



PRISMA CENTRE FOR DEVELOPMENT STUDIES

A Conceptual Model for Location Based Games

developed in the framework of the
PREHealth project



Wissenschaftsstadt
Darmstadt



Utrecht University



EINDHOVEN



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Terms of References

Development of the conceptual framework for the creation of location based games by higher education, students, schools, educators of chronically ill children, and adult learners (IO5) submitted in fulfilment of the requirements for the Erasmus+ Project Promoting education and jobs to enhance the use of urban blue and green infrastructure for health and fitness (PREHealth).

Project partners

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1. SERIOUS GAMES IN EDUCATION: A Review

1.1 Introduction

The major challenge in using “serious games” in education, is to “create games that please as many players as possible and are still educationally effective¹. A range of constructs have been consequently identified, e.g. flow, immersion, presence and arousal, which may be used to explain how players can have a positive experience by playing a game, and thus offer useful guidance to game designers about transferring the benefits of entertainment into education.

The basic elements that define a serious game or “learning game” as is often referred to, have been defined as follows: mechanics, story, aesthetics and technology². To these, the learning objectives should be added as a separate element, making the design of the game even more challenging. Certainly, one of the essential goals of learning games is to find a balance between gameplay and learning objectives.

Lameras³ argues in a scoping paper entitled ‘Essential Features of Serious Games Design’ that gaming, when used as a learning tool, “*should be goal directed, competitive and designed within a framework of rules, choices and feedback to enable teachers and students to monitor progress towards the goal*”. It is also argued, on the basis of relevant evidence, that the goals of the game must be communicated to the player by such game attributes as a score mechanism or a puzzle to resolve. Although the review carried out targets higher education and has a direct reference to it, some of its conclusions apply to the educational use of games in different settings as well.

When considering game design in an education context, it is important to define the tasks, activities and challenges to be included in the design, but also note down the learning outcomes that can be mapped against such activities and challenges. The taxonomy of learning outcomes developed by Bloom, as shown by Lameras, provide a useful guide on the understanding of learning derived by serious games.

Category	Outcome
Remembering	Learner can memorise and recall information
Understanding	Learner can comprehend, explain and predict.
Applying	Learner can use information and solve problems
Analysis	Learner can analyse data patterns or concepts and findings can be discerned to prior evidence
Evaluating	Learner can compare and make justifiable judgements about the value of ideas, methodologies or products
Creating	Learner can design, build, invent, plan or produce original knowledge and transferring it to new contexts for making a contribution to the society

Bloom’s classification of learning outcomes

¹ Kiili et al (2012)

² Schell, J. (2008)

³ Lameras P. (2015)

Kiili et al⁴ also point out that the engagement and immersion of the player lead to learning that is not based on the expectation of some future benefit but simply because playing the game is in itself a reward. This type of attitude according to the authors, supports the ideology of life-long learning and is a priceless goal in education.

Evidence coming from Estonia⁵ offers an interesting dimension to another learning effect of games, referring this time specifically to augmented reality games (location-based games fall within this category). Such games have been shown to increase physical activity to some extent, although they cannot fully substitute actual exercising. Players of mobile AR games known as “exergames” – aiming to stimulate physical exercise, enjoyed the gaming process, claiming that it could encourage them to move more. The author concludes that “*exergames have a great potential in promoting active lifestyle and making players more aware of their health*”. However, a study in the Netherlands, showed that an intervention aiming to enable and motivate adolescents to engage in active gaming at least one hour per week, succeeded for only 14% of the participants. Reported reasons for not playing the active games were lack of time, preferring to play non-active games, and the active games being experienced as boring⁶. Thus, we can conclude that it is not enough to engage learners in active learning games, but the games have to be interesting and exciting for the target group, and also use incentives to motivate younger users who are accustomed to game playing of a passive nature.

Further work from Paredes et al⁷ on the effects of Games on health starts from the statement that is “*Persuasive technologies such phone apps or serious games share common goals of creating an engaging and efficacious experience towards behaviour change*”. The change of the players’ health behaviour has been in focus for developing design principles that would encourage such change. The results of this study have shown the important effects games can have in helping the player to develop skills that would eventually change their health behaviour.

⁴ Ibid

⁵ Ivanova, I (2016)

⁶ Simons (2015)

⁷ Paredes P. et al (2013)

1.2 Experience in game-based learning by the project partners

University of Darmstadt – School of Architecture

1. Why is it good to use games in education?
2. WHY should we use games?
3. HOW does this help meet the learning objectives?

“We aim at teaching civil society XY, therefore we use method AB”^[2]

This part of the literature review aims to collect evidence on how and to what extent location based games are used to a) stimulate physical activities and b) change perception of open space.

Knöll et al. (2014)⁸ have described how “urban exergames” seek to motivate players to be physically active in, and to interact with their urban environment. They presented seven criteria including that they require PA, being played in the urban environment, on mobile devices, being sensitive to context and players, consider safety aspects, raise awareness of the environment as opposed to screen, and finally are being fun to play. Elsewhere, Knöll et al. (2011, 2012)⁹ have specified suitable locations for “health games” to invite for PA, learn in situ everyday, and be safe while playing. It has been also specified how games can be designed location-specific, but still be adapted to different urban environments and use cases. In this model, the active design guidelines were used (Burden, Burney, Farley, & Sadik-Khan, 2013)¹⁰ to extract typologies of open spaces that are suitable to stimulate physical activity while playing location-based games. This list includes open space that will optimize players’ safety and immersion while playing an outdoor game, but also to identify locations that allow for an easy access and starting point (Knöll, et al. 2013)¹¹. Early studies indicate that gaming can help to increase moderate and vigorous physical activity by up to 20% as part of an active travel-to-school programme (Coombes et al. 2016)¹². While Urban Exergames seek to be innovative in their use of storytelling, design & health, GPS data, gesture recognition and bio data of current smartphones in order stimulate physical activity, there is a still limited amount of studies that can show their impact on PA.

The following section focuses on location based games in relation to users’ perception of their environment. In the Ottawa Charta, the World Health Organization (WHO) has set improving of health literacy and health skills as important element of health promotion (WHO, 1986)¹³. More recently, a Lancet series on adolescent health has emphasized the necessity for young people to learn about public health hazards, to prevent cyber mobbing and responsible media use (Patton et al. 2017)¹⁴. The role of urban design is gaining traction in public health (Giles-Corti et al. 2016)¹⁵, but the potentials to engage young people using new

⁸ Knöll et al. 2014

⁹ Knöll et al. (2011, 2012)

¹⁰ Burden, Burney, Farley, & Sadik-Khan, 2013

¹¹ Knöll, et al. 2013

¹² Coombes et al. 2016

¹³ WHO, 1986

¹⁴ Patton et al. 2017

¹⁵ Giles-Corti et al. 2016

technologies and concepts of gaming are still overlooked (Roe & Knöll, 2018)¹⁶. Halblaub Miranda and Knöll (2016)¹⁷ have presented a location based game for users to learn about urban environment features that have a positive impact on people's health. In their prototype, players can move in the real environments, interacting with physical objects including stairs, ramps, water basins in busy streets, quiet courtyards. Players are presented with real time data whilst on the move, for example, being shown heart rate data on their smartphone screen.

Utrecht University

Utrecht University has designed, developed, and evaluated various games for training skills, targeted to professionals and higher education students. Indeed, serious games have a great potential for training and educating people in novel and engaging ways. However, little empirical research has been done on the effectiveness of serious games, and although early findings do point to a moderately positive direction, even less is known about why some games succeed in effectively educating while others do not. The serious game "COgnition-based DEsign Rules Enhancing Decision-making TRaining In A Game Environment (Code Red: Triage)"¹⁸ is designed to empirically test a number of cognition-based design guidelines in the context of crisis management training that ameliorate mental model construction. The purpose of the study was to come to a number of design guidelines through empirical experiments that enhance the instructional design of serious games, and can be used in the development of future games. Also, a method to extract the mental structure players have built during gameplay was introduced. This research was part of the GATE program (Game Research for Training and Entertainment), <http://gate.gameresearch.nl/>, a 19 M€ budget national research program coordinated by Utrecht University 2007-2012.

The Communicate! Initiative started as a USO (Utrechts Stimuleringsfonds Onderwijs) project, 2013-2016. It supports practicing interpersonal communication skills between a healthcare professional such as a doctor or a pharmacist, or a (business) psychologist, and a virtual patient or client¹⁹, <https://communicate.sites.uu.nl/>. There are various versions of the system. Initially, Communicate! was developed for practicing communication skills with students in the Pharmacy curriculum. The Virtual Patient was developed in collaboration with the City of Utrecht as a serious game in which healthcare professionals can practice complicated conversations with patients. In 2016, scenario development and training with the Virtual Patient is transferred to Stichting Volte (<http://www.stichtingvolte.nl/>), commercialisation of the software is transferred to the startup DialogueTrainer BV (<https://www.dialoguetrainer.com/>). An EIT Digital project developed the Virtual Training Doctor for older adults to prepare themselves for conversations with healthcare professionals, <https://www.prepdoc.eu/>.

¹⁶ Roe & Knöll, 2018

¹⁷ Halblaub Miranda and Knöll 2016

¹⁸ van der Spek (2011)

¹⁹ Jeuring (2015)

PRISMA

PRISMA has tried out serious games as an education tool in projects involving mostly secondary school students, but addressing also the general public, and relating to issues of environmental protection, urban design and multi-cultural comprehension. All serious games were tried out in a school environment and the learning results were evaluated systematically. PRISMA coordinated these projects, which were implemented in several EU and non-EU countries, by transnational cooperation.

The ASPIS game aimed to make players aware of a range of sustainability issues in the design of parks and other public open spaces in cities. The game was designed as a computer game, where the player tried to solve problems that arose in a park, taking decisions and initiating actions that improved the sustainability of the open space. The INVOLEN and RAISE games aimed to make players aware of environmental protection issues, especially in area of high environmental and ecological value. Especially INVOLEN, aimed also to bring the generations together in this effort for environmental protection and preservation, by using stories of seniors (related to the protected area where the game was based) as input in the games created by teenagers. 25 location based games were created in the context of INVOLEN and 4 location-based games (LBGs) were created in the context of RAISE, by an equal number of groups of school students.

The results of the evaluation showed that the education benefits of the LBGs were superior to those achieved by a computer-based game, mostly in the sense that there was more intense involvement by the students in an LBG, the knowledge was hands-on given that the LBG is played on location, and messages and knowledge conveyed by the game stayed in the minds of students for a long time, because of their direct relationship to real experiences. The groups that developed location-based games reported some significant learning benefits derived from the process of developing their game. Examples are:

- Increased awareness about the topic of the game (in that case, environmental protection issues) and the desire to help solve (environmental) issues
- Feeling of being useful to society
- Eagerness to demonstrate to others related problems and solutions (concerning environmental conservation in that instance) leading to active citizenship
- Learning to work in a team – development of cooperation skills
- Development of ICT skills

The teachers who led these LBG projects were also very positive: although several of them reported some reservations about the project in the beginning, because creating games on mobile devices was not an activity familiar to them, they became enthusiastic during the “journey” as they called it. The majority evaluated LGGs as an “excellent pedagogical tool” going beyond the conventional learning methods and opening new possibilities for participative learning.

2. LOCATION-BASED GAMES AS EDUCATION TOOLS

Location-based games allow the players to refer to physical objects and location(s) and use their creativity and imagination in order to interact meaningfully with others, as well as with the location(s). In recent years there has been a rise in the number of creative games, interactive narratives and playful activities that are facilitated by mobile devices in such a way that the game activity follows the players' location. A term used to describe such games is "mobile location-based games".²⁰

The universal use of mobile devices, such as smartphones and tablets, and the fast evolution of game technology, have provided great opportunities to develop place-based games that encourage participants to become immersed in playful and meaningful interactions, using different layers of information. These products also offer real opportunity for learning and storytelling about specific locations and routes, introducing the natural or built environment as a participant in the players' interaction and experience. We note here that the new media, such as internet-connected mobile devices, enable instant social networking, micro-blogging and video sharing, all of which are being widely used by young people²¹. The nature of these media and the applications used, possibly more than their content, have greatly influenced the way the younger generation and society at large think²².

Many applications for modern smartphones incorporate LBSs to provide location-based information. This information can be used to give location-based advice, navigation directions, to track movement and conveniently communicate one's current location to friends, etc. However, it can be also used in the fields of entertainment and learning, to create games that makes the position of the player an essential part of the gaming process²³.

A location-based game (LBG) is defined as a form of play designed to evolve on a device in motion, directly linking the game experience with the location of the player. To create a location-based experience, usually a connection to other devices, e.g. a server or other players, is necessary. However, it is also possible to run single player games, provided that all required information is stored in the player's device. In this case, a connection to other devices is not necessary to run a LBG, as long as the game follows the changing locations of the player's device²⁴.

Mobile games are particularly suited to creating educational experiences in informal settings. Mobile media and augmented reality can fruitfully combine the advantages of educational video games with place-based learning²⁵. Thus, LBGs offer great opportunities to include educational content in the playful experience by using context-aware learning tactics and content generation mechanisms like augmented reality, embedded in a mobile device game or triggered by simple technologies such as QR (Quick Response) Codes and RFID (Radio Frequency Identification).

LBGs have another important feature, which makes them valuable for education: they connect places and stories. In an LBG, it is possible to embed extra layers of information and

²⁰ Avouris & Yannoutsou, 2012.

²¹ Smith & Caruso, 2010.

²² McLuhan et al., 1994.

²³ Lehmann, 2012.

²⁴ Lehmann, 2012.

²⁵ Squire, 2007.

narratives about, for example, historical locations or other places in a city. By visiting real places, the story becomes a personal experience linking physical objects with learning content. This conveys to the player location-specific knowledge, which is easy to remember, exploiting the connection between the real world and the game²⁶.

Taking into consideration the above, it becomes clear that in the context of the Health and Fitness Route of IO4, the location-based type of game provides the best mechanism for connecting (a) physical locations, (b) observations and information concerning these locations, (c) personal experiences and (d) learning content. Indeed, the PREHealth game aims to build activities and define challenges along a linear route across blue and green locations of the city (specified as the Health and Fitness Route) and connect these activities and challenges with specific locations along the route.

²⁶Lehmann, 2012.

3. CONCLUSIONS FROM THE PUBLIC OPEN SPACE USERS' SURVEYS (IO2) AND STATE OF THE ART DESK RESEARCH (O1)

The results of the public open space users survey (IO2) have provided the PREHealth team with useful guidance regarding the construction of the AR tools, one of which is the PREHealth LBG. The results across the 4 project-countries have some remarkable similarities, although certain pointed differences also exist (for details see IO2 – Synthesis Report).

We can learn a lot from the similarities observed across the 4 cities surveyed (Athens, Darmstadt, Gyor, and Eindhoven): for example

- The visitors of the surveyed opens spaces in the 4 cities represent all ages, are almost 50/50 split among men and women, come from all age brackets and strands of professional backgrounds; and belong to nuclear families as much as to other types of family.
- The majority prefer to visit their neighbourhood parks, and they do this on a weekly basis. Such trend is more pointed among older people, while the younger open space visitors are prepared to travel further than their neighbourhood to visit their favourite park.
- The most popular activities while in the open space include both “passive” pursuits, such as resting, observation of nature, socialization; and “active” pursuits, such as walking, jogging or playing with the children.
- If the opportunity was given, visitors would like to undertake more activities like walking and jogging as well as sports (basketball, volleyball, football, tennis, swimming, skating), exercise in an open air gym and cycling
- Significant proportions of open space visitors in all cities reported, among their suggested open space improvements, the provision of more facilities for physical exercise and sport and more information about opportunities for such activity. In some cities, like Athens for example, such suggestions were offered by 1 in 3 visitors; while in the online survey of open space users, one in 4 respondents desired improvements that would increase opportunities for physical exercise in the open space.
- Amongst the most widely acclaimed benefits, the improvement of one’s health possesses a high position, together with relaxing and enjoying nature. It is important that these three benefits were rated the highest in all the cities that participated in the survey. It is interesting to note the differences and similarities between younger and older people regarding the stated benefits:
 - older people appear to experience stronger benefits than younger people regarding the improvement of their health, the enjoyment of nature, keeping fit, meeting other people and socializing
 - younger people appear to experience more benefits than older people regarding taking-up exercise and a sport that they like, while visiting the open space
- People who spend more time sitting in their homes appear to be among the less frequent users of open spaces, and less inclined to take up physical exercise, thus stressing the need to attract these citizens to open spaces and entice them to become involved in some kind of keep fit activity for the benefit of their health.

- people who visit the open space more frequently appear to experience more benefits regarding the improvement of their health, the improvement of their family's health, resting and relaxing, keeping fit, taking up a sport they like meeting other people and socializing
- people who appreciate the open space highly, offering high evaluation rates, appear to experience more benefits regarding keeping fit and taking up a sport they like
- The above findings, in combination with the free time reported by the majority exceeding 4 hours daily and the reported levels of stress which for about 90% of the open space users was reported to be medium of high, suggests that more opportunities for physical exercise in the open spaces would be welcome, feasible and very beneficial for the citizens.

Thus, it becomes fairly clear that open space users would highly benefit from initiating Health and Fitness Routes in their cities, cutting across existing public open spaces, which would offer opportunities for physical exercise and improvement of the users' health. It is also recommended that younger people are offered a wider range of physical activity, but older people should also be provided with opportunities for exercise, which they seem to appreciate highly. The results of the surveys give us some good ground to propose a mix of activities that can be pursued along the Health and Fitness Routes, which can satisfy those looking for mild forms of keep fit activities and those who would prefer more demanding exercise. Moreover, the proposed activities along the Health and Fitness Routes should take into account the time available from visitors; and should also be attractive enough to entice those who are not frequent users of open spaces to get out of their homes and try the keep fit and health improvement opportunities that are included in the Routes.

We also note that the wide use of mobile telephones makes the spread of information much easier and provides easy navigation to the Health and Fitness Route users as well as targeted information about opportunities for health improvement along the Route.

The need to establish and promote Health and Fitness Routes in our cities is also established by the results of the bibliographical research undertaken under IO1. In IO1, we found that there is a strong and vast documented relationship between health-related behaviours, especially for physical activity (PA), and the built environment (e.g. urban open public spaces).

PA is widely recognized to be important for health and wellbeing. Nevertheless, a small percentage of the population is aware of the minimum standards of PA and often considers themselves wrongly as 'physically active'. Studies have shown that around two thirds of adult Europeans are not physically active as recommended by the World Health Organization, evidencing the need of action²⁷. One example is a study²⁸ that focuses on PA among old adults in England and finds that the majority of the population researched lack the knowledge of what constitutes sufficient PA. As a response to this challenge, and given the new technologies available and their wide acceptance, location based games can be a promising tool to encourage city dwellers to learn to use urban green and blue spaces more actively.

Moreover, space characteristics such as accessibility, quantity and quality (e.g. cleanliness, paved roads, short routes from A to B, good state of trees and green areas, etc.) have the

²⁷ Cavill, Kahlmeier, & Racioppi, 2006

²⁸ Chaudhury and Shelton, 2010

potential to enhance active travel, social interaction and active recreation. We also found the need for better collaboration between stakeholders, more possibilities for citizens to participate in co creating and management of green spaces, as well as increasing health literacy skills. We thus assume that Health and Fitness Routes as part of open blue and green spaces and in combination with featuring LBGs can be a new way to meet these demands.

4. THE PREHEALTH GAME

4.1 The concept

Based on the above “review of principles and features” for the design of educational games, and on the experience of the PREHealth partners on game-based learning, the PREHealth team developed a game concept to apply in the Health and Fitness Routes defined in the four participating cities. This incorporated the following characteristics:

Elements

Mechanics: Location-based games (Chapter 4)

Game template (Chapter 6): comprising

- Story: my Neighbourhood Olympics
- Aesthetics: Photography, video, cartoons, maps, illustrations
- Technology: a free platform for LBGs useable on smart phones, such as ARIS, EnigmApp or TaleBlazer

Learning objectives

Bloom’s taxonomy of learning outcomes, presented in Chapter 1 of this document, is used to define the objectives that would lead to the listed outcomes. Such objectives would include:

General learning objectives related to educational games (according to Bloom’s taxonomy)

- collect and recall information gathered on location (along the H&F Route)
- comprehend, explain and predict “opportunities” (along the H&F Route)
- collect and use information to solve problems, develop an inquiring mind and creative thinking
- analyse data patterns, concepts and findings and relate them to previous evidence
- compare and evaluate the “challenges” (along the H&F Route)
- design, build, invent, plan or produce original knowledge and ideas that can be transferred to new contexts for making a contribution to the health of the community.

In addition, more specific objectives, related directly to PREHealth project and to the locations for the development of the games, have been defined.

Learning objectives specific to PREHealth

- Understand the multiple functions of green and blue infrastructure in the urban web
- Learn to “read” and evaluate the features of open public spaces, especially in relation to health, fitness and well-being of citizens
- Develop the feeling of responsibility toward public spaces as amenities belonging to all people

- Exercise the rights of public participation in the design and improvement of public open spaces
- Acquire ICT knowledge, in particular relating to mobile technology
- Develop the spirit of cooperation and responsibility
- Develop skills: e.g. health literacy skills, artistic skills, ICT skills, cooperation skills, citizenship skills

A more detailed list of project-specific learning objectives is presented in Chapter 6.

Guidance to formulate the concept of the game narrative (the story)

The concept of the game narrative is derived from the results of the field survey of open space users, conducted under IO2 in appropriate open spaces in the four participating cities. The conclusions of the surveys, presented in brief below (Chapter 5). The main axes along which the narrative has been defined stems from

- How open space visitors use these locations
- What are the benefits expected and derived
- What else they would like to do, if they were given the opportunity
- What is their attitude towards the public open spaces they visit, regarding their health, fitness and well-being

Given the positive results we derived from the field surveys of users of open spaces in the 4 cities participating in the project, we propose a narrative that takes into account the following components:

- The expressed behaviour of open space users, who in their majority visit weekly at least one open space, preferably in their neighbourhood but farther away as well, being aware of the benefits they derive from their contact with the green and blue infrastructure of their cities.
- The expressed desire of open space users to embark in more physically active behaviour while visiting an open space, if the opportunity were provided
- The lack of sports grounds and other organized sports facilities in many open spaces, especially un those used locally by people; this makes it important to guide opens pace visitors to use their imagination and create innovative ways for using standard features that exist in most open spaces (e.g. trees, benches, footpaths, fences etc.) for physical exercise and improvement of their fitness and health.
- The expressed attitude of open space users that public open spaces are places for relaxation and enjoyment, and therefore their pursuits in these places should be approached with an element of play and pleasure.

4.2 The PREHealth game template

4.2.1 Aims and objectives

The PREHealth game aims to motivate and mobilize the city residents, young and old, to take advantage of the public open spaces in the city in order to improve their health, through physical exercise, contact with nature, relaxation and if wished, social contact.

The PREHealth game is shaped as an educational tool for open space users, to help them understand the importance of public open spaces in the life of the city dwellers and their “multi-functionality”, offering clean air, contact with nature, relaxation, social contact and many different options for exercise and fitness. Moreover, the game is a “teaser” for its users to encourage them to use their imagination and creativity in order to discover the many different ways an open space and its features can be used to improve one’s health, while they amuse themselves and enjoy the newly discovered “opportunities”.

One of the main features of the PREHealth game is that it is developed by user groups, namely by teenagers, university students and other adults, so as its very development to achieve two further objectives:

- To reflect the perceptions, preferences and capabilities of several user groups, thus becoming a tool developed by citizens for citizens;
- To design and test an education process that would achieve a number of learning objectives and would be suitable for more general implementation in both formal and informal education systems.

Learning objectives

The learning objectives the game would achieve are partly specific to the different groups involved in its design and partly general. Here we list some of the general objectives. IOs7, 8, 9 and 10 include the more specific objectives, as they relate to the different implementing and piloting groups of game-users/designers:

- To understand why green and blue infrastructure play an important role in the structure and operation of the city, as well as the several ways in which they affect positively the urban environment
- To recognize the components and features of the open public spaces included in the green and blue infrastructure of cities and learn to detect the multi-functionality of such spaces
- To improve one’s perception of the linkages between green and blue infrastructure on the one hand and health, fitness and well-being of citizens on the other hand
- To develop an inquiring mind and creative thinking regarding the use of open public spaces for health and fitness
- To raise one’s awareness of a citizens’ responsibility for caring, respectful use and improvement of public spaces as amenities belonging to all people; and encourage public participation in the design and improvement of such spaces
- To use mobile technology in a way that is educational, interactive and offers opportunities for personal health benefits

- To undertake group work, develop a spirit of cooperation and responsibility
- To develop skills for doing research, collect and analyse information via fieldwork or bibliography, and use this information to create narratives
- To develop artistic skills, such as taking and using photos and videos, and devising artistic impressions of characters and situations.
- To develop ICT skills, especially game design and game development skills. The necessary skills concentrate on on-line multimedia management, Web 2.0 environments, usage of new generation smartphones and GPS devices, online mapping, geo-tagging and basic knowledge of Location Based Game (LBG) design using the available free online platforms.

4.2.2 The theme of the game: neighbourhood Olympics!

The theme chosen as an overall framework for designing the PREHealth game in different countries and with different groups of public space users (namely teenagers-secondary school pupils, university students, adults), reflects the main aim of the game, as it has been stated above: *“encourage them to use their imagination and creativity in order to discover the many different ways an open space and its features can be used to improve one’s health, while they amuse themselves and enjoy the newly discovered opportunities”*.

The theme described here offers a central idea around which the scenario for the game is built in the different settings, locations and user-groups of the project. This theme is expected to lead to different scenarios, served by the game mechanics that each designing group chooses according to their preferences and capabilities.

The theme: Create your own neighbourhood Olympics!

An "Olympics" theme is chosen, where people compete in different imaginary Olympic sports, exploiting opportunities to exercise their creativity and imagination as well as their body and mind.

Examples of city-and-open-space-friendly “Olympic sports”: cross-pavement obstacle course – walking or jogging, nature-gymnastics or pavement-gymnastics (using features of open spaces, like trees or bars obstructing car parking), cycling-with-friends-tour, grocery shop tennis. etc and win trophies. Players can also submit their own sport ideas.

Narrative: Players are challenged to enter their very own city Olympics where new missions are unlocked everyday along the Health and Fitness Route. With famous Olympic medalists or historic persons or mythology heroes as coaches, the players will be training in various city-and-open-space-friendly Olympic sports like those mentioned above, and many others created by the game designer groups (young and older citizen groups piloting under IO7, 8, 90, 10) and by the players themselves

Game: Each time a player unlocks a mission, the coach will give them a goal, e.g. perform one of the sports included in the location of the player, take a group picture and upload the group picture to complete the mission. Once you complete a mission you unlock a badge and with it comes the photo proof that you did it.

Community: Players can form a community and play the game as a group of competing athletes: they can organize a neighbourhood-Olympics day when they compete in their own invented Olympic games.

4.2.3 The process of creating the PREHealth game

The design of the PREHEALTH game, as explained above, forms part of an education process, which will be piloted with different citizens' groups, ranging from teenagers to seniors, with a view to develop a learning package suitable for formal and informal education systems.

Working with amateur game designers is a challenge. However, given that the emphasis is placed mostly on the learning aspects of the game design process, the challenge can be transformed to substantial learning benefits, leading to improvement of knowledge and skills of the designing groups, as well as raising their awareness and sensitivity on issues that concern the green and blue infrastructure of cities.

The process of creating the PREHealth game includes three main stages: the preparatory work, the actual game design, and the playtest and refinement.

The preparatory work includes all these aspects that define the “environment” of the game, in terms of physical environment, technology and constituent parts of the game, namely the story and the characters, both playing and non-playing.

STAGE A. Preparatory work

STEP 1: WRITE A BACKSTORY

Having an overall backstory will help the LBG designers (pupils, students, adults) to create a narrative and, later on, the characters of the game.

The Olympic games' theme can be used as a starting point and the game designers can exercise their imagination to give shape and provide examples on this theme!

EXAMPLE:

“Your city/neighbourhood is hosting the Olympic games for the first time. What an honour! Everyone is ready to start training for the big event but there is a twist! All the games are new; from bench tennis to pedestrian obstacle course. You will use your phone to get new challenges and train with experienced coaches”.

STEP 2: FIND A LOCATION

Identify a minimum of ten spots along the Health and Fitness Route where people can sign up for challenges. Make sure these locations are safe to play (e.g. away from car traffic) and provides the needed infrastructure (e.g. WIFI access, GPS reception) and potential to stimulate physical activity (e.g. steps) and/or provide the fitting background ambience for the storytelling.

EXAMPLE:

“Benches, Public signs, Squares, a School yard, pedestrian pathways, parks, are all great places to start.”

STEP 3: BRAINSTORM

The designing team should gather together to brainstorm Olympic game ideas that match the location (Health and Fitness Route) and the backstory created during the initial step of the game design preparation.

EXAMPLE:

“Give everyone post-its and take five minutes to write down classic Olympic games. Then take another five minutes to write down landmarks in your selected location. Put all the post-its on a wall, what happens when you combine the two categories? What games will you invent?”

STEP 4: CHOOSE COACHES

Some characters should be chosen by the team to be the coaches of the sports that are being developed along the Health and Fitness Route. These characters will give players directions for the Olympic Games invented, and some words of encouragement. These will be the non-playing characters.

EXAMPLES:

“You can choose as trainers anyone from a famous athlete like Serena Williams, to an ancient figure like Hercules, to a local hero in your neighbourhood”.

STEP 5: CHOOSE A PLATFORM

We recommend 3 platforms that are free, simple and suitable for LBGs:

- *the EnigmApp platform, <http://www.enigmapp.fr/>*
- *the ARIS platform, <https://arisgames.org/>*
- *the TaleBlazer platform, <http://taleblazer.org/>*

Project participants can use any other LBG platform they prefer, or even QR codes

STAGE B. Game Design

1. GAME DESCRIPTION

This is what players will see when choosing the game on the selected LBG Platform. A short description that would have the place of an introduction to the LBG.

EXAMPLE:

“We’re calling all local athletes to join the 2018 Olympics Games of our neighbourhood. All you need is your phone and some comfortable clothes. Ready to join?”

2. GAME ARCHITECTURE:

a) Goal

The architecture of the game defines the goal of the game and the means the players can use in order to win. At this point the designing team should also consider several alternatives that may make the game more interesting: whether the game will be for single players or for

groups of 2+ players; how the players can compete between themselves and how they can compare scores to determine eventually the winner.

EXAMPLE:

“Your goal is to complete in 10 Olympic sports within the app. For every Olympic sport you complete you unlock a trophy. Collect 10 and you become a local Olympian. Are you ready to take the Gold Medal home?!”

b) Rules

Define what players can and cannot do, and consequently, how the game works. The rules should be set clearly as instructions and will determine the options the player will have when entering various “missions”.

EXAMPLE:

- *To complete a sport you have to take a photo or video of you doing it.*
- *For each sport you complete you win a trophy.*
- *If you submit your own sport ideas to the community you win extra trophies.*
- *Complete a set number of sports i.e. 10 and unlock the Olympian status and the golden medal.*
- *Every month there is a new challenge with new sports, so you will have to keep on training to keep your Olympian status.*

c) Sport Challenges

Each of the sports or “missions” included in the games should be clearly described.

EXAMPLE:

- *Bench tennis: compete with someone else on a tennis match played over a bench. Record a video to complete the challenge.*
- *Pedestrian Obstacle course: Run a suggested route while avoiding pedestrians, street lamps, trees or other obstacles. Take a photo of the starting point and the end point to complete the challenge.*
- *Tree Gymnastics: Find a tree and do 100 jumps, 50 Hula hoop spins and 50 jumping rope jumps. Take a short video of you to complete the challenge*

3. DIALOGUES WITH YOUR COACH

The dialogues with the sport coaches should be written down or spoken, with a clear objective to help the player undertake and finish each mission. Once the non-playing characters have been defined during the preparatory stage of the game, then their role in unlocking and successfully completing each mission should be defined. Fun and encouraging dialogues should be included to stimulate the players.

EXAMPLE:

“Hello future Olympian, this is Hercules speaking, I just got out of this crazy fight with a monster whose heads I just couldn’t cut off. What a day! I bet you had a long day too- but nothing than can keep us from training together, ready for your new sport?”

4. GAME ASSETS

The images and art for the game are assets that contribute greatly to making the game look attractive or not. Several types of assets can be used.

EXAMPLE:

“If you have an illustrator on your team it would be fun to draw images (cartoons) for the coach and for each sport.

Photos and videos taken on location, along the Health and Fitness Route should also be used, to make the LBG look real and relevant.”

STAGE C. Playtesting

Once a first version of the game is shaped, the team should make sure to playtest it, amongst themselves and with friends and fellow students, to see what works and what doesn’t, and how to improve it.

5. SOME SUGGESTIONS ABOUT GAME DEVELOPMENT

It is useful to note here some general suggestions which apply to game development, as it is undertaken by the PREHealth project, i.e. as a learning process rather than as an expert's job.

A. Getting started on the PREHealth game development

Certain restrictions and requirements apply, which should be made clear to the students or other adults taking part in game development along the Health and Fitness route in their cities:

- Games should be accessed via an app in a mobile phone or tablet.
- Games should be location-based (LBG)
- Games should follow the Health and Fitness Route
- Games should encourage and include physical exercise or sport, or a playful experience which involves physical exercise
- The game players should be invited to play mini-games or “quests” in selected points of the Health and Fitness Route
- Games should be developed using a free source platform, as those described in IO6
- Games should be developed taking into account the existing restrictions of the members of the learning team involved, in terms of time available and capabilities.

Here are also some questions that need to be answered before starting the game design, to communicate to the learners the main components of the game architecture:

1. How many players can play and how they are expected to cooperate:
 - Is the game played by one or more players or by a group of players?
 - Does each player play autonomously or together with others?
 - Will it be possible for a family to play together?
2. What are the mechanisms used to sustain interest
 - Emulation?
 - Curiosity?
 - Competition?
 - Scoring?
 - Story?
 - Surprises?
3. What are the requirements of equipment
 - How many appliances are necessary (mobile phones or tablets) for a group to play?
One appliance per person or one per group?

4. How will scoring work?

- What kind of scoring should be applied? Or only winners will be named in each mini-game or quest, earning medals.

B. Define the technical specifications of game architecture

1. What should be shown on the initial screens of the game?

- introduce the players in the scenario (audio or video can be used),
- define the locations where it can be played
- Define the ages of players most suited to the game
- Define the target of the game
- Provide an estimate of the time needed to play the game (possibly with an option for longer and shorter time requirements) – define the time needed to complete a quest
- Suggest the materials that the players must have with them in order to play (if necessary)

2. What are the components of the game

- The story
- The quests
- The characters
- The dialogues
- The scoring
- The interface: art, photos, videos

C. Work with the learners – a sequence of sessions

1. Introduction to game design concepts. The teacher/facilitator guides the students to play a simple group game and then to incrementally improve it and playtest the improved version to increase the game's interest, competitiveness, complexity.
2. The students gain practical experience of quick development of a game and of playtesting it.
3. The students learn to recognise the mechanisms of a game and improve their skills for making new generations of improved game prototypes.
4. The students are guided to understand and practice game hacking as an important mechanism for developing their own location-based games.
5. They start from popular street games (hide and seek, petanque, etc.) and create their own prototypes by "hacking" the known games.
6. The students have to change the game rules and mechanisms, and then define the structural elements of the game:
 - Name

- Aim
 - Rules
 - Location
 - Number of players
 - Materials needed
7. Development of the scenario
- Create a story as the basis for the scenario
 - Provide first ideas about the mini-games/quests and tasks the player performs in the quest
 - Define the non-playing characters
 - Define the logical steps of the scenario – the storyboard
 - Connect the storyboard to the H&F Route map and to the selected points of interest
 - Content development: an important task that includes the composition of texts, the formulation of dialogues, taking and using photos, drawings, video; doing some art work (drawings, sketches, cartoons etc)
 - Introduce the content into the selected gaming platform
 - Prepare a draft game prototype. At first, choose a small “preview” of the game to be playtested (e.g. a selection of three stations with different play activities, but in close proximity to each other).
8. The game prototype is ready for playtesting
9. After playtesting, write down all observations in relation to timing of quests, the suitability of the chosen points along the H&F Route, obstacles present – physical or technological etc
10. Go back to the classroom for adaptations and improvements on:
- Structural elements of the game, mechanisms
 - Addition or removal of certain elements
 - Adjustment of the quest to the physical space

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