



## Developing educational game for pre-school children to improve dietary choices

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### Abstract

Nutrition-related problems in children, such as obesity, unbalanced diet, and high intake of junk food, have been an area of extensive focus among parents, child nutrition experts, and teachers on early childhood education. To ensure that they grow properly and form healthy eating habits, children need direction and encouragement to maintain a healthy diet and level of physical exercise. Serious video games have been found to improve children's eating knowledge, attitudes, and behaviors; however, there is no study on the effectiveness of these games with younger kids (8–10 years old). A multidisciplinary research design was used to develop the game following an iterative methodology based on a user-centered design. A total of 50 participants were allowed to test out the game. The findings of this study demonstrated that using computer games to teach preschoolers about nutrition might significantly increase their understanding of that subject. The parents of the participants concurred that the game had a favorable impact on their kids' views towards a number of healthy eating practices. These results support that a health game such as Nutri Game is a viable tool to help children aged between 8 and 10 years old to increase their food knowledge and improve their dietary behaviors.

**Keywords:** Computer Games, Nutrition Knowledge, Junk Food

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### Introduction

All people and families should have access to nutrition education, which has been defined as the process by which beliefs, attitudes, environmental influences, and understanding about food lead to practices that are rational, doable, and in line with individual needs and available food resources. The essential tenet of nutrition education is that rather than crisis intervention, efforts should be directed towards establishing and protecting nutritional health. No matter your income, where you live, your cultural, social, or economic practices, or your degree of education, you need it. Nutrition education must be a continuing process throughout the life cycle as new research brings additional knowledge. In view of the multifactorial influences on food habits, there is no one way to persuade people to change their food choices. Thus, nutrition education must use a variety of techniques that must be a part of total family and community environments. In other words, nutrition education involves information exchange as well as techniques to motivate and reinforce improved food habits. Successful nutrition education must include endeavors to make beliefs, attitudes, values, environmental factors, and individual ideas about food conducive to nutritionally sound, practical, and acceptable dietary habits. Nutritional education can be approached in various ways. What might be termed the rational–empirical curriculum design is the approach that is typically used by educators; it is logical and planned, and it involves behavioral objectives, activities that are designed to achieve objectives, and evaluation to determine the discrepancy between planned and achieved outcomes. The idea of self-responsibility for health suggests the basic notion that the individual possesses a dignity, worth, and responsibility to maximize these characteristics.

Self-responsibility assumes that the individual has the potential and motivation to make wise judgments about factors that affect their health status. Another strategy has been termed the travel metaphor method. The idea is that there is a body of knowledge, facts, concepts, values and beliefs that are known and understood by the educator. It is the educator's responsibility to lead the learner through this body of knowledge and beliefs, and point out to the learner what is thought to be of importance.

The educator is thus a travel guide whose job is to provide the student with a set of stimuli and the opportunity to take advantage and react positively. It then becomes the responsibility of the student to determine how they will make use of the contacts provided by the educator.

Another approach to health and nutrition education takes a strategy of social manipulation. The basic premise is that the matters affecting health are too urgent, too important, and beyond the individual's power to control on their own.

Thus, the role of the health educator is seen as one of attempting to control behavior and to shape the desired responses. This approach is often employed by the mass media. The manipulative approach is more concerned with the behavior response patterns rather than the manner in which the individual reaches these patterns. The approach is an attempt to reach the desired behavior through a short-cut method and does not take time to prepare the individual to make fully informed, wise choices.

The most appropriate and effective strategy for stimulating improved food habits will depend upon the knowledge, background, personal characteristics, and motivation of the audience. It may also depend upon the size of the target group. Ideally, the approach should be individualized to the target audience's needs, goals, objectives, and other characteristics. A mix of various approaches may be necessary.

Activities that provide verbal and visual knowledge and instruction to participants, or participants and carers in a group or individual context, constitute nutrition education. An RD, an ICE, or another person under the supervision of an RD or someone with comparable skills may be in charge of the presentations or activities. One nutrition education presentation should last at least five minutes.

Presentations, cooking classes, food preparation demonstrations, field trips, plays, panel discussions, menu planning and/or evaluation, food tasting sessions, question and answer sessions, gardening, exercise programmes, videos and video games are a few examples of nutrition education activities. The distribution of educational materials might be one of the activities for participants who are delivered to their homes.

Parents, child nutrition experts, and early childhood education teachers have recently placed a lot of attention on nutrition-related issues in children, such as obesity, an unbalanced diet, and a high intake of junk food. 93% of kids eat packaged food, 68% drink sugary drinks more than once a week, and 53% eat items high in fat, salt, calories, or sugar at least once a day, according to statistics.

The preschool years (i.e., ages 3-6) are crucial for establishing or changing a child's eating habits. The development of eating habits affects a person's dietary preferences as well as their health, academic performance, and behavioural issues. According to studies, young children who are malnourished may score lower on cognitive tests, have less favourable psychological outcomes, have smaller fine motor abilities, and engage in less physical activity. Importantly, eating habits (such as food selections or motivations) will influence the development of diseases in the future.

These changes are also affecting the eating patterns of our kids. Many kids enjoy eating prepared foods from outside. Some parents are even hesitant to change their kids' eating habits. They even voluntarily disclose providing their infants with prepared outside meals. Fast food is referred to as "food

that can be served ready to eat quickly." Fast food and junk food are frequently used in the same sentence. The majority of junk food is fast food since it is made and delivered quickly. However, not all fast food is unhealthy, especially when it is made with wholesome ingredients.

A new trend among kids is fast food culture. "Junk food" is defined as nutrient-poor foods that are high in energy-dense ingredients like sugar, fat, and salt but lacking in nutrients like protein, fiber, vitamins, and minerals. They are well-liked by kids because of their accessibility, taste, parent's occupation, and marketing techniques. The fact that fast food restaurants are standardized and ready to maximize service speed is a crucial component. Customers can therefore take their food faster. The culinary options available here are scarce. Fast food is reportedly consumed by approximately 30% of kids aged 4 to 19 on an average day.

In addition, it will raise the risk of obesity, diabetes, high blood pressure, cardiovascular disease, and other chronic illnesses. Regular use may also lead to reduced levels of vitamins, minerals, and vital fatty acids, which may ultimately have an impact on children's growth and development. Therefore, it is crucial to instill healthy dietary practises in young children.

Fast food intake is unquestionably bad for kids' health. Children who consume fast food consume more calories, fat, saturated fat, sodium, and carbonated soft drinks than children who do not consume it, while also consuming less vitamin A and C, milk, fruits, and vegetables. Disabilities like obesity, hypertension, dyslipidemia, and impaired glucose tolerance are caused by diets heavy in sugar, salt, saturated fat, and calories. The body mass index and fast food consumption frequency had a positive connection ( $p=0.001$ ). Obesity-related issues in terms of morbidity and death are so obvious. Fast food may be linked to shoddy handling, storage, and preparation practises. It attracts microbial contamination and potentially increases the risk of cardiac disorders. Such foods contain far more energy than what is advised for children. Where micronutrient content is low, it causes greater total and saturated fat calorie intake. Fast food with low levels of calcium and magnesium is to blame for osteoporosis.

In the preschool years, nutrition education is a crucial tool for young children. The introduction of nutrition education in preschools may enhance young children's eating habits and knowledge of nutrition. Preschool teachers adapt their nutrition education lessons to the interests and developmental stages of their students in order to maximise their involvement and learning.

Computers serve as an essential learning tool. Children find computer games to be interesting and appealing. They progressively become their favourite due to their easy-to-use, practical, vibrant, intriguing, amusing, and demanding characteristics. Therefore, using video games in the classroom could aid in the growth of kids' cognitive abilities, social skills, and practical knowledge. Computer games integrate knowledge and pleasure, therefore the idea of learning while having fun might be successful in achieving the goal of education. A computer game may also aid in the behaviour, character, and skill development of young people. Computer games have been utilised in numerous research to analyse the connection between kids' dietary knowledge and eating habits. Computer games have a good effect on kids' dietary intake, nutritional knowledge, attitudes, behaviours, and level of activity, according to the findings of these

studies.

According to several studies, children who play video games for 1-6 weeks develop good attitudes towards healthy eating, make healthier food choices, and consume less sugar. In addition, their attitudes towards exercise and nutrition also improve. These findings suggest that instructional computer games can be effective tools for assisting young children in developing their understanding of food and dietary habits.

Computer games may therefore have a favourable impact on kids' food habits, nutritional knowledge, attitudes, and behaviours. A suitable nutrition teaching tool for youngsters is a computer game, which can help to improve their attitudes towards eating.

### Related Literature

The application of gaming as a method to change health behavior carries with it the burden to impact the consequences of morbidity and mortality. Nowhere, then, is the contention of games having a "serious" purpose more relevant than in the domain of serious games for health. Serious games are gaining profile as a potential strategy to educate the public about health in new and novel ways. Computer games represent an emerging approach to the continued research and development of health education and health promotion programs in the service of national health objectives. Research has indicated that many evidence-based health education and health promotion programs are effective because they are grounded in behavioral theory. It follows, therefore, that serious games might be made optimally effective in changing health behavior if they are also informed by behavioral and motivational theory. [Shegog R. 2010] <sup>[1]</sup>.

Video Games for health (G4H) offer exciting, innovative, potentially highly effective methods for increasing knowledge, delivering persuasive messages, changing behaviors, and influencing health outcomes. Although early outcome results are promising, additional research is needed to determine the game design and behavior change procedures that best promote G4H effectiveness and to identify and minimize possible adverse effects. Guidelines for ideal use of different types of G4H by children and adolescents should be elucidated to enhance effectiveness and minimize adverse effects. G4H stakeholders include organizational implementers, policy makers, players and their families, researchers, designers, retailers, and publishers. All stakeholders should be involved in G4H development and have a voice in setting goals to capitalize on their insights to enhance effectiveness and use of the game. [Baranowski T, Blumberg F, *et al.* 2015]

Serious games are a promising venue to increase children's nutritional knowledge in an entertaining format. The aim of this study was to test the short-term effectiveness of the Alien Health Game, a videogame designed to teach elementary school children about nutrition and healthy food choices. [Roel C J Hermans, *et al.* 2018]

It is not an easy matter to influence the dietary habits of adults in so far as affective, family related and sociocultural factors play an essential role in nutritional behavior. It seems that children gain greater advantages from nutritional education than adults. The goal in this form of training is the prevention of nutrition related diseases like obesity, diabetes and atherosclerosis whose prevalence is constantly increasing in the industrialized countries. Early educational initiatives have already been proposed and evaluated. In most countries

the best place to implement a major initiative is at school. In France education for health is part of the school curriculum, but remains superficial. Our study involved design and evaluation of microcomputer nutritional teaching games with 1876 children in primary schools. This study was intended to evaluate the games and their contribution to the children's acquisition of nutritional knowledge and improvement of their eating habits by means of questionnaires and diet records. [M.C. Turnin, M.T. Tauber, *et al.* 2001] <sup>[4]</sup>.

Previous literature reviews identified educational strategies directly relevant to a behavioral focus and theory-driven strategies among the elements conducive to successful programmes. Other features that contribute to gain effectiveness are the provision of adequate time and intensity for the intervention, involvement of families, particularly for younger children, and incorporation of self-assessment and feedback in interventions for older children. School meals provide a valuable opportunity for nutrition education. The emphasis on environmental and behavioral factors in successful school-based physical activity and nutrition interventions highlights the importance of involving parents and other community members. [C Pérez-Rodrigo & J Aranceta. 2003] <sup>[5]</sup>.

Childhood obesity is a significant problem, with 32% overweight or obese in the United States. Prevention is key to combating obesity and necessitates unique strategies that engage children and can be implemented widely. One novel approach uses health videogames to encourage healthy eating and activity. Although once considered exclusively for entertainment, videogames are increasingly being used as a captivating way to educate children on issues such as diabetes and healthy eating. Two reviews reported that health videogames improved diet and physical activity in children. This promising initial work led Read and Shortell<sup>2</sup> to advocate for research on whether health videogames facilitate behavior change. [Kristin L. Schneider, John Ferrara, *et al.* 2012] <sup>[6]</sup>.

The majority of children and youth around the world do not meet current physical activity guidelines and are considered to be inactive. Self-reported measures of physical activity (PA) from the Global School-based Student Health Survey and the Health Behaviors in School-Aged Children Study (HBSC) show that 80% of 13–15-year-olds do not participate in at least 60 minutes of moderate- to vigorous-intensity physical activity (MVPA) daily. Further, it is now understood that children and youth spend a significant part of their day being sedentary. International data from the HBSC study show that 66% of girls and 68% of boys watch more than two hours of television per day, and data from a Canadian study show that youth accumulate an average of 7.8 hours of screen time daily. [Allana G. LeBlanc, *et al.* 2013].

Childhood obesity is a global epidemic. Health videogames are an emerging intervention strategy to combat childhood obesity. This systematic review examined published research on the effect of health videogames on childhood obesity. Fourteen articles examining 28 health videogames published between 2005 and 2013 in English were selected from 2433 articles identified through five major search engines. Results indicated that academic interest in using health videogames for childhood obesity prevention has increased during this time. Most games were commercially available. Most studies were of short duration. Diverse player and game play patterns have been identified. Most studies involved players of both genders with slightly more boys. Most studies had the players



play the games at home, whereas some extended the play setting to school and sports/recreational facilities. Most of the games were commercially available. Positive outcomes related to obesity were observed in about 40 percent of the studies, all of which targeted overweight or obese participants. [Amy Shirong Lu, Hadi Kharrazi, Fardad Gharghabi, Debbe Thompson. 2013] <sup>[8]</sup>.

Considering adolescents' heavy use of media, serious videogames may provide an engaging and innovative way to achieve positive impact on adolescents' diet and physical activity. The objective of this study was to evaluate the efficacy of playing a serious game, "Creature-101" (developed by Teachers College, Columbia University [New York, NY] and Stottler Henke Inc. [San Mateo, CA]), at promoting energy balance-related behaviors (EBRBs) such as increasing fruits and vegetables intake, water intake, and physical activity and decreasing processed snacks intake, sweetened beverages intake, and recreational screen time. [Majumdar D, Koch PA, Lee H, Contento IR, Islas-Ramos AD, Fu D. 2013] <sup>[9]</sup>.

Globally, the prevalence of overweight and obesity among children and adolescents increased 10-fold from 11 million in 1975, to 124 million in 2016. In Germany, the prevalence of overweight and obesity among children and adolescents (3 to 17 years) is estimated at 15% and 6%, respectively, with increasing trends in later life. In particular, school entry and school age are associated with a considerable increase in the prevalence of overweight and obesity. Therefore, established prevention programs (e.g., nutritional education) aim to address this health challenge. Besides these traditional approaches, "serious games" are novel digital tools for educational purposes. Serious games are games which are applied in non-gaming contexts, and have motivational and enjoyable characteristics. Serious games for health-related behavioral change are becoming increasingly available. There is evidence that serious games can enhance the long-term retention of information and can promote behavioral change maintenance. Thus, serious games may have the potential to become a novel digital educational method to improve nutritional knowledge and behavior in an entertaining and intrinsically motivating format. [Sophie Laura Holzmann, Hanna Schäfer, *et al.* 2019] <sup>[10]</sup>.

It is widely accepted that increase in obesity results from an imbalance between energy intake and expenditure, with an increase in positive energy balance being closely associated with the lifestyle adopted and the dietary intake preferences. However, there is increasing evidence indicating that an individual's genetic background is important in determining obesity risk. Research has made important contributions to our understanding of the factors associated with obesity. The ecological model, as described by Davison *et al.*, suggests that child risk factors for obesity include dietary intake, physical activity, and sedentary behavior. The impact of such risk factors is moderated by factors such as age, gender. Family characteristics parenting style, parents' lifestyles also play a role. Environmental factors such as school policies, demographics, and parents' work-related demands further influence eating and activity behaviors. [Sahoo K, Sahoo B, Choudhury AK, Sofi NY, Kumar R, Bhadoria AS. 2015] <sup>[11]</sup>. Children need guidance on and support for maintaining a healthy diet and physical activity to ensure that they grow appropriately and develop healthy eating behaviors. Serious games are an emerging complementary intervention strategy to fulfill that need by providing exciting, innovative, and

enticing methods for attracting attention, educating, and promoting changes in attitudes and human behaviors. Ismael [Edrein Espinosa-Curiel, PhD Edgar Efrén Pozas-Bogarin, *et al.* 2020] <sup>[12]</sup>.

Effective environmental change strategies have been emphasized as key in improving the eating behaviors and dietary intakes of youth. However, there have been few studies with published results reporting on environmental-level efforts. Teens Eating for Energy and Nutrition at School (TEENS) was a randomized school-based intervention trial conducted in middle schools with a goal of developing and evaluating school and family-linked intervention strategies to promote students' consumption of fruit, vegetable, and lower fat snacks (FVLFS); these results are presented elsewhere. Environmental outcomes were evaluated as secondary outcomes of the study. The purpose of this paper is to describe the results of the TEENS intervention on school and family-level nutrition environments including the effectiveness of the intervention to positively influence the availability of FVLFS in families' homes; snack food selections made by families at the grocery store; fruit, vegetable, and salad sales occurring in school cafeterias; and the proportion of lower fat and healthier items offered and sold in a la carte lines. [Leslie Lytle, Martha Kubik, Cheryl Perry, *et al.* 2006] <sup>[13]</sup>.

The epidemic of childhood obesity is no more limited to high-income countries, and has become as one of the most important global health problems of the 21<sup>st</sup> century. The World Health Organization (WHO) experts have estimated that there are 43 million overweight children under the age of 5 and by 2020 more than 60% of global disease burden will be the result of obesity related disorders. Childhood obesity is associated with several short term and long-term health hazards as cardiovascular diseases, hypertension, type 2 diabetes, fatty liver disease, orthopedic problems, low self-esteem, etc. Childhood obesity can reduce life expectancy by 2-5 years. Moreover, the increasing trend of obesity has enormous economic outcomes. Two main underlying causes of excess weight are genes and environment. Although both genes and environment have a role in an obesity epidemic, gene defects need to time to show their phenotype; so obesogenic environment is responsible for obesity. [Roya Kelishadi and Fatemeh Azizi-Soleiman. 2014] <sup>[14]</sup>.

In Western societies, choosing what to eat can be a demanding task due to the excessive availability of food. To make feeding decisions more complex, the explicit and implicit evaluations of foods may differ as they are multi-attribute stimuli. Previous research has focused on investigating implicit and explicit evaluations towards high and low energy dense foods, the main finding being that participants' hunger level and dietary habits (restrained eating) modulate such evaluations. In the present study, it was investigated that whether normal-weight healthy individuals assigned different values to natural and transformed foods depending on implicit (assessed with the Implicit Association Test) or explicit measures (assessed with explicit ratings), and whether participants' hunger level or dietary habits modulated the responses at both levels. The results showed that while for natural foods implicit and explicit measures (*healthiness*) seemed to converge, dietary habits or hunger level did not affect such evaluations. For transformed foods, a dissociation between implicit and explicit measures (*healthiness*) seemed to emerge, along with a strong modulation of dietary habits and hunger level on the

evaluations of such foods. Thus, these findings reveal how the type of food can modulate evaluations at both the implicit and explicit level and highlight a critical role of long-term health consequences and eating patterns in food evaluations. [Coricelli C, Foroni F, Osimo SA, Rumiati RI. 2019] <sup>[15]</sup>.

The statistics of obesity and its related chronic diseases throughout the life course are clearly linked to worsening dietary intake patterns. The necessity to shift toward more healthful intakes to prevent these illnesses and to attain optimal health requires an understanding and integration of the research related to children's development of food preferences and intakes and the factors that influence children's eating. Early experience with foods, e.g., vegetables, has the potential for long-lasting effects on an individuals' diets because this period is a sensitive, if not critical, period for sensory, motor, and experiential learning. Development and learning occur across multiple and varied contexts and understanding the influences of environments and caregivers will help to identify modifiable factors for effective interventions to improve children's vegetable and overall dietary intakes. [Susan L Johnson. 2016] <sup>[16]</sup>.

The purpose of this study is to explore the effects of the meta-cognitive strategies on the academic and gaming achievements. Exploring the effects of those achievements on the social problem solving of students is also of interest. The social problem-solving ability, which is the mediating variable, affects the academic achievement and the game performance very strongly. These results imply that a commercial game playing in conjunction with meta-cognitive strategies can be an effective way to increase students' performance both in learning and gaming by keeping them involved. Talking and observation activities such as thinking aloud and modeling are more effective than writing activities in enhancing the students' achievements both in learning and gaming. [Kim, B., Park, H., & Baek, Y. 2009] <sup>[17]</sup>.

## Methodology

### Game Design and Development

To design the game, by using an iterative game design approach based on user-centered design methodology.

The methodology has the following five steps:

1. Learning and behavior change planning,
2. Game design,
3. Prototype development,
4. Play testing, and
5. Evaluation.

#### In Step 1

Performing a literature review to place the game within the context of nutrition knowledge and specialized serious gaming literature. Additionally, also conducting several multidisciplinary design sessions based on nutritional requirements and personality traits of children. In these sessions, the learning objectives, target behaviors, behavior change objectives, and behavior change methods (BCTs) that may be incorporated into the gameplay aspects were established or modified support the behavior change objectives.

#### In Step 2

In the multidisciplinary design sessions with relation to nutrition, behavioral changes, human-computer interaction, and game design is done. These meetings are held to discuss design concepts, as well as game mechanics and rules, and to

determine how to incorporate nutritional ideas and specific BCTs into gaming aspects. On the basis of these actions, prototypes are created.

#### In Step 3

Implementing the high-fidelity prototype based on the game design obtained in the previous step in the web page.

#### In Step 4

Experimenting the prototype with children. (Prototype in figure: fig 1, fig 2, fig 3. They are allowed to subsequently participated in a focus group wherein they are encouraged to talk about their game experience (e.g., instructions, activities, challenges, game flow, human-computer interaction, and engaging gameplay) and propose new game elements or features. Some suggestions are collected from cycle 1 and improved in the next.

For cycles 1, 2, and 3, the play lasted for 10, 15, and 15 minutes, respectively.

#### In Step 5

Conducting a multidisciplinary session with the same participants as in the Step 2 sessions to discuss and analyze the obtained results, the changes suggested for the game, and the new requirements obtained in the previous step. Based on this information, elaborating a set of recommendations to improve usability, enjoyment, player experience, game mechanics, game elements, and learning and behavior change strategies.



Fig 1: Snake Game



Fig 2: Match the Food



Fig 3: Smash the Pizza

### Results and Discussion

This result is consistent with those of other studies, which have shown that playing computer games can help kids learn how to discern between nutritious foods and junk food. Children's motivation and interest in learning may be increased by the light, audio, and visual impacts of video games. Children's excitement for learning can be maintained by incorporating video games into the classroom. One of the key strategies for igniting students' excitement for learning and promoting active learning has been to play computer games.



Fig 4



Fig 5

Children preferred to eat healthy foods after playing the computer game, suggesting positive changes in attitudes and behaviors. The results of this study clearly indicate that the application of computer games to nutrition education can effectively improve the eating habits and promote healthy behaviors among young children.

Among these factors, parent's eating behavior and family dietary habits are the key to cultivating good eating habits and behaviors among preschool children. If the parents have a high intake of junk food or frequently offer junk foods to their children, then their children will also have these poor eating habits. Therefore, the way that families or parents eat has a big impact on how well-informed preschoolers are about nutrition and how they should eat. To the best of knowledge, the family's eating habits directly impact those of children, and so they need a long time to develop their own eating habits. The realization that the computer game intervention period in this study was so brief may be to blame for the lack of a meaningful difference in the frequency of junk food intake.

The findings of this study demonstrate that using computer

games to teach preschoolers about nutrition can significantly increase their understanding of that subject. This study can serve as an inspiration for creating educational software and video games for young children.

### Suggestions

1. The game has simple aspects, which can include more difficulty rate.
2. The game can incorporate more visual elements, sound effects and attractive game mascots.
3. The game can include more levels with interesting concepts.
4. The game can encompass more on the information and knowledge about the eating habits.
5. The game can comprise point system like leader board among other players.
6. The game page can be further added with many more elements and be developed as a gaming application.

### References

1. Shegog R. Application of behavioral theory in computer game design for health behavior change. In J. Cannon-Bowers, & C. Bowers (Eds.), *Serious Game Design and Development: Technologies for Training and Learning*, 2010, 196-232). IGI Global. DOI: 10.4018/978-1-61520-739-8.ch011.
2. Baranowski T, Blumberg F, *et al.* Games for Health for Children-Current Status and Needed Research. *Games for health journal.* 2016; 5(1):1-12. DOI: 10.1089/g4h.2015.0026.
3. Hermans RCJ, Van den Broek N, *et al.* Feed the Alien! The Effects of a Nutrition Instruction Game on Children's Nutritional Knowledge and Food Intake. *Games for health journal.* 2018; 7(3):164-174. DOI:10.1089/g4h.2017.0055.
4. Turnin MC, Tauber MT, *et al.* Evaluation of microcomputer nutritional teaching games in 1,876 children at school. *Diabetes & metabolism.* 2001; 27(4-1):459-464.
5. Pérez-Rodrigo C, Aranceta J. Nutrition education in schools: experiences and challenges. *European journal of clinical nutrition.* 2003; 57(1):S82-S85. DOI: 10.1038/sj.ejcn.1601824.
6. Schneider KL, Ferrara J, Lance B, *et al.* Acceptability of an Online Health Videogame to Improve Diet and Physical Activity in Elementary School Students: "Fitter Critters". *Games for health journal.* 2012; 1(4):262-268. DOI: 10.1089/g4h.2012.0009.
7. LeBlanc AG, Chaput JP, McFarlane A, Colley RC, Thivel D, Biddle SJ, *et al.* Active video games and health indicators in children and youth: A systematic review. *PloS one.* 2013; 8(6):e65351.
8. Lu AS, Kharrazi H, Gharghabi F, Thompson D. A Systematic Review of Health Videogames on Childhood Obesity Prevention and Intervention. *Games for health journal.* 2013; 2(3):131-141. DOI: 10.1089/g4h.2013.0025.
9. Majumdar D, Koch PA, Lee H, Contento IR, Islas-Ramos AD, Fu D. Creature-101: A Serious Game to Promote Energy Balance-Related Behaviors Among Middle School Adolescents. *Games for health journal.* 2013; 2(5):280-290. DOI: 10.1089/g4h.2013.0045.
10. Holzmann SL, Schäfer H, Groh G, *et al.* Short-Term Effects of the Serious Game "Fit, Food, Fun" on

- Nutritional Knowledge: A Pilot Study among Children and Adolescents. *Nutrients*. 2019; 11(9):2031. DOI: 10.3390/nu11092031.
11. Sahoo K, Sahoo B, Choudhury AK, Sofi NY, Kumar R, Bhadoria AS. Childhood obesity: causes and consequences. *Journal of family medicine and primary care*. 2015; 4(2):187-192. DOI:10.4103/2249-4863.154628.
  12. Espinosa-Curiel IE, Pozas-Bogarin EE, Lozano-Salas, *et al*. Nutritional Education and Promotion of Healthy Eating Behaviors among Mexican children through video games: Design and Pilot Test of Food Rate Master. *JMIR serious games*. 2020; 8(2):e16431. DOI: 10.2196/16431.
  13. Lytle LA, Kubik MY, Perry C, Story M, Birnbaum AS, Murray DM. Influencing healthful food choices in school and home environments: results from the TEENS study. *Preventive medicine*. 2006; 43(1):8-13. DOI:10.1016/j.ypmed.2006.03.020.
  14. Kelishadi R, Azizi-Soleiman F. Controlling childhood obesity: A systematic review on strategies and challenges. *Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences*. 2014; 19(10):993-1008.
  15. Carol Coricelli, Francesco Foroni, Sofia Adelaide Osimo, Raffaella Ida Rumiati. Implicit and explicit evaluations of foods: The natural and transformed dimension, *Food Quality and Preference*. 2019; 73:143-153, ISSN 0950-3293, DOI:10.1016/j.foodqual.2018.11.014.
  16. Susan L Johnson. Developmental and Environmental Influences on Young Children's Vegetable Preferences and Consumption, *Advances in Nutrition*. 2016; 7:220S-231S. DOI:10.3945/an.115.008706.
  17. Bokyeong Kim, Hyungsung Park, Youngkyun Baek. Not just fun, but serious strategies: Using meta-cognitive strategies in game-based learning, *Computers & Education*. 2009; 52(4):800-810. ISSN 0360-1315, DOI:10.1016/j.compedu.2008.12.004.