BRITEC – Bringing Research Into the Classroom

Learning Scenario

1. Title

Analysis of students' dietary habits activities and Lesson plan

Author(s)

Riviou Katerina, Researcher, R&D Department of Ellinigermaniki Agogi
1 supervisor researcher from the Aristoteleion University of Thessaloniki
Konstantinos Soutos, Head of the Department of Physical Education at *Ellinogermaniki* Agogi
Panousis Clearchos, Physical education teacher at *Ellinogermaniki* Agogi

Area of research

Childhood obesity and public health

Subject(s)

The project and research were applied in an interdisciplinary way involving subjects from the curriculum such as Science, ICT, Technology

Topic

The programme was developed in the context of the **BigO project (https://bigoprogram.eu/)** and of the "Flexible Zone" foreseen in the current Primary School Curriculum. The "Flexible Zone" expands the content of the Research Projects, so that in addition to the scientific micro-researches they also include artistic, social activities (volunteering, solidarity, interpersonal, etc.), environmental, cultural, activities related to modern and traditional media and information (print and digital media, creation of printed or electronic student magazine, actions related to internet student radio, etc.), as well as others, related to a variety of issues of school life and the environment.

Age of students

Primary School students (age 9 – 12, 3rd, 4th, 5th and 6th grades)

More focused on 9-10 years old students, 4th grade of Primary School in the specific context (due to the multidisciplinary project on Nutrition)

2. Introduction

Contribution of the CS project to Science in general

The purpose of the program is to evaluate a series of real-life Primary School students' meal pictures, physical activity, and geographic data (GPS) collection and analysis tools. Data collected is anonymous. With these tools we will analyze similar data from a large number of students in order to create community profiles (e.g. a neighborhood) on how and what students eat, how they move and how they sleep, in order to assess the relationship between these behaviours with the prevalence of overweight and obesity young people. The ultimate goal is to make these results available to the public health authorities to help them intervene and help communities in need. Individual behaviors, such as high and fast eating, when accompanied by little exercise and poor sleep, can be a reason why people become obese. In addition, the specific environmental conditions of a community, such as fewer exercise areas, many fast-food restaurants, or a greater number of food ads, etc., can contribute to the individual behaviors described above. Because of this, we are developing a system to measure these behaviors and relate them to specific environmental parameters of a community to see if they are related.

Aim of the activities plan and learning objectives

The number of children and adolescents with obesity is high and still increasing. These children have a higher risk of developing various diseases later on, compared to children without obesity. The reasons why some children become obese are complex. Behaviour is, amongst others, influenced by many factors in the living environment (such as transportation options, food advertisements, safety, food prices, et cetera). In turn, the living environment is affected by public health policies. Combined, these are components that determine obesity rates.

The program collects and analyses anonymous data on children's behavioural patterns and their living environment. By using advanced analytics and sophisticated visualizations it extracts data-driven evidence on which local factors are involved, and how these factors influence childhood obesity.

This is done in various steps. School aged children become citizen scientists by collecting data about their behavioural patterns and local environment, with the myBigOapp. This data is anonymized and used to create complex statistical models to analyse how behaviour and the environment influence obesity prevalence. This anonymous information can be used to predict how policy changes could influence obesity rates and can be used to compare different communities on group level. With this information it will be able to advice stakeholders and researchers on how to develop and plan effective programs and policies in an attempt to reduce childhood obesity.

The overall aim of the program is to collect and analyse big data on behavior and living environments related to childhood obesity in order for public health authorities to plan and execute effective programs to reduce childhood obesity prevalence. This is not because programs to reduce obesity do not exist, but because they are less effective than intended. In the EU, approximately 2.8 million deaths result from causes associated with overweight and obesity (easo.org).

Causes of obesity are complex, however evidence exist that interventions targeting multiple elements of children's behavioral patterns and living environment are needed.

Specific objectives

To accomplish the main goal of effectively advising public health and clinicians, specific objectives have been set. These objectives are divided into different domains.

Scientific objectives

The scientific objectives are all geared towards gathering the information needed to study the relationship between the various behavioural and environmental factors related to obesity and creating the analytical models to use this information. More specifically these objectives are:

- To extract what relationships between the external living environment and behavioural patterns increase behavioural risk factors for obesity. (Aetiology)
- To create models that show how changes in the external living environment can alter behavioural patterns, which in turn modify behavioural risk factors for obesity. (Prediction)
- To produce models that predict how changes in behavioural risk factors of obesity impact obesity prevalence. (Prediction)
- To define a behavioural model in such a way that it is useful for the above purposes, but does not store sensitive information or redundant personal information. (Privacy Preservation)

Technological objectives

The technological objectives are related to building the infrastructure to collect, store and analyse data. Moreover, they are focused on developing the technological programs, warrant privacy and develop the decision support tools for care facilities and public health authorities. More specifically these objectives are:

- Building an extensive network of information sources: namely sensors like smartphones and smartwatches which run mobile applications used to collect subjective data and objective data to get information on behaviour and the local environment.
- Moreover, server-based applications will be developed so that publicly available data (like maps, statistics and metadata) can be shown.
- To determine policies and the technical means to enforce these policies relating to big data governance, privacy and anonymization
- To provide 3 decision support functionalities:
    - the Policy Advisor that offers aetiology and data evaluation services. For example, visualizing aggregated evidence for public health authorities and schools to help them design and monitor programs.
    - the Policy Planner that offers simulation and prediction services. For example, extracting associations between environment and obesogenic behaviours to investigate causality and create prediction models and developing intelligent algorithms to recognize behavioural patterns.
    - the Clinical Advisor that offers evaluation and decision support for the individual at the point of care. For example: visualizing individual behavioural patterns for health professionals to help them follow-up obese children patients.

Validation objectives

The validation objectives are aimed at evaluating how the systems and platforms work. More specifically these objectives are:

- Evaluation of the system components
- Evaluation of the system in realistic usage environments
- Evaluation of the decision support platform.

Business objectives

The business objectives include:

- defining an effective, pragmatic and viable business plan and exploitation scheme in line with the use as a framework for supporting public health authorities on the one hand and as a tool that offers evidence to the health professionals on the other hand.

- Building the program around the “citizen-scientist” model, which relies on individuals sharing their behaviour data.

Summary of activities

Number of activity	Name of activity
1	Measuring students' weight and height.
2	Install the data collection app on the student’s mobile phone. Once students activate the app, they will be asked to complete a small number of questions about their most common eating, physical activity, and sleeping habits.
3	Students use the app to take meals pictures (see Appendix III). During the week students take pictures of meals, focusing mainly on breakfast and the main meal after school. Once such an image is captured, the application will ask the user to record their mood at this particular time, through a multiple-choice question.
4	Students use the app to take food and photos in their everyday environment (outside of school), regardless of the medium of advertisement (brochure, billboard, bus poster, digital, online or on television). Students are asked not to include faces of the people around them when taking photos.
5	Students use the smart watch to record GPS, physical activity and sleep data, self-assessment data (see Appendix I) and transfer it automatically to the phone. If students are comfortable, they are asked to wear the 'smart watch' for at least 2 weekends. They are also asked to wear it while sleeping for at least 3 nights during the week.
6	At the end of the week students will be asked to answer some questions (see Appendix II) about their experience using the application and the "smart" watch.

3. Detailed description of each activity (to be completed as many times as activities are implemented)

Activity 1: Measuring students' weight and height

First Part: Aim of the activity

Measuring students' weight and height by the school's physical education teachers.

Second Part: Suggested procedure

Preparation time	1h
Teaching time	1 teaching hour
Online teaching material	N/A
Offline teaching material	N/A
Citizen science purpose of the activity (if any) *	Outline questions or guidelines required for collecting data
*** Guidance for teachers**	Add some kind of guidance for teachers about why it is important to address those questions and collect those data.

Third Part: Advice on methodology

Use of Height and Weight Electronic Scales to measure weight and height of students

Fourth Part: Educational analysis

N/A

Activity 2: Install the data collection app on your personal mobile

Once students activate the app, they are asked to complete a small number of questions about their most common eating, physical activity, and sleeping habits.

First Part: Aim of the activity

The Aim of the activity is students to meet methodologies of recording initial data

Second Part: Suggested procedure

Preparation time	2h,
Teaching time	1 teaching hour
Online teaching material	See Appendix I
Offline teaching material	
Citizen science purpose of the activity (if any) *	• Record Initial data • Complete the activity.
*** Guidance for teachers**	Reliable and cleansed **data** supports effective decisions that help drive research

Third Part: Advice on methodology

Reliable and cleansed data supports effective decisions that help drive research. Web Applications can be used to collect and save data.

Fourth Part: Educational analysis

STEM Learning: Increased focus on Science, Technology, Engineering, Mathematics subjects in the curriculum
Peer Learning: students learn from peers and give each other feedback.
Cloud Based Learning: data, tools, software is all online and can be reached and modified from different devices.
Edutainment: playful learning. Learning while having fun.
Compare uploaded ideas with original ideas

Data collection allows students to stay on top of trends, provide answers to problems, and analyze new insights to great effect.

Through data collection a research project has the quality information it needs to make informed decisions from further analysis, study, and research.

Activity 3: Students use the app to take meals pictures.

First Part: Aim of the activity

Participating students will be asked to use the app outside of school hours for 4 weeks. During this time, participating students will be asked to take pictures of the foods they ate. Once such an image is received, the application will ask the user to record the mood at this particular time, through a multiple-choice question. Students are instructed not to include faces in the photos. It should be noted that the photos will only be used for analysis by researchers and will not be published on any website. They are used only to detect the type of food consumed, and only statistical (group and anonymous) results are published.

Second Part: Suggested procedure

Preparation time	1h,
Teaching time	1 teaching hour
Online teaching material	N/A
Offline teaching material	N/A
Citizen science purpose of the activity (if any) *	Outline questions or guidelines required for collecting data Why use digital technologies to edit, store, process, transmit data and information How digital technologies contribute to the development of sciences How digital technologies are used by sciences and scientists
*** Guidance for teachers**	In a citizen science program teachers must be ready to explain the questions above and be fully informed of the physical object of the program

Third Part: Advice on methodology

Give clear instructions on how students take pictures of the foods they ate.

Fourth Part: Educational analysis

Cloud Based Learning: data, tools, software is all online and can be reached and modified from different devices.

Project-Based Learning: students get fact-based tasks, problems to solve.

Outdoor Education: learning outside of the school building in the “real” environment

STEM Learning: Increased focus on Science, Technology, Engineering, Mathematics subjects in the curriculum

Peer Learning: students learn from peers and give each other feedback.

Snack Learning: small and attractive bits of learning rather than pro-longed forms of study

Activity 4: Students use the app to take food ads pictures in their everyday environment

First Part: Aim of the activity

Students will also be asked to take photos of food advertisements in their daily environment (inside or outside school), regardless of the medium of advertising (brochure, billboard, poster on bus, digital, online or on TV). In this case too, the same instruction will be given not to include persons. Also, these photos will only be used for analysis by the researchers, and will not be published on any website. They are used only to train algorithms that calculate children's exposure to advertisements and only statistical (group and anonymous) results will be published.

Second Part: Suggested procedure

Preparation time	1h
Teaching time	30 minutes
Online teaching material	N/A
Offline teaching material	N/A
Citizen science purpose of the activity (if any) *	Outline questions or guidelines required for collecting data Why use digital technologies to edit, store, process, transmit data and information How digital technologies contribute to the development of sciences How digital technologies are used by sciences and scientists
*** Guidance for teachers**	In a citizen science program teachers must be ready to explain the questions above and be fully informed of the physical object of the program

Third Part: Advice on methodology

Give clear instructions on how students take pictures of food advertisements in their daily environment (inside or outside school), regardless of the medium of advertising (brochure, billboard, poster on bus, digital, online or on TV).

Fourth Part: Educational analysis

Cloud Based Learning: data, tools, software is all online and can be reached and modified from different devices.

Project-Based Learning: students get fact-based tasks, problems to solve.

Outdoor Education: learning outside of the school building in the “real” environment

STEM Learning: Increased focus on Science, Technology, Engineering, Mathematics subjects in the curriculum

Peer Learning: students learn from peers and give each other feedback.

Snack Learning: small and attractive bits of learning rather than pro-longed forms of study

Game Based Learning & Gamification: learning is mixed with games or with game mechanisms; badges according with the data contributed by students

Activity 5: Students use the smart watch (provided by the project)

First Part: Aim of the activity

Students use the smart watch to record GPS, physical activity and sleep data (see Appendix) and transfer it automatically to the phone. If students are comfortable, they are asked to wear the 'smart watch' for at least 2 weekends. They are also asked to wear it while sleeping for at least 3 nights during the week.

The smartwatch is connected to the mobile application. Students will be asked to pair it with their mobile phone when they are out of school. They will be asked to wear it outside of school for as long as possible they feel comfortable during the study but with specific minimum periods of use per week: at least 2 daily when they are out of school, at least 1 day of the weekend and 3 any nights. The data will be automatically sent to the application's servers as soon as the mobile is on a Wi-Fi network (without the use of mobile data in order to avoid extra costs for the student).

Second Part: Suggested procedure

Preparation time	30 min
Teaching time	1 teaching hour
Online teaching material	N/A
Offline teaching material	N/A
Citizen science purpose of the activity (if any) *	Why use digital technologies to edit, store, process, transmit data and information How digital technologies contribute to the development of sciences How digital technologies are used by sciences and scientists
*** Guidance for teachers**	In a citizen science program teachers must be ready to explain the questions above and be fully informed of the physical object of the program

Third Part: Advice on methodology

Give clear instructions on how to pair the smart watch with their mobile phone and explain how the data will be automatically sent to the application's servers as soon as the mobile is on a Wi-Fi network (without the use of mobile data in order to avoid extra costs for the student).

Fourth Part: Educational analysis

Cloud Based Learning: data, tools, software is all online and can be reached and modified from different devices.

Project-Based Learning: students get fact-based tasks, problems to solve.

Outdoor Education: learning outside of the school building in the "real" environment

STEM Learning: Increased focus on Science, Technology, Engineering, Mathematics subjects in the curriculum

Peer Learning: students learn from peers and give each other feedback.

Snack Learning: small and attractive bits of learning rather than pro-longed forms of study

Activity 6: Students use the smart watch

First Part: Aim of the activity

At the end of the week students will be asked to answer some questions (see Appendix II) about their experience using our application and the "smart" watch

Second Part: Suggested procedure

Preparation time	30min
Teaching time	30 min
Online teaching material	See Appendix II
Offline teaching material	N/A
Citizen science purpose of the activity (if any) *	*Outline questions or guidelines required for collecting data* Why use digital technologies to edit, store, process, transmit data and information How digital technologies contribute to the development of sciences How digital technologies are used by sciences and scientists
*** Guidance for teachers**	In a citizen science program teachers must be ready to explain the questions above and and be fully informed of the physical object of the program

Third Part: Advice on methodology

Give clear instructions on how to complete the q/re

Fourth Part: Educational analysis

Cloud Based Learning: data, tools, software is all online and can be reached and modified from different devices.

Project-Based Learning: students get fact-based tasks, problems to solve.

Outdoor Education: learning outside of the school building in the “real” environment

STEM Learning: Increased focus on Science, Technology, Engineering, Mathematics subjects in the curriculum

Peer Learning: students learn from peers and give each other feedback.

Snack Learning: small and attractive bits of learning rather than pro-longed forms of study

4. Assessment after implementation of the activities plan

Student´s learning

Discussion with students at the end of the school year has shown that students believe that:

- The projects criteria were met successfully
- Acquired Proficiency in thinking like a researcher
- Achieved understanding of the science, math and ICT tools needed to solve the problem
- Achieved progress in working successfully in teams was achieved
- Developed the attitude and gained confidence leading to successful citizen science projects

Citizen Science experience

Lessons Learnt

- The structure of the activities as well as objectives need to be defined during the first meeting among teachers and researchers
- A presentation of the structured methodology has to be defined
- The training of the teachers involved (by the researcher)
- The connection with the involved subjects, informatics, sciences must be clear
- The experimental phase together with the researchers
- Clear guidance and explanation of the scientific questions and research that students had to answer and accomplish.
- It is expected that the students' outcome presentations will be exhibited to the school board and parents' associations, while local authorities will also be invited in the presentations. This is a strong motivation for students, as they have the chance to promote their research work and propose specific environmental measures that can potentially be applied in practice. In the same framework, the publication of the students' work in educational scientific conferences and journals will be considered, such as the OSJ - Open Schools Journal for Open Science (https://ejournals.epublishing.ekt.gr/index.php/openschoolsjournal/index)
- In overall, the project is expected to increase the students' knowledge and awareness about dietary habits and healthy diet and its importance in human health. The students will also practice in conducting research and in exploiting the resulting outcomes in the framework of serving society and their community.
- Student's training involves:

    - One instructional lecture by the project's researchers, including the demonstration of the tools (mobile app, smart watch, tablets use, etc.) that will be used.
    - Practice in the methods and tools having the guidance of the teachers.
- The expectations were related to the development of knowledge and skills inextricably linked to the approach methodologies concerning the science of citizens such as:
    - Bring researchers and students together
    - The collection of data,
    - Sorting the data
    - Register the data
    - Processing and statistical analysis of data and
    - the recording of the results in a comprehensible form by non-experts
- But also, with the development of similar knowledge and skills such as:
    - the use and utilization of collaborative tools,
    - ways of remote communication,
    - utilization of cloud services
    - Utilization of statistical analysis and processing analysis tools
    - Use of office applications for data registration and presentation etc.
- The citizen science initiatives/activities are suitable for cooperation between schools and scientists because it brings researchers and students together under the same projects, sharing same questions, difficulties and expectations and because it was a great opportunity and experience for researchers to transmit knowledge at school level
- Researchers offer motivation to the students
- Access to special equipment needed to implement science programs such as special sensors, special equipment, telescopes, access to original scientific data, electronic devices, science laboratories and last but not least, computer and network equipment and fast internet access.
- Teachers need training.
- Researchers, universities and research centers need to come closer and collaborate with schools, schools need to open up to the societal needs (Open schooling model,

5. Bibliography

Parallel activities in the context of the multidisciplinary project implemented in the 4th Grade of Primary School, https://portal.opendiscoveryspace.eu/en/osos_authoring_tool/view/849827

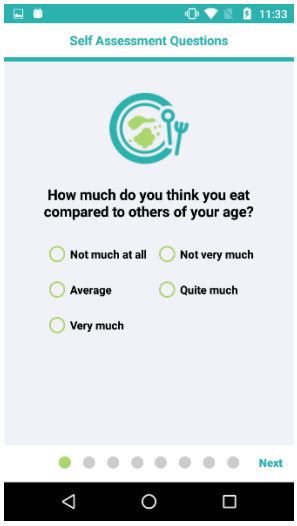
- http://ecoico2020.com/
- https://easo.org/
- https://www.worldobesity.org/
- https://asoi.info/
- https://www.obesityaction.org/
- https://stop.publichealth.gwu.edu/

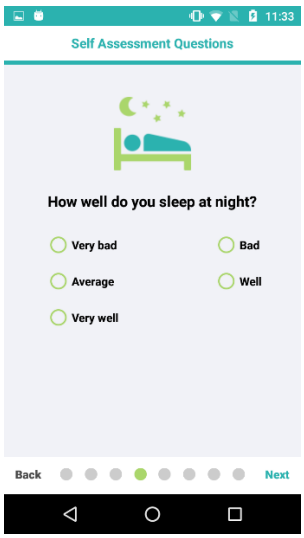
6. Annexes

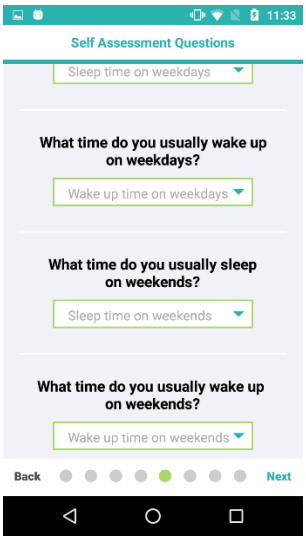
Any document needed for the development of the activity.

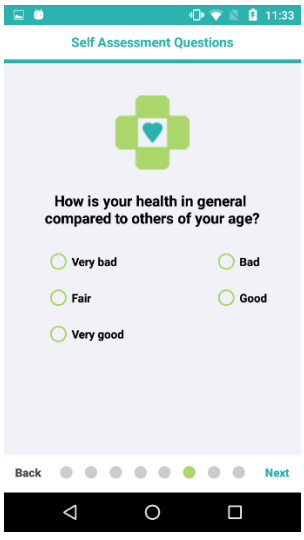
Appendix I.

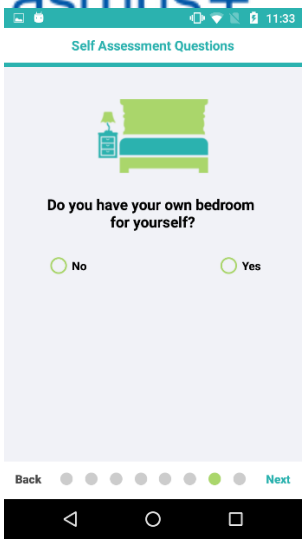
Physical activity and sleep data

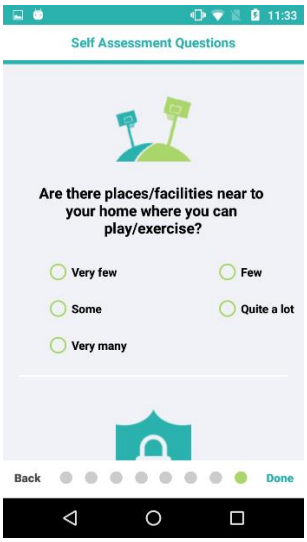


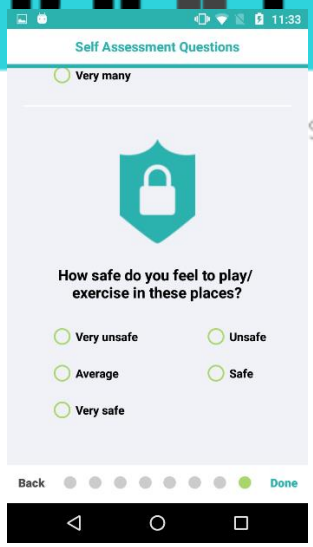




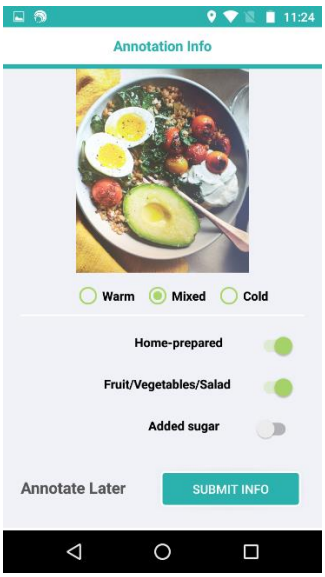


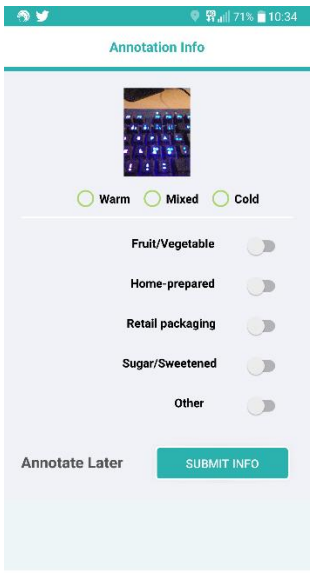


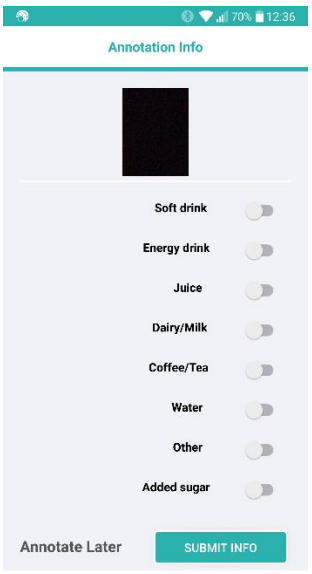


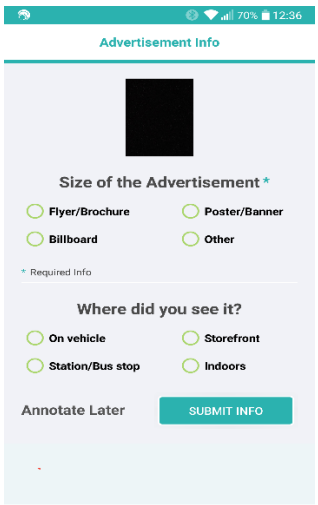


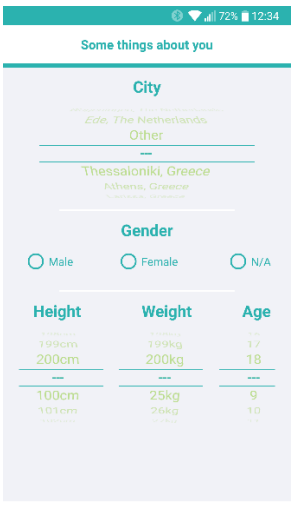
Self-Assessment Question screens

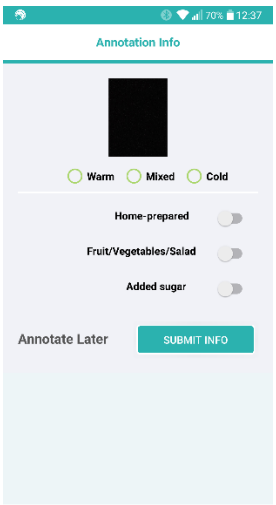


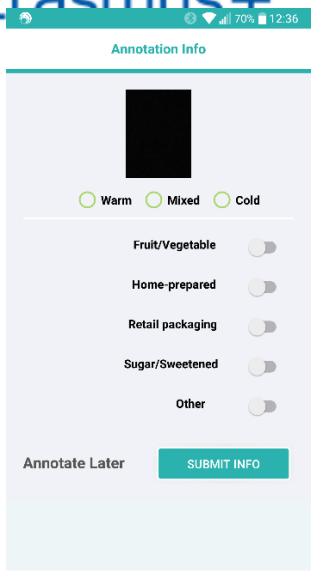




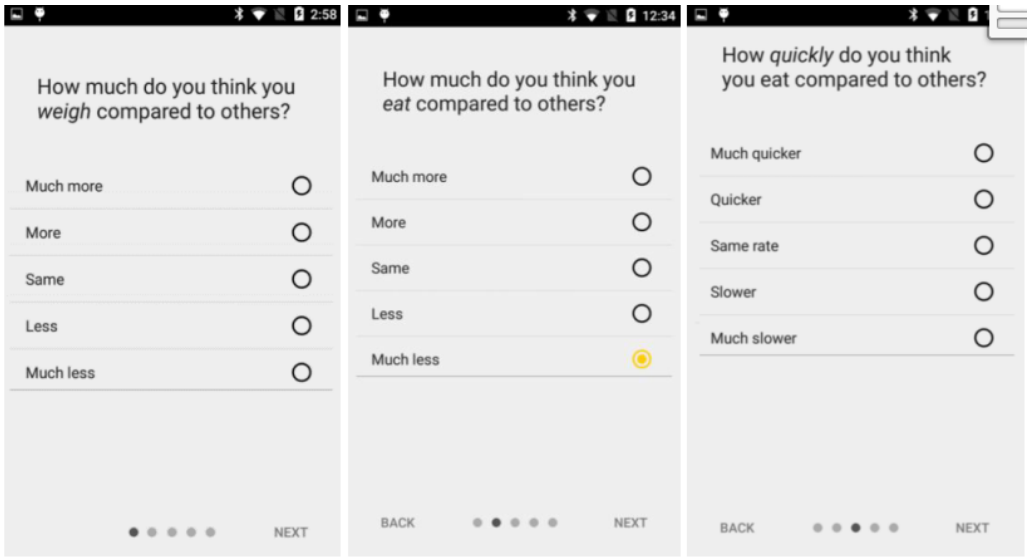


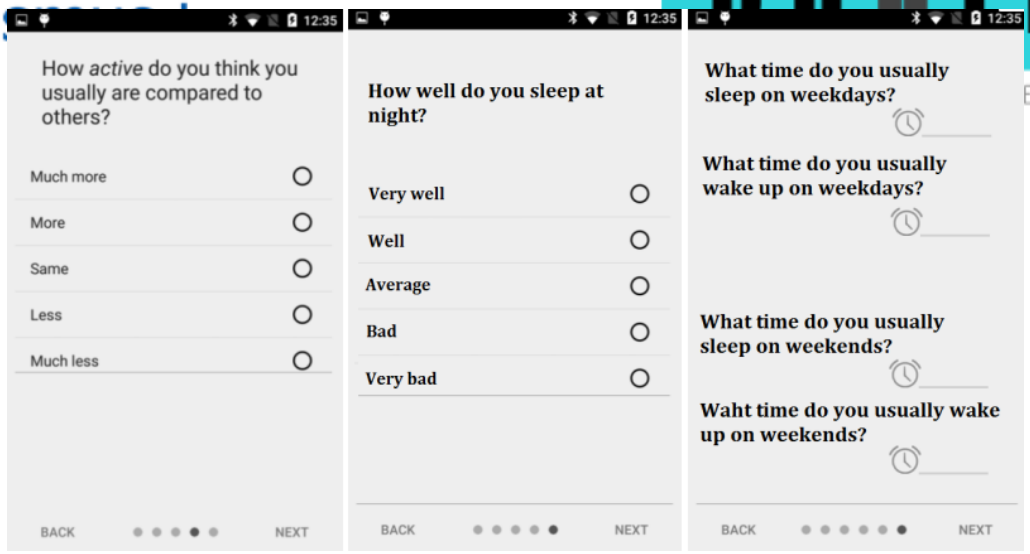






Evaluation questionnaires





A mood question that will be asked through the mobile application when the user has photographed a meal or some kind of food he ate. It concerns organized data collection action and spontaneous data collection action.

Appendix II

The following is a questionnaire of usefulness and expediency that students and / or their parents will be asked to answer at the end of the period of use of the system during both the organized and the spontaneous collection action data. Initially was administered in paper format but then came in the format of an online Google Form.

System Usability Scale (SUS)

Sensors and user-friendliness for the application will be measured using the System Usability Scale (SUS). This is a questionnaire where the people who used the system answer 10 questions. Each question follows a Likert scale with 5 answer options, where 0 represents "Strongly Disagree" and 4 represents "Strongly Agree".

Questions	0	1	2	3	4
1. I think I would like to use this system often.					
2. I found the system unnecessarily complicated					
3. I think the system was easy to use.					
4. I think I would need the support of a technician to be able to use this					
5. I found that the various functions in this system were well integrated					
6. I thought there was too much inconsistency in thi system.					
7. I imagine most people will learn to use this system very quickly.					
8. I found the system very difficult to use.					
9. I felt very confident when I used the system					
10. I had to learn a lot before I could proceed with this system often.					

Questionnaire of usability quality and user friendliness

1. How comfortable did you feel when participating in the study?

1 2 3 4 5 6 7 8 9

○ ○ ○ ○ ○ ○ ○ ○ ○

2. Would you recommend a friend to take part in a similar study?

1 2 3 4 5 6 7 8 9

○ ○ ○ ○ ○ ○ ○ ○ ○

3 To what extent did using the system affect your normal behavior?

1 2 3 4 5 6 7 8 9

○ ○ ○ ○ ○ ○ ○ ○ ○

4. Do you have any ideas about the system? What would you improve?;

_ _

_ _

_ _

5. Do you have any ideas about the study process? Any obvious problems? Any comments?

_ _

_ _

_ _

Smartwatch

6A. How comfortable do you feel using the supplied smartwatch?

1 2 3 4 5 6 7 8 9

○ ○ ○ ○ ○ ○ ○ ○ ○

6B. Would you recommend the use of Smartwatch, in a similar study, to a friend?

1 2 3 4 5 6 7 8 9

○ ○ ○ ○ ○ ○ ○ ○ ○

6C. How many hours a day (on average) did you use your smartwatch? _ _ _ _

6D. How did the Smartwatch affect your behavior during the day?

_ _

_ _

_ _

6E. Indicate to what extent you agree with the Smartwatch statements below.

The Smartwatch was bothering me.

1	2	3	4	5	6	7	8	9
○	○	○	○	○	○	○	○	○

My Smartwatch was easy / comfortable to use.

1	2	3	4	5	6	7	8	9
○	○	○	○	○	○	○	○	○

I would use the Smartwatch at school

1	2	3	4	5	6	7	8	9
○	○	○	○	○	○	○	○	○

You would use a Smartwatch while you are at home

1	2	3	4	5	6	7	8	9
○	○	○	○	○	○	○	○	○

You would use a Smartwatch outside (eg in a restaurant).

1	2	3	4	5	6	7	8	9
○	○	○	○	○	○	○	○	○

6F How many hours (per day) could / would you like to wear the Smartwatch in everyday life?

_ _

6G1. Any other ideas on using Smartwatch? Any suggested improvements?

_ _

_ _

_ _

Appendix III

Photos of meals















Appendix IV

Smart watches and mobile phones used

«Έξυπνα» κινητά & εφαρμογή BigO για κινητό

Η εφαρμογή **BigO**, την οποία θα κληθείτε να εγκαταστήσετε σε Android κινητό σας υποστηρίζει τις ακόλουθες λειτουργίες:

α) Λειτουργεί ως κεντρικό σημείο για τη σύνδεση του «έξυπνου» ρολογιού, συλλέγοντας τα παραγόμενα δεδομένα μέσω Bluetooth.

β) Θα σας επιτρέψει να πάρετε τις απαιτούμενες φωτογραφίες των διαφημίσεων τροφίμων που συναντάτε στην καθημερινότητά σας καθώς και φωτογραφίες γευμάτων του παιδιού σας.

γ) Θα μεταδίδει αυτόματα όλα τα δεδομένα που συλλέγονται στους διακομιστές BigO όταν είναι συνδεδεμένο σε Wi-Fi και θα είστε σε θέση να ελέγξετε πόσα δεδομένα έχετε φορτώσει στους διακομιστές μας.

«Έξυπνα» ρολόγια

Θα σας δώσουμε το TicWatch E. Παρακαλούμε να το φοράει το παιδί σας, αν αισθάνεται άνετα, τουλάχιστον 3 καθημερινές και 1 ημέρα το Σαββατοκύριακο ανά εβδομάδα. Η συσκευή θα χρησιμοποιηθεί για την παροχή δεδομένων επιτάχυνσης και GPS μέσω του αντίστοιχου 'έξυπνου' κινητού σας. Θα μπορείτε να ενεργοποιήσετε/απενεργοποιήσετε τη λειτουργία καταγραφής του ρολογιού κατά βούληση μέσω της εφαρμογής μας.