>	✓	✓	✓	✓			✓		✓		
13.	<i>Quest to Lava Mountain</i>	✓	✓			✓		✓				✓
14.	<i>Rango Cards</i>		✓		✓	✓						

**REFERENCES**

1. Bahrami, F., Rahimi Chegini, Z., Kianzadeh, A., Emami, F., & Abdi, H. (2012). A comparison of the effectiveness of game-based and traditional teaching on learning and retention of first grade math concepts. *Pelagia Research Library European Journal of Experimental Biology* (Vol. 2).
2. Baños, R. M., Cebolla, A., Oliver, E., Alcañiz, M., & Botella, C. (2013). Efficacy and acceptability of an Internet platform to improve the learning of nutritional knowledge in children: the ETIOBE Mates. *Health Education Research*, 28(2), 234–48. <https://doi.org/10.1093/her/cys044>
3. Baranowski, T., Baranowski, J., Cullen, K. W., Marsh, T., Islam, N., Zakeri, I., Honess-Morreale, L. & deMoor, C. (2003). Squire's Quest! Dietary outcome evaluation of a multimedia game. *American Journal of Preventive Medicine*, 24(1), 52–61.

4. Baranowski, T., Baranowski, J., Thompson, D., Buday, R., Jago, R., Griffith, M. J., Islam, N., Nguyen, N. & Watson, K. B. (2011). Video Game Play, Child Diet, and Physical Activity Behavior Change. *American Journal of Preventive Medicine*, 40(1), 33–38. <https://doi.org/10.1016/j.amepre.2010.09.029>
5. Baranowski, T., Buday, R., Thompson, D. I., & Baranowski, J. (2008). Playing for real: video games and stories for health-related behavior change. *American Journal of Preventive Medicine*, 34(1), 74–82. <https://doi.org/10.1016/j.amepre.2007.09.027>
6. Beasley, N., Sharma, S., Shegog, R., Huber, R., Abernathy, P., Smith, C., & Hoelscher, D. (2012). The Quest to Lava Mountain: Using Video Games for Dietary Change in Children. *Journal of the Academy of Nutrition and Dietetics*, 112(9), 1334–1336. <https://doi.org/10.1016/j.jand.2012.05.010>
7. Bober, M. (2010). *Games-based experiences for learning*. Available from: <https://www.nfer.ac.uk/media/1775/futl11.pdf> (Accessed on 10 Oct 2018)
8. Chagas, C. M. dos S., Pontes e Silva, T. B., Reffatti, L. M., Botelho, R. B. A., & Toral, N. (2018). Rango Cards, a digital game designed to promote a healthy diet: a randomized study protocol. *BMC Public Health*, 18(1), 910. <https://doi.org/10.1186/s12889-018-5848-0>
9. Chitra, U., & Reddy, C. R. (2007). The role of breakfast in nutrient intake of urban schoolchildren. *Public Health Nutrition*, 10(1), 55–8. <https://doi.org/10.1017/S1368980007219640>
10. Cullen, K. W., Liu, Y., & Thompson, D. I. (2016). Meal-Specific Dietary Changes From Squires Quest! II: A Serious Video Game Intervention. *Journal of Nutrition Education and Behavior*, 48(5), 326–330.e1. <https://doi.org/10.1016/j.jneb.2016.02.004>
11. Cullen, K. W., Watson, K., Baranowski, T., Baranowski, J. H., & Zakeri, I. (2005). Squire's Quest: intervention changes occurred at lunch and snack meals. *Appetite*, 45(2), 148–51. <https://doi.org/10.1016/j.appet.2005.04.001>
12. de Oliveira Otto, M. C., Afshin, A., Micha, R., Khatibzadeh, S., Fahimi, S., Singh, G., Danaei, G., Sichieri, R., Monteiro, C. A., Louzada, M. L. C., Ezzati, M., Mozaffarian, D., Global Burden of Diseases, Injuries, and Risk Factors Metabolic Risk Factors of Chronic Diseases Expert Group & Nutrition and Chronic Diseases Expert Group (NutriCoDE). (2016). The Impact of Dietary and Metabolic Risk Factors on Cardiovascular Diseases and Type 2 Diabetes Mortality in Brazil. *PLOS ONE*, 11(3), e0151503. <https://doi.org/10.1371/journal.pone.0151503>
13. Deol, S., & Chadha, R. (2015). Development of an Educational Computer Game to promote Healthy Food Choices among Adolescents (11-14 years) attending Government Schools. *Unpublished Research – M.Sc. (Food and Nutrition) Thesis*. Lady Irwin College, University of Delhi, New Delhi.
14. Dickey, M. D. (2005). Engaging by Design: How Engagement Strategies in Popular Computer and Video Games Can Inform Instructional Design. Springer. *Educational Technology Research and Development*, 53(2), 67-83. <https://doi.org/10.2307/30220429>
15. Eatwell. (2011). Review of policy actions, data available for their analysis and existing evaluations throughout Europe. Retrieved March 14, 2014, from <http://eatwellproject.eu/en/Eatwell-research/Project-Reports/>
16. Frost, J. L., Wortham, S. C., & Reifel, S. (2012). *Play and Child Development* (4th ed.). Pearson.
17. Griffiths, M. (2002). The educational benefits of videogames. *Education and Health*, 20, 47–51.

- 18.Hawkes, C. (2006). Uneven dietary development: linking the policies and processes of globalization with the nutrition transition, obesity and diet-related chronic diseases. *Globalization and Health*, 2, 4. <https://doi.org/10.1186/1744-8603-2-4>
- 19.Hermans, R. C. J., van den Broek, N., Nederkoorn, C., Otten, R., Rüter, E. L. M., & Johnson-Glenberg, M. C. (2018). Feed the Alien! The Effects of a Nutrition Instruction Game on Children’s Nutritional Knowledge and Food Intake. *Games for Health Journal*, 7(3), 164–174. <https://doi.org/10.1089/g4h.2017.0055>
- 20.Inglés-Camats, G., Presno-Rivas, M. M., Antonijoan, M., Garcia-Panella, O., & Forrest, T. (2012). Yummy tricks: a serious game for learning healthy eating habits. *Studies in Health Technology and Informatics*, 172, 185–90.
- 21.Johnson-Glenberg, M. C., & Hekler, E. B. (2013). “Alien Health Game” : An Embodied Exergame to Instruct in Nutrition and MyPlate. *Games for Health Journal*, 2(6), 354–361. <https://doi.org/10.1089/g4h.2013.0057>
- 22.Kohli, S., & Chadha, R. (2014). Development of an Educational Computer Game to promote Healthy Food Choices among Primary School Children (7 - 9 years) attending Public Schools. *Unpublished Research – M.Sc. (Food and Nutrition) Thesis*. Lady Irwin College, University of Delhi, New Delhi
- 23.Ledoux, T., Griffith, M., Thompson, D., Nguyen, N., Watson, K., Baranowski, J., Buday, R., Abdelsamad, D., & Baranowski, T. (2016). An Educational Video Game for Nutrition of Young People. *Simulation & Gaming*, 47(4), 490–516. <https://doi.org/10.1177/1046878116633331>
- 24.Lucas, BL; Feucht, S. (2008). Nutrition in Childhood. In S. Escott-Stump & L. K. Mahan (Eds.), *Krause’s Food and Nutrition Therapy* (12th ed., pp. 222–245). Saunders/Elsevier.
- 25.Manios, Y., & Kafatos, A. (1999). Health and nutrition education in elementary schools: changes in health knowledge, nutrient intakes and physical activity over a six year period. *Public Health Nutrition*, 2(3A), 445–8.
- 26.Miszkurka, M., Haddad, S., Langlois, É. V, Freeman, E. E., Kouanda, S., & Zunzunegui, M. V. (2012). Heavy burden of non-communicable diseases at early age and gender disparities in an adult population of Burkina Faso: World Health Survey. *BMC Public Health*, 12, 24. <https://doi.org/10.1186/1471-2458-12-24>
- 27.Moore, J. B., Pawloski, L. R., Goldberg, P., Kyeung, M. O., Stoehr, A., & Baghi, H. (2009). Childhood obesity study: a pilot study of the effect of the nutrition education program Color My Pyramid. *The Journal of School Nursing : The Official Publication of the National Association of School Nurses*, 25(3), 230–9. <https://doi.org/10.1177/1059840509333325>
- 28.Oblinger, D. G. (2004). The Next Generation of Educational Engagement. *Journal of Interactive Media in Education*, 2004(1), 10. <https://doi.org/10.5334/2004-8-oblinger>
- 29.Papastergiou, M. (2009). Exploring the potential of computer and video games for health and physical education: A literature review. *Computers & Education*, 53(3), 603–622. <https://doi.org/10.1016/J.COMPEDU.2009.04.001>
- 30.Pérez-Rodrigo, C., & Aranceta, J. (2003). Nutrition education in schools: experiences and challenges. *European Journal of Clinical Nutrition*, 57, S82–S85. <https://doi.org/10.1038/sj.ejcn.1601824>
- 31.Popkin, B. M., Adair, L. S., & Ng, S. W. (2012). Global nutrition transition and the pandemic of obesity in developing countries. *Nutrition Reviews*, 70(1), 3–21. <https://doi.org/10.1111/j.1753-4887.2011.00456.x>



32. Prensky, M. (2003). Digital game-based learning. *Computers in Entertainment, 1*(1), 21. <https://doi.org/10.1145/950566.950596>
33. Rideout, V. J., Ulla, M. A., Foehr, G., & Roberts, D. F. (2010). Generation M2: Media in the Lives of 0-18 Year Olds. Retrieved October 17, 2018, from <https://files.eric.ed.gov/fulltext/ED527859.pdf>
34. Rosi, A., Dall'Asta, M., Brighenti, F., Del Rio, D., Volta, E., Baroni, I., Nalin, M., Coti, Z. M., Sanna, A., & Scazzina, F. (2016). The use of new technologies for nutritional education in primary schools: a pilot study. *Public Health, 140*, 50–55. <https://doi.org/10.1016/j.puhe.2016.08.021>
35. Rosi, A., Scazzina, F., Ingrosso, L., Morandi, A., Del Rio, D., & Sanna, A. (2015). The “5 a day” game: a nutritional intervention utilising innovative methodologies with primary school children. *International Journal of Food Sciences and Nutrition, 66*(6), 713–717. <https://doi.org/10.3109/09637486.2015.1077793>
36. Šakić, M., & Varga, V. (2015). Video Games as an Education Tool. In *The Sixth International Conference on e-Learning (eLearning-2015)*. Belgrade, Serbia.
37. Schneider, K. L., Ferrara, J., Lance, B., Karetas, A., Druker, S., Panza, E., Olendzki, B., Andersen, V. & Pbert, L. (2012). Acceptability of an Online Health Videogame to Improve Diet and Physical Activity in Elementary School Students: “Fitter Critters”; *Games for Health Journal, 1*(4), 262–268. <https://doi.org/10.1089/g4h.2012.0009>
38. Sharma, S. V., Shegog, R., Chow, J., Finley, C., Pomeroy, M., Smith, C., & Hoelscher, D. M. (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, 115*(8), 1260–71. <https://doi.org/10.1016/j.jand.2015.02.022>
39. Srivastava, A., Mahmood, S. E., Srivastava, P. M., Shrotriya, V. P., & Kumar, B. (2012). Nutritional status of school-age children - A scenario of urban slums in India. *Archives of Public Health, 70*(1), 8. <https://doi.org/10.1186/0778-7367-70-8>
40. Thompson, D., Bhatt, R., Lazarus, M., Cullen, K., Baranowski, J., & Baranowski, T. (2012). A Serious Video Game to Increase Fruit and Vegetable Consumption Among Elementary Aged Youth (Squire’s Quest! II): Rationale, Design, and Methods. *JMIR Research Protocols, 1*(2), e19. <https://doi.org/10.2196/resprot.2348>
41. Thompson, D., Bhatt, R., Vazquez, I., Cullen, K. W., Baranowski, J., Baranowski, T., & Liu, Y. (2015). Creating action plans in a serious video game increases and maintains child fruit-vegetable intake: a randomized controlled trial. *The International Journal of Behavioral Nutrition and Physical Activity, 12*(1), 39. <https://doi.org/10.1186/s12966-015-0199-z>
42. Turnin, M. C., Tauber, M. T., Couvaras, O., Jouret, B., Bolzonella, C., Bourgeois, O., Buisson, J. C., Fabre, D., Cance-Rouzaud, A., Tauber, J. P., & Hanaire-Broutin, H. (2001). Evaluation of microcomputer nutritional teaching games in 1,876 children at school. *Diabetes & Metabolism, 27*(4 Pt 1), 459–64.
43. UNICEF. (2010). *Food & Nutrition Security: In Pacific Island Nations and Territories*. Suva, Fiji Islands.
44. Wang, J. J., Baranowski, T., Lau, P. W. C., Buday, R., & Gao, Y. (2017). Story Immersion May Be Effective in Promoting Diet and Physical Activity in Chinese Children. *Journal of Nutrition Education and Behavior, 49*(4), 321–329.e1. <https://doi.org/10.1016/j.jneb.2017.01.001>

45. Wouters, P., van Nimwegen, C., van Oostendorp, H., & van der Spek, E. D. (2013). A meta-analysis of the cognitive and motivational effects of serious games. *Journal of Educational Psychology*, 105(2), 249–265. <https://doi.org/10.1037/a0031311>