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To cite this article: Alice Rosi, Furio Brighenti, Viviana Finistrella, Lisa Ingrosso, Giorgia Monti, Maurizio Vanelli, Marco Vitale, Elio Volta & Francesca Scazzina (2016): Giocampus school: a “learning through playing” approach to deliver nutritional education to children, International Journal of Food Sciences and Nutrition, DOI: [10.3109/09637486.2016.1144720](https://doi.org/10.3109/09637486.2016.1144720)

To link to this article: <http://dx.doi.org/10.3109/09637486.2016.1144720>

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 Published online: 17 Feb 2016.

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RESEARCH ARTICLE

## Giocampus school: a “learning through playing” approach to deliver nutritional education to children

Alice Rosi<sup>a</sup>, Furio Brighenti<sup>a</sup>, Viviana Finistrella<sup>b</sup>, Lisa Ingrosso<sup>c</sup>, Giorgia Monti<sup>d</sup>, Maurizio Vanelli<sup>e</sup>, Marco Vitale<sup>f</sup>, Elio Volta<sup>b</sup> and Francesca Scazzina<sup>a</sup>

<sup>a</sup>Department of Food Science, University of Parma, Parma, Italy; <sup>b</sup>Giocampus Steering Committee, Parma, Italy; <sup>c</sup>Madegus S.R.L., Parma, Italy; <sup>d</sup>Children Hospital Pietro Barilla, University of Parma, Parma, Italy; <sup>e</sup>Postgraduate School of Pediatrics, University of Parma, Parma, Italy; <sup>f</sup>Department of Biomedical, Biotechnological and Translational Sciences, University of Parma, Parma, Italy

### ABSTRACT

To improve nutritional knowledge of children, single-group educational interventions with pre/post knowledge assessment were performed in primary schools in Parma, Italy, participating to the Giocampus Program. A total of 8165 children (8–11 years old) of 3rd, 4th and 5th grades of primary school were involved in 3 hours per class nutritional lessons, with specifically designed games and activities for each school grade. To evaluate children learning, a questionnaire was administered before and after three months of educational intervention. A total of 16330 questionnaires were analysed. Children nutritional knowledge significantly increased ( $p < 0.001$ ) in all school grades. The integrated “learning through playing” approach, including the educational figures, tools and games, was successful in improving children’s nutritional knowledge. A stable integration of this method in primary school settings could prepare a new generation of citizens, better educated on health-promotion lifestyles.

### ARTICLE HISTORY

Received 7 October 2015  
Revised 4 December 2015  
Accepted 4 December 2015  
Published online  
18 February 2016

### KEYWORDS

Edutainment; healthy eating; Master of Taste; nutrition literacy; primary school

### Introduction

A healthy diet during childhood and adolescence promotes optimal health, growth and cognitive development and may contribute to the prevention of immediate health problems and of chronic diseases later in life (Berenson et al., 1998; Evans et al., 1996; FAO/WHO, 2003). Evidence suggests that there is a change in food group consumption patterns from childhood to young adulthood with a decrease in overall diet quality (Story et al., 2002). Food preferences are formed early in life and predict food consumption, so eating habits adopted in early life influence adulthood (Demory-Luce et al., 2004; Lien et al., 2001; Kelder et al., 1994). It is therefore important to establish healthy eating behaviors early in life and give spatial attention to the transition from childhood to adolescence. There is evidence-based information on the nutritional needs of healthy children and adolescents. Dietary guidelines across Europe recommend to eat a varied diet, mainly from plants, to consume at least five portions of fruit and vegetables a day, to reduce intake of saturated fat and salt, and to increase consumption of complex carbohydrates and fiber (WHO, 2000,2003). However, dietary consumption

surveys show that most European children and adolescents do not meet these dietary recommendations (Lambert et al., 2004). These unhealthy diet behaviors joined with a sedentary lifestyle lead to energy intakes higher than energy needs with increasing numbers of obese and overweight children and adolescents (Carlson et al., 2012; Leech et al., 2014). In Italy, it is estimated that >1 million children, between 6 and 11 years old, are overweight, with a consequent rise in type 2 diabetes among young people over the next few years (Spinelli et al., 2012).

Physical activity and nutrition are the primary objectives of health promotion campaigns oriented to reduce or prevent overweight in children and adolescents (Flodmark et al., 2006; Waters et al., 2011). Nutrition education is largely recognized as an effective tool to improve dietary knowledge and healthy eating behaviors (Contento, 2008; Kattelman, 2014; Shafer et al., 1996). Schools seem to be an optimal setting for implementation of health education initiatives, allow to reach almost 100% of school-aged children and to offer constant contact with them (Brown & Summerbell, 2009; Van Cauwenbergh et al., 2010). School-based interventions

aimed at promoting a healthy diet show evidence of effect on behavior in European school-aged children (Van Cauwenberghe et al., 2010).

In response, lifestyle interventions have been promoted in many Italian schools to teach children the basic topics of healthy nutrition and encourage them to be physically active. While these programs have been somewhat successful, a new approach has been promoted in the northern city of Parma hoping to resolve the shortcomings of previous initiatives. The Giocampus program is an educational project aiming to promote the wellbeing of future generations through a program of physical activity and healthy eating education. Prior to the beginning of Giocampus, a large-scale cross sectional study of the health-related behavior of school children in Parma collected data that provided the program with a robust scientific context. Overweight and obesity were associated with some common dietary mistakes (skipping breakfast or eating inappropriate breakfast; making unhealthy snacks; inadequate daily consumption of fruit and vegetables; and excessive intake of soft drinks) and with sedentary behavior (only one in 10 children took part in physical activity every day; half of the children watched television or played computer/videogames for more than 3 h a day; half had a television set in their bedroom; and 55% were taken to school by car) (Vanelli et al., 2005).

The aims of this article are to present the result reached in the early school years of the nutritional intervention within the Giocampus school project and explain this new approach for nutrition education in school-aged children.

## Methods

### *Giocampus school: study design*

This article presents data related to 2010–2012 academic years, in which 8165 children ranging from 8 to 11 years of age were involved in 3 h per class of nutrition activities, delivered on three different times. Informed consent and assent for participation in the study were obtained from children and their parents/legal guardians. The survey was approved by the Ethical Committee of the University of Parma.

### *Master of Taste*

The nutrition activities were realized by the Maestro-del-Gusto (literally, Master of Taste), an educational figure who has a background in food science. To ensure a consistent and high level of teaching, each Master of Taste attended a spatial training in order to deliver to children the same nutritional contents and with the same

procedure, by a “learning through playing” approach. First, he/she taught the key concepts of nutritional themes; later, the Master of Taste and children played educational games, aiming to increase children’s understanding.

### *Nutritional themes*

The Giocampus Scientific Committee identified the nutritional themes based on uncorrected eating habits and nutritional priorities for Italian children (Di Martino et al., 2008; Spinelli et al., 2012, 2014). Below are the three nutritional themes with the main topics of each school grade.

#### *Third-grade lessons*

- (1) “The five colors of fruit & vegetables”: the importance of varying the quality of fruit and vegetables; the importance of the five colors of fruit and vegetables; the importance of consuming five portions per day of fruit and vegetables.
- (2) “The importance of water”: the importance of water for the human body; the different water content in solid food; the importance of drinking at least eight glasses of water per day (EFSA NDA Panel, 2010; SINU, 2014).
- (3) “The importance of breakfast”: the importance of food as energy source for the human body; the importance of breakfast as an energy source for the brain for school and extra-school activities.

#### *Fourth-grade lessons*

- (1) “The importance of carbohydrates”: what are the food sources of carbohydrates; the importance of carbohydrates as sources of energy for the human body; the difference between monosaccharides and polysaccharides.
- (2) “The importance of dietary fiber”: what are the food sources of dietary fiber; the importance of dietary fiber for human body health.
- (3) “Five meals per day”: the main concepts of the previous five themes were recalled before talking about the importance of taking five meals per day.

#### *Fifth-grade lessons*

- (1) “The double pyramid”: children got to know the Mediterranean diet, what are the foods for each step of the pyramid; what is the consuming frequency for each step (first lesson), the meaning of the

upside-down pyramid and the environmental impact of foods (second lesson).

- (2) “The nutritional label”: the importance of reading nutritional labels for being aware of food choices.

### **Educational games**

Specific games and activities were designed to facilitate the “learning through playing” approach, improving children’s understanding of each nutrition theme. An artisan craftsman manufactured the educational games to allow for children to physically play in class. As competition motivates children’s attention and participation (Cagiltay et al., 2015), during the games the class was split into two or more teams. The game modality was always the same: in order for a team to win the game, the children had to answer correctly the Master of Taste questions in relation to each nutritional theme’s topics

#### **Third-grade games**

For “The five colors of fruit & vegetables” lesson the “five color cake” was produced. This tool resembled a puzzle with five slices, one for each color, images of fruit and vegetables were represented on each slice. Each team completes its cake by gaining slices from replying correctly to Master of Taste questions.

For “The importance of water” lesson “Mr. H<sub>2</sub>O” was created. It was a dummy with two compartments: one for food item images and one for water. Children filled the dummy with chosen food items and the Master of Taste filled it with a quantity of water in proportion to food items. The team who filled the dummy with more water won.

For “The importance of breakfast” lesson “The energetic scale” was produced. The loads represented breakfast food items or morning activities (for example, 1 h of math lesson). The weight of the loads was different and in proportion to energy request (for activities) or energy supplied (by items). The team who chose the breakfast energetically balanced with morning activities won.

#### **Fourth-grade games**

For “The importance of carbohydrates” lesson the “GiOCampus” was produced; OCA in Italian means goose, and the game is similar to the famous “game of the goose.” The tool was a board with images of food source of carbohydrates, which correspond to a question (e.g. what is the cereal source of popcorn?). The team who completed the board first won.

For “The importance of dietary fiber” lesson a board “The dietary fiber way” representing a gastrointestinal tract was produced. Each step corresponded to a question related to food items containing dietary fiber or not (e.g. among these foods, which one does contain more dietary fiber?). The team who completed the board first won.

For the “5 meals a day” lesson each team had to design the five meals of a day considering all the nutritional teachings learned in the past. The team who designed the best meals, by a nutritional point of view, won.

#### **Fifth-grade games**

For “The double pyramid” lessons the game was composed of a board designed as a Trivial<sup>®</sup> board with food item images in the external circular part and images relative to ecology items in the internal radial part. In addition, tools of different dimensions represented the pyramid steps. The aim of this game was to gain all the steps by answering correctly the questions related to food items and to reach the center of the board answering the ecological questions.

For “The nutritional label” lesson “The identity card of food” was produced. The Master of Taste gave one packed food to each team and the team had to classify the food item by nutritional and ecological points of view.

#### **The questionnaires**

A questionnaire was specifically designed for each school grade to challenge children about the nutritional themes learned during the specific year. The Masters of Taste administered the questionnaires to each class before and after 3 months intervention. Questionnaires included one or two questions related to each topic presented. Questions and related answers are reported in Tables 1–3, respectively, for each grade questionnaire.

#### **Data analysis**

Questionnaires were collected and decoded. Based on given answers, a *Cultural-Nutritional Awareness Factor* (AF) was calculated for each school grade both before and after the educational intervention. The AF score of each single questionnaire could have a minimum value of 0 and a maximum of 15, calculated by adding points to each answer based on the question’s difficulty, as shown in Tables 1–3, respectively, for each grade questionnaire. Data on AF were analyzed using the Wilcoxon Test for comparison within groups before and

**Table 1.** Third-grade questionnaire and AF determination.

Theme	Questions	Answers	Minimum points	Maximum points
The five colors of fruit & vegetables	Which of these fruit and vegetables do you know? Cross under the pictures	Picture of pea, bean, lettuce, sweet pepper, tomato, aubergine, fennel, carrot, artichokes, courgette, pumpkin, cauliflower, broccoli, spinach, beet, banana, apple, pear, tangerine, orange, strawberries, fruit salad, kiwi, berries, avocado, grapes, melon, watermelon, peach, apricot	1 point: <6 fruits and vegetables	5 points: 25–30 fruits and vegetables
The importance of water	What do you think you should drink at breakfast/morning break/lunch/afternoon snack/dinner? Cross under the pictures	Breakfast: Picture of water, tea (hot or ice), soft drink, fruit juice, orange squeeze, milk (hot or cold) Morning break: Picture of water, tea (hot or ice), soft drink, fruit juice, orange squeeze, milk (hot or cold) Lunch: Picture of water, tea (hot or ice), soft drink, fruit juice, orange squeeze, milk (hot or cold) Afternoon break: Picture of water, tea (hot or ice), soft drink, fruit juice, orange squeeze, milk (hot or cold) Dinner: Picture of water, tea (hot or ice), soft drink, fruit juice, orange squeeze, milk (hot or cold)	1 point: <3 times/day water, squeeze or milk	5 points: 13–15 times/day water, squeeze or milk
The importance of breakfast	How many times do you think you should have breakfast during a week? Pick up the best answer for you	Every day Never Only during school days Only during weekend days I don't know	0 point: never had breakfast	3 points: had breakfast every day
	What do you think you should eat in the morning? Pick up the best answers for you	nothing, biscuits, sweet snack, toast, crisp bread with jam or chocolate cream, cereals, orange, apple or pear, banana, kiwi, strawberries, milk, yogurt, tea, orange squeeze, fruit juice, water, other	0 point: 0 food/drink	2 points: 2 or more food/drink
Minimum and maximum points assigned for each question are based on question's difficulty and relevance. Asterisks indicate the correct answer if there is any.				

**Table 2.** Fourth-grade questionnaire and AF determination.

Theme	Questions			Answers		Minimum points	Maximum points
The importance of carbohydrates	What kind of bread do you think you should usually eat at home?	White	Wholemeal	With grains and seeds	0 point: only white bread	1 point: wholemeal or seeds bread	
	Do you know these cereals? Cross the cereals	Wheat, corn, spelt, barley, oat, rye			1 point: <2 cereals known	3 points: 5–6 cereals known	
The importance of dietary fiber	What do you think is the function of dietary fiber?	Forming crust or peel of foods	Colouring foods	Filling stomach after meal*	0 point: incorrect or not given answer	2 points: correct answer	
	Which of the following food groups contains more fiber?	Vegetables, fruits, legumes, pasta, rice, bread*	Milk, yogurt, fruit juice	Meat, fish, eggs	0 point: incorrect or not given answer	2 points: correct answer	
5 meals per day	How many times do you think we should eat every day?	3 times (breakfast, lunch and dinner)	2 times (lunch and dinner)	4 times (breakfast, morning break, lunch and dinner)	5 times (breakfast, morning break, lunch, afternoon break and dinner)*	2 points: correct answer	
	Choose the best menu for each meal	Breakfast: Morning break: Lunch: Afternoon break: Dinner:	Menu 1* Menu 1 Menu 1 Menu 1* Menu 1	Menu 2 Menu 2 Menu 2 Menu 2* Menu 3	Menu 3 Menu 3* Menu 3* Menu 3 Menu 3	0 point: 0 correct menu	5 points: correct menu for each daily meal

Minimum and maximum points assigned for each question are based on question's difficulty and relevance. Asterisks indicate the correct answer if there is any.

**Table 3.** Fifth-grade questionnaire and AF determination.

Theme	Questions		Answers		Minimum points	Maximum points
The double pyramid	What is the Food Pyramid?	An Egyptian monument	A food game	A schematic representation of the correct diet*	0 point: incorrect or not given answer	1 point: correct answer
	How many portions of fruit and vegetables do you have to eat in a day?	1	5*	1 fruit and 1 vegetable	0 point: incorrect or not given answer	2 points: correct answer
The nutritional label	Which of the following food items contains more sugar/fat/fiber?	Milk and dairy products	Cereal-based foods (pasta, bread, rice)	Sweets and confectionary*	0 point: incorrect or not given answer	2 points: correct answer
	Which one of these labels is the ingredient list?	Sugar Fat Fiber	Soft drinks* Soft drinks Soft drinks	Wholemeal pasta Wholemeal pasta Wholemeal pasta*	0 point: incorrect or not given answer	2 points: correct answer
Minimum and maximum points assigned for each question are based on question's difficulty and relevance. Asterisks indicate the correct answer if there is any.	Which one of these labels is the ingredient list?	Ingredients list*	Nutritional label	Energetic label	0 point: incorrect or not given answer	1 point: correct answer
	If you see this data on a milk bottle, what does it mean? (image of milk bottle with the expiry date 17 June 2007)	Must be drunk by 17 June 2007*	Was bottled on 17 June 2007	Must be drunk on 17 June 2007	0 point: incorrect or not given answer	2 points: correct answer
Minimum and maximum points assigned for each question are based on question's difficulty and relevance. Asterisks indicate the correct answer if there is any.	Which one of these labels is the nutritional label?	Ingredients list	Nutritional label*	Traceability label	0 point: incorrect or not given answer	1 point: correct answer

after the Giocampus educational intervention to verify the hypothesis of improving knowledge. Significance was accepted at  $p < 0.05$ . The statistical analysis was performed with SPSS<sup>®</sup> statistics 21.0 software (IBM, Chicago, IL). Results were shown as median (interquartile range). Moreover, a descriptive analysis was made for each question to examine all factors involved in the changing of cultural-nutritional awareness.

## Results

The total number of coupled questionnaires is in Table 4. During the first year only the third and the fourth grades of the Parma primary school participated in the study, and in the last year the fourth and fifth cycle. The AF significantly increased in all school grades, as shown in Table 4. These results suggest that children understood and learned the Giocampus' main topics. A descriptive analysis of each question of the three-grade questionnaires is reported below.

### Third-grade questionnaire

All data are shown in a supplementary material (see Additional Data 1 – Third Grade).

#### First theme: “the five colors of fruit & vegetables”

For all the reported vegetables, data show that the positive answers increased. This means that after the Master of Taste lesson, the number of children who knows the specific vegetable increased. In particular, the difference between first and second answers was different for all vegetables. Carrots seem to be one of the preferred vegetables (more than 90.0%); in any case, the number increased (+1.3%). For some vegetables, the changes were very impressive and definitely positive. Data relating to artichoke (+10.3%), aubergine (+8.5%), pumpkin and beet (+8.1%) show how the Master of Taste intervention let children to recognize vegetables they did not listen before. Relating to fruit, the answers show that they are more familiar than vegetables, in fact most of the children declared they already knew them. The affirmative answers in the “in” questionnaire were >80% apart from berries (71.4%) and avocado (18.3%). In any case, after the Master of Taste lesson, the number

of children who recognized a specific fruit significantly increased for all fruits apart from bananas and tangerines.

#### Second theme: “the importance of water”

Water choice increased during every meal, in particular during the main meals (+5.2% for lunch; +3.6% for dinner). In addition, the number of children who selected “to drink nothing” decreased during each meal. During breakfast, the choice of soft drinks decreased (−2.8%); however, during the other four meals it increased. Probably because the breakfast meal was one of the three themes taught, children were more careful of this meal but not of the others. This observed improvement is supported by two other results: increased water selection for all the meals, and increased orange squeeze during breakfast meals.

#### Third theme: “the importance of breakfast”

The results of the first question show how the key message of the Master of Taste was reached. The number of children who think they should have breakfast every day increased from 89.3% to 95.5% and the other four options decreased. Also, the second question shows how the key message of the Master of Taste reached children. Food and beverage choices increased, in particular: sweet snack (+3.9%) and apple or pear (+1.4%), orange squeeze (+2.8%) and water (+2.6%). These results confirm and validate the data shown before.

### Fourth-grade questionnaire

All data are shown in a supplementary material (see Additional Data 2 – Fourth Grade).

#### First theme: “the importance of carbohydrates”

Relating to bread, data show that white bread decreased (−2.5%) while whole grain bread increased (+5.8%), according to what the Master of Taste taught about the importance of eating whole grain cereals. Also, the number of cereals known increased for all cereals. Rye, spelt and oat were the least-known cereals and corn was the best-known one.

**Table 4.** Total number of questionnaires coupled and values of AF for each school grade.

School year	Grade	Number of questionnaires (Male-Female)	AF first detection	AF last detection	<i>p</i> Values
2010–2011	Third grade	2249 (1158–1091)	11.0 (2.0)	11.0 (2.0)	<0.001
2010–2011/2011–2012	Fourth grade	3696 (1834–1862)	8.0 (3.0)	10.0 (4.0)	<0.001
2011–2012	Fifth grade	2220 (1088–1132)	11.0 (3.0)	11.0 (3.0)	<0.001

Values of AF are shown as median (interquartile range). Significance was accepted for  $p < 0.05$  (Wilcoxon Test).

### ***Second theme: “the importance of dietary fiber”***

Data related to the two questions on fiber show an overall improvement of the knowledge about the function of fiber and the foods that contain fiber. This indicates that the main topics of the lessons were understood and learned. The number of correct answers for both questions increased +9.5% and +16.2%, respectively.

### ***Third theme: “five meals per day”***

Results for the first question show that the key message explained by the Master of Taste was understood. An increasing number of children gave the right answer after the lesson (+14.3%), while the other answers decreased. In addition, children were asked to choose the most balance and healthy combination for each meal. There was an improvement in the correct choice in every meal except for lunch, in which the correct answer remained rather the same.

### ***Fifth-grade questionnaire***

All data are shown in a supplementary material (see Additional Data 3 – Fifth Grade).

### ***First theme: “the double pyramid”***

Children understood the Master of Taste explanation of what the Food Pyramid is, with 97.4% of students giving the right answer with knowledge improvement. The second answer was on proper portions of fruit and vegetables to eat daily: five portions and one fruit and one vegetable were mainly the chosen answers. The correct option increased and the wrong one decreased. Also, the results of the third question showed a positive trend. Children who chose the correct answer increased from 58.8% to 91.2% after the Master of Taste’s lesson and the other two options decreased. This data suggests that children involved in the nutrition lesson understood and remembered the pyramid structure and the food distribution in it. Data related to the last part of the questionnaire on nutrients (sugar, fat and fiber) contained in foods did not show an improvement in children’s knowledge. These results may be due to topics explained by the Master of Taste that were not completely understood because they were too complex and difficult, or the questions utilized to analyze the knowledge may have been tricky and not so clear for the target age of children.

### ***Second theme: “the nutritional label”***

The section was based on the nutritional label and was tested only in the last year of the educational program. Data on the nutritional label questions showed a positive trend, although the percentage of the right answers was high already at the first assessment. These results suggest that fifth-grade children already know the nutritional label themes.

## **Discussion**

The study resulted in general knowledge improvement. The specifically designed questionnaires, based on the key messages taught and tailored for each school grade, seem to be a valid tool to evaluate 8–11 years old children’s knowledge on specific topics. However, test-retest reliability of the questionnaires was not performed, which is a clear limitation of these tools. Unfortunately, post-study assessments were not done to evaluate very long-term results. This analysis would be very interesting to evaluate if the transition from childhood to adolescence was a critical time, or if the proper behavior previously acquired thanks to nutrition education prevented the decrease in diet quality during growth. Further limitations were the brief amount of available teaching time and the marginal presence of parents. As suggested in many research outcomes, there is a significant correlation between parent and child for nutritional behavior and eating motivation (Brown & Ogden, 2004; Gross et al., 2010; Scaglioni et al., 2008). Therefore, future improvements have to be planned to primarily involve children’s families. Finally, a significant limitation was the absence of a control group, because of ethical and logistical reasons. In addition, selection bias could have been done in a community-based intervention, frequently linked to cross contamination between groups (Perez-Rodrigo & Aranceta, 2001; Vidhyashree et al., 2015). However, the large sample size of children involved in the project is a strength of the study. In addition, a very important aspect of the Giocampus program is the synergy between nutrition education and physical activity promotion. The same children were also involved in 2 h a week (for a total of 60 h a year for each class) of theoretical and practical physical education activities. It is now largely accepted that between healthy eating education and physical activity there is a strong and unbreakable bond and that they represent two different approaches to fight obesity (Kuo et al., 2013). A combined program of healthy eating and physical activity – realized in schools – seems to be a very great opportunity to increase the future health of children (Veugelaers & Fitzgerald, 2005) and prevent them from



becoming overweight (Brown & Summerbell, 2009). With this synergistic work, the Giocampus school program encourages the adoption of a healthy lifestyle that will help children during their entire life.

## Conclusions

The integrated “learning through playing” approach, including the educational figure, the educational tools and games, and the new way of delivering nutritional education was successful in improving children’s knowledge about healthy foods and a healthful lifestyle.

The presented methodology could be extended and personalized for other institutions to approach overweight and obesity as a public health problem that requires a global intervention as part of a multi-sector commitment to a community. The stable integration of the Master of Taste in the primary school educational system should therefore be considered advantageous and beneficial to reach the goal of preparing a new generation of citizens better educated on health-promotion lifestyles.

## Acknowledgements

We gratefully acknowledge all actors of the GIOCAMPUS Project, including children, teachers and families involved in it.

## Disclosure statement

The authors declare that they have no competing interests.

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