

# MEAL Project: Modifying Eating Attitudes and Actions through Learning

E. Oliver, A. Cebolla, A. Dominguez, A. Gonzalez-Segura, E. de la Cruz, S. Albertini, L. Ferrini, K. Kronika, T. Nilsen, R. Baños

**Abstract**—The main objective of MEAL is to develop a pedagogical tool aimed to help teachers and nutritionists (students and professionals) to acquire, train, promote and deliver to children basic nutritional education and healthy eating behaviours competencies. MEAL is focused on eating behaviours and not only in nutritional literacy, and will use new technologies like Information and Communication Technologies (ICTs) and serious games (SG) platforms to consolidate the nutritional competences and habits.

**Keywords**—Nutritional Education, Pedagogical ICT Platform, Serious Games, Teachers and Nutritionists, Training Course.

## I. INTRODUCTION

UNHEALTHY nutritional habits are an important health problem worldwide. In Europe, some of the main risk factors for premature death are related to eating habits and physical inactivity [1]. According to the literature, the number of obese people tripled over the last 20 years, whereas the overweight problem in children has increased even more [2]. Furthermore, poor nutrition and inadequate eating behaviours habits are a crucial risk factor to develop Eating Disorders (ED) that is alarmingly increasing every year, especially in teenagers [3], [4]. Nutrition is also related to many common European diseases such as cardiovascular disease, cancer, diabetes, etc. [5]. The promotion of behavioural changes in the field of nutrition from the childhood can lead to a prevention of food-associated diseases. On the other hand, healthy eating is particularly important for children and adolescents, because its influence on their wellbeing, growth and development [6]. Childhood overweight is related to academic underachievement, social isolation and lowered self-esteem, but also to ED vulnerability and obesity in adulthood. Furthermore, eating habits are established early in the life

E. Oliver, A. Dominguez, and R. Baños are with the University of Valencia (UVEG), Valencia (Spain) and CIBER Obn (Spain).

A. Cebolla is with the University Jaume I (UJI), Castellón (Spain) and with CIBER Obn (Spain) (Phone: 0034-69 386 44 12; e-mail: banos@uv.es).

A. Gonzalez-Segura and E. de la Cruz are with the everis Spain SLU in Valencia (Spain) (e-mail: ana.gonzalez.segura@everis.com).

S. Albertini and L. Ferrini are with the FVA di Louis Ferrini and Co.; Rome (Italy) (e-mail: fvaweb@tiscali.it).

K. Kronika is under BEST Institut für berufsbezogene Weiterbildung und Personaltraining GmbH; Vienna (Austria); (e-mail: Karin.kronika@best.at).

T. Nilsen is under Rogaland School and Business Development Foundation, (Stavanger, Norway) (e-mail: Thomas@nilsen.com).

This project has been funded with the support of the Lifelong Learning Programme from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein. Project number: 543535-LLP-1-2013-1-ES-KA3-KA3MP.

cycle and tend to carry through to adulthood. To face this challenge, the EC elaborated in 2007 a Strategy on Nutrition, Overweight and Obesity-related health issues [7] to reduce the risks associated with poor nutrition and limited physical exercise. Besides, the WHO European Action Plan for Food and Nutrition Policy 2015–2020 presents goals and targets for the various health challenges for the next years [8].

## II. NUTRITIONAL EDUCATION

Nutritional Education (NE) is defined as “any set of learning experiences designed to facilitate the voluntary adoption of eating and other nutrition-related behaviours conducive to health and well-being” [9]. NE not only refers to nutrition literacy, but also to other eating behaviours and habits that should be incorporated to curriculum like how to eat, timetables, planning eating or impulsivity. These competences have a positive influence on wellbeing and health [10], [11], are protective factors for developing obesity and ED, and empower children to be active agents in the promotion of their own health. Although NE is present in the school curriculum of European children, several studies have shown that NE level is very low and needs to be reinforced [6]. Furthermore, the NE competencies incorporated in curriculum are mainly based on food components and nutrition biological mechanisms, but it is not included information about eating habits or behaviours like intake planning, developing strategies and competences about how to improve the awareness during the intake, learning techniques of self-control or make nutritional decision in specific situations, etc.[9].

## III. THE MEAL PROJECT

MEAL is an European Project funded under the Lifelong Learning Program (Project number: 543535-LLP-1-2013-1-ES-KA3-KA3MP). The motivation of MEAL is to develop a pedagogical tool aimed to help teachers and nutritionists (students and professional) to acquire, train, promote and deliver to children basic NE and healthy eating behaviours competencies.

MEAL consortium is composed by 5 partners from 4 European Countries (everis Spain SLU and University of Valencia (UVEG) in Spain; FVA di Louis Ferrini and Co. in Italy; BEST Institut für berufsbezogene Weiterbildung und Personaltraining GmbH; in Austria; and Rogaland School and Business Development Foundation (RSBD) in Norway.

In comparison to previous projects, MEAL is focused on

eating behaviours and not only in nutritional literacy, and uses ICTs and Serious Games (SG) platforms to consolidate the nutritional competences and learning. Serious games, i.e., games designed to attain a serious outcome (e.g., behaviour change) other than simply enjoyment, show promise for promoting lifestyle behaviour changes [12].

MEAL pedagogical tool is based on Contento's [9] nutritional educational model (see Fig. 1), and supported by ICT, allowing a "Learning by doing" perspective where users not only learn specific knowledge but also train skills and learn competencies, determinants to move from knowledge into action. ICTs allows the development of a better and more attractive and efficient way of learning for professionals, students and children (see Fig. 2).

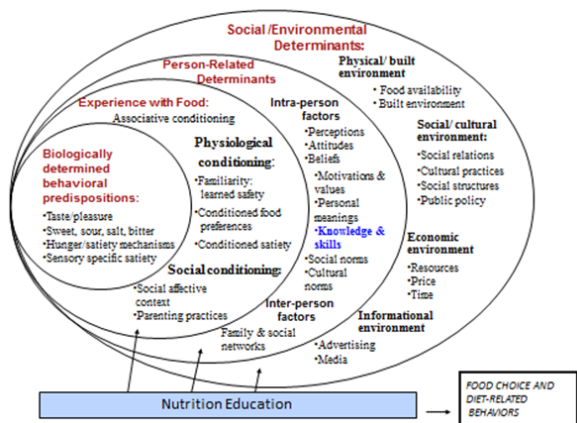


Fig. 1 Nutrition Education Model [9]

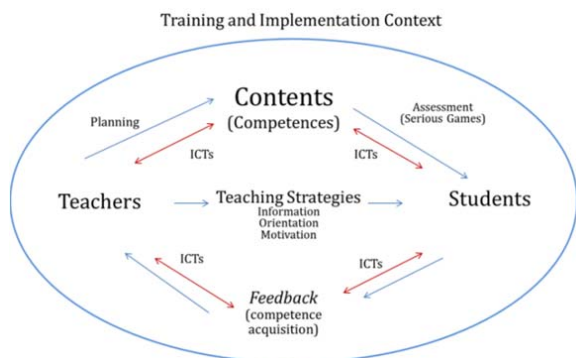


Fig. 2 Training and Implementation Context

The direct target groups of the project are 1) students in education and nutrition disciplines, 2) professionals (teachers and nutritionists) and 3) in less extent, children.

For each target group the project will design a training methodology, specific contents (knowledge assets) and ICT infrastructures to better deliver the learning experiences, based on the user needs.

IV. MEAL TOOL

MEAL aims to develop and test a NE training program and a ICT-tool focused on a) teaching nutritional competences to

"Primary School Education" and "Nutrition and Dietetics" students, to deliver NE to promote healthy eating behaviours in children (9-12 aged); and b) helping professionals (teachers and nutritionists) to implement this NE program in their education or clinical contexts. In order to do so, a tool composed of three main components - ICT platform itself, a Training Course (TC) and SG - has been developed.

A. Training Course (TC)

The TC of MEAL project include the training and pedagogical model used as a guideline to achieve the objectives of the project. The training model has been used to organize the information needed to develop the competencies and to train the skills in professionals and students in order to transfer the information and knowledge to children. The TC specifies the contents and the way these competencies and information are developed and delivered.

The NE training program is focused on information about eating habits, and decision-making in specific situations related to nurturing and self-empowerment in learning techniques.

B. Serious Games (SG)

SG refer to "applications of interactive technology that extend far beyond the traditional videogame market, including: training, policy exploration, analytics, visualization, simulation, education and health and therapy" [13]. Within MEAL; SG are used to consolidate the nutritional competences and habits acquired by children and also, to support the NE courses addressing them.



Fig. 3 CookIt Serious Game



Fig. 4 PickIt Serious Game

Two SG (PickIt and CookIt) have been designed in the context of MEAL Project, and both of them are aimed to transfer NE knowledge and skills and to promote healthy behaviors in children. Figs. 3 and 4 show a screen view of each one of them.

C. MEAL Platform

MEAL Platform is an ICT solution aimed at supporting the learning process. It is built following the requirements of end users obtained in the first stage of the project. The platform has been developed as a Web Application based on the standards HTML5 and CSS3, following the principles of the Responsive Design, Progressive Enhancement and Mobile First methodologies. Its development has followed the technologies shown in Fig. 5.

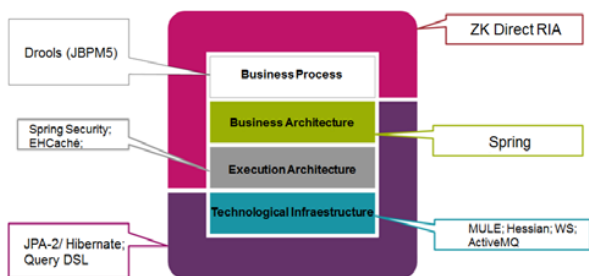


Fig. 5 Technologies used in the development of MEAL Platform

Fig. 6 shows the visual aspect of the Platform. The mock ups are presented in English although it is also available in German, Norwegian, Italian and Spanish.

The platform conforms the ICT tool that supports the TC and the SG.

V. TESTING METHODS AND FIRST RESULTS

MEAL Platform offers teachers and nutritionist useful tools, procedures and strategies to promote an experiential learning in children, mainly achieving: (1) Knowledge transfer, (2) Skill acquisition and (3) Attitudinal and behavioral change.



Fig. 6 MEAL Platform. (a): Log in; (b): Welcome message; (c) Home menu; and (d) Example of TC contents.

Within the project, a testing strategy (validation trials) has been defined. The main objective of the validation trials is to test (1) the MEAL web platform among the target groups, (2) to assess the results obtained from the implementation of the TC using the MEAL platform and (3) to assess the efficacy of the Serious Games to learn the specific competences designed in the TC. Besides, through these trials, trainers and experts



will be involved in the project in order to improve the first version of MEAL web platform using their suggestions and experiences. This will facilitate the elaboration of the definitive version of the MEAL platform, adapting it to the real needs of the users.

In order to evaluate the MEAL web platform, an assessment protocol has been designed taking into account the different users (professionals and students, and children) and the different components of the MEAL project (ICT platform, TC and SG). Currently these trials are running, although some preliminary results have been obtained and are presented below.

#### A. Procedure

The first validation trial has been carried out in Spain by UVEG. The sample was composed by 40 students (36 females and 4 males) of the first year of Educational Science Degree of the University of Valencia.

After the signing of the informed consent, the objectives of the validation and the contents of the platform (TC and SG) were presented and described. After that, the students used the platform and SG for 20 minutes and then answered the validation questionnaire protocol composed by several instruments described as follows:

##### 1) Acceptability and Satisfaction Questionnaire

Questionnaire developed ad hoc in order to assess the opinion, suggestion and valuation of the students regarding the training course (4 items) and the MEAL Platform (10 items)

##### 2) Technology Acceptance Model (TAM)

Usefulness questionnaire is based in the Technology Acceptance Model (TAM) [14]. It was composed by 4 items about the perceived usefulness of MEAL platform for the specific target of the trials (students).

##### 3) Diffusion Theory

Questionnaire based on the Diffusion Theory (DT) [15] composed by 4 components: (a) Perceived relative advantage (11 items); (b) Compatibility (6 items); (c) Visibility (6 items); and (d) Intention of use (3 items)

##### 4) System Usability Scale (SUS)

Questionnaire used to assess how easy or difficult the users perceived the use of MEAL technological tools from a usability point of view [16].

##### 5) Acceptability – Playability Questionnaire

Questionnaire developed ad hoc in order to assess 3 main areas of the Serious Games: (1) Playability (11 items); (2) Immersion (2 items) ; and (c) Acceptance (7 items).

#### B. Results

The data obtained through the questionnaires has been analyzed with the statistical software SPSS v21. To study the acceptability, playability scores and ratings in the evaluation of the MEAL platform, a descriptive analysis with percentages will be applied. Finally, a one-way ANOVA test has been applied to analyze the differences on the items scores of the

acceptability, playability and immersion questionnaire.

Regarding the MEAL platform and the TC the SUS mean score was 80.57, which means that MEAL tool is acceptable for users. Results about satisfaction and opinion of MEAL platform and TC are showed in Figs. 7 and 8.

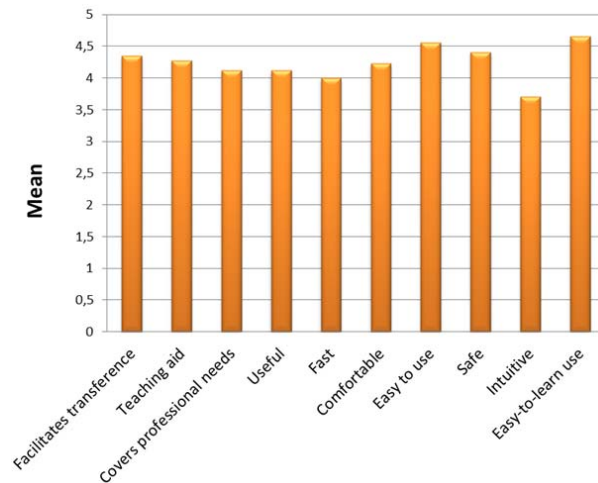


Fig. 7 Evaluation of MEAL platform (1 to 5 likert scale)

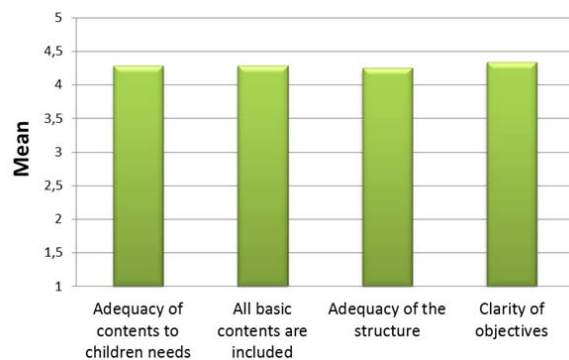


Fig. 8 Evaluation of MEAL TC (1 to 5 likert scale)

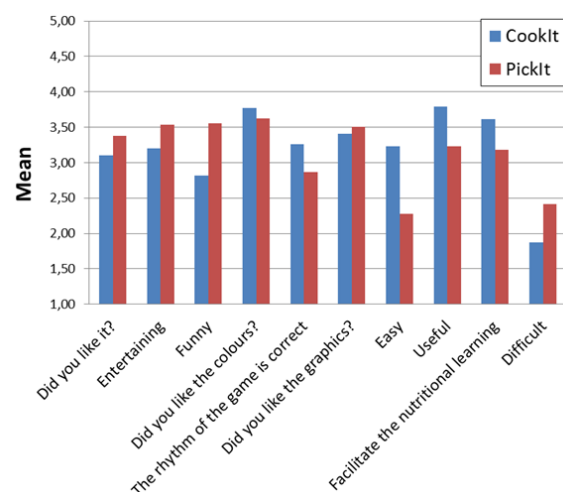


Fig. 9 Evaluation of Serious Games (1 to 5 likert scale)



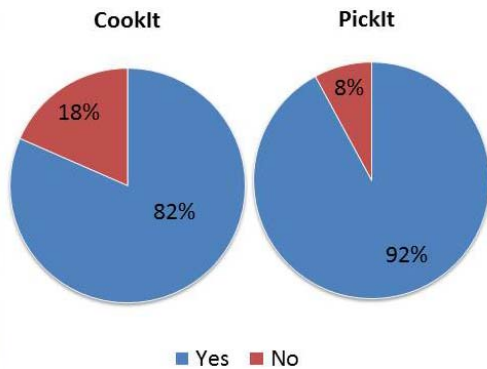


Fig. 10 “Do you want to play again?” results for CookIt and PickIt SGs

Regarding the Serious Games, results showed good acceptability and satisfaction with both Cookit and Pickit games (Fig. 9). Moreover, participants indicated that they would like to play again if they have the possibility (Fig. 10). Further validation about the tool is being performed at the moment of the submission of the current paper.

## VI. DISCUSSION AND CONCLUSIONS

The obesity and nutrition related diseases prevention is a crucial challenge in Europe nowadays as they will have a strong economic and social impact in the next decades in all the European Countries. The main objective of MEAL project is to raise awareness, deliver contents and promote behavioural changes in the field of nutrition and consequent prevention of food-associated diseases. To take profit of project results, it is expected that the partners providing training solutions (BEST, UVEG and RSBD) will include MEAL learning framework in their training programs. This will keep disseminating the project results and reaching the identified target users of the project. In particular each partner has developed a strategy that will support the future sustainability of MEAL initiative.

EVR will include MEAL as one of its health products for commercialisation and will set up the services to assure the correct operation of MEAL. EVR will use its client network including health care agencies, hospitals, insurance companies and health provider organisations for dissemination and exploitation.

UVEG foresee to incorporate the MEAL results in the academic curricula of “Primary School Education and “Nutrition and Dietetics” degrees. UVEG will also disseminate the MEAL outcomes among all the hospitals, universities and research centres of the Spanish Biomedical Research Centre in Physiopathology of Obesity and Nutrition CIBEROBn, and MEAL practice will be incorporated in guidelines proposed by CIBEROBn.

FVA will keep promoting the project results among its selected customers network, such as organizations (having an interest in promoting positive health attitude in young generations), institutions (dealing with education and training), psychological and social actors (i.e. dealing with

food disorders prevention).

BEST foresees to incorporate the MEAL outputs in their teacher training programmes, as well as in programmes for youngsters. In addition, they will use their network of Austrian educational providers to make sure the MEAL products will be implemented in Austria.

The inclusion of project results in training courses by RSBD is foreseen to be done as in-service teacher training courses and in competence building courses for sports coaches. An intensive dissemination campaign in Norway and abroad in the sport domain will be set up by the partner, reaching 500 recipients in education, 1 700 000 members of the Norwegian national sports federation, 145 000 members of the Regional sports council and 120 local communities. Moreover, the project results are expected to generate both knowledge and contents that can be the basis for future research and training programs. Follow-up projects and initiatives will be studied to increase the number of target beneficiaries after the project conclusion.

## ACKNOWLEDGMENT

E. Oliver, A. Cebolla, A. Dominguez and R. Baños thank CIBER Obn Fisiopatología de la Obesidad y Nutrición (Spain; www.ciberobn.es).

## REFERENCES

- [1] cf Diet, Nutrition and the Prevention of Chronic Diseases, Report of a Joint WHO/FAO Expert Consultation, 2003 (<http://www.who.int/dietphysicalactivity/publications/trs916/download/en/index.html>).
- [2] R. Hyde, “Europe Battles with obesity”, *The Lancet*, vol. 371 (9631), pp. 2160–2161, 2009.
- [3] I. Krug, C. Villarejo, S. Jimenez-Murcia, C. Perpiña, N. Vilarrasa, R. Granero, et al., “Eating-related environmental factors in underweight eating disorders and obesity: are there common vulnerabilities during childhood and early adolescence?”, *Eur Eat Disord Rev.*, vol. 21(3), pp. 202–208, 2012.
- [4] A. Preti, G. Girolamo, G. Vilagut, J. Alonso, R. Graaf, R. Bruffaerts, et al., “The epidemiology of eating disorders in six european countries: results of the ESEMeD-WMH Project”, *J. Psychiatr. Res.*, vol. 43, No. 14, pp. 1125–1132, 2009.
- [5] A. Robertson, C. Tirado, T. Lobstein, M. Jermini, C. Knai, J. Hensen, et al., *Food and Health in Europe: a new basis for action*, WHO Regional Publications, European Series, No. 96, 2004.
- [6] E. Weichselbaum, J. Buttriss, “Nutrition, health and schoolchildren”, *British Nutrition Foundation - Nutrition Bulletin*, vol. 36(3), pp. 295–355, 2011.
- [7] EC, *White paper on A strategy for Europe on Nutrition, Overweight and Obesity related health issues*, 2007.
- [8] WHO, *European Food and Nutrition Action Plan 2015-2020*, Regional Committee for Europe, 2014
- [9] I. Contento, “Nutrition education: linking research, theory, and practice”, *Asia Pac J Clin Nutr*; vol17(1), pp. 176–179, 2008.
- [10] Effects of diet on behaviour and cognition in children. *Br J Nutr.*, vol. 92 Suppl 2. pp. 227–232, 2004
- [11] G. Mitchell, J. Brunstrom, “Everyday dietary behaviour and the relationship between attention and meal size”, *Appetite*, vol. 45(3), pp. 344–355, 2005.
- [12] T. Baranowski, R. Buday, D. Thompson, J. Baranowski, “Playing for real: video games and stories for health-related behavior change”, *Am J Prev Med.*, vol. 34(1), pp. 74–82, 2008.
- [13] B. Sawyer, D. Rejeski, *Serious Games: Improving Public Policy Through Game-based Learning and Simulation*, *Woodrow Wilson International Center for Scholars*, 2002.
- [14] M. Yi, Y. Hwang, “Predicting the Use of Web-based Information Systems: Self-efficacy, Enjoyment, Learning Goal Orientation, and the

Technology Acceptance Model', *International Journal Human-Computer Studies*, vol. 59(4), pp. 431-449, 2003.

[15] E. Rogers, *Diffusion of Innovations*, The Free Press, 1962.

[16] J. Brooke, *SUS: a "quick and dirty" usability scale*. In P. W. Jordan, B. Thomas, B. A. Weerdmeester, & A. L. McClelland. *Usability Evaluation in Industry*. London: Taylor and Francis, 1986.