

Environmental education by gaming

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Nowadays kids are incredibly familiar and skilled to use Information and Communication Technologies (ICT) like computers and mobile devices. These tools are mostly used for connecting individuals to social networks, downloading music and videos, playing but also searching information and developing school tasks. Among the technological tools available for didactic purposes, a platform for developing Location Based Games for mobile devices has been tested for didactic purposes. Since 2014, the I.C. Sacchetti in San Miniato, in Tuscany, in the frame of two European projects, Involen and Raise projects (Erasmus+), is experimenting the development of LBGs (Location Based Games) in environmental education. The aim of these projects is raising the environmental awareness and active citizenship for nature protection through volunteering and the use of new technologies. Pupils, teachers (together with other facilitators like environmental guides) are part of a team committed to follow a learning process focused on nature protection that will bring to the creation of a LBG for the local protected area.

Keywords: education, environment, mobile phones, tablet, LBG platforms, school, game, coding

1. Introduction

The European Year for Active Ageing and Solidarity between Generations 2012 posed “the challenge to politicians and stakeholders to improve opportunities for active ageing in general, acting in areas as diverse as adult learning, volunteering, IT services” [Bird, 2007]. At the same time, WHO stated “over the past 30 years, 30% of the world's natural environment has been destroyed, populations of freshwater animal and plant species have been halved and natural forests have declined by 10%” (<http://www.who.int>).

The two issues have been the basis conceptions for the development of Involen (Intergenerational learning for nature protection volunteers, 2012-2015) and Raise (Raising environmental awareness among young people, 2015-2017) projects, which base on three pillars: knowledge transfer, voluntary environmental protection and use of new technologies.

It is clear that there is, even in our local environmental contexts, the need to take protection actions to overcome nature's injury.

In recent years, volunteering has been increasing, encouraged by the UN policy: 2011 was declared the 2nd European year of Volunteering and the EU shows strong interest especially for its contribution to social cohesion, building European identity and values. Key motives for participating in the nature conservation volunteering generally regard 'helping the environment', 'improving areas that volunteers use for their own recreation', 'expressing their values', 'learning about the natural environment' and 'socializing with people with similar interests' [Brett Bruyere and Silas Rappe, 2007] and 'learning and contact with nature' [Liarakou et al, 2011].

Moreover, every natural area is characterized by significant environmental, historical and cultural aspects that deserve not only to be preserved, but also known widely, especially by youngsters. Thus, identifying the best way of knowledge transfer and awareness raising, becomes an important achievement.

Environmental education plays an important role on children and youth, putting efforts to provide the next generation with the desire, commitment, and ability to create an ecologically sustainable future.

Both projects, are committed at raising environmental awareness among young people, promoting volunteering for environment, making non-formal education more attractive to youth especially in the framework of environmental issues, enhancing the preservation of protected areas and environment, but also developing new curriculum for environment and promoting the culture of active citizenship.

Furthermore, considering that nowadays children in urban environments are particularly disadvantaged - an estimation (though relative to UK) states that 10% of children play in the natural environment compared to 40% of adults when they were young [Thomas and Thompson 2004, England Marketing 2009] – it is relevant to offer students the possibility to approach nature and experience hands-on activities. **Storytelling**, presentations are relevant and widely used learning experiences, but direct observations and contact in and with nature are even more important experience.

In particular, **Raise** bases on **LINE “Learning In the Natural Environment”** which encompasses a range of provision, including activities within a school's or college's own buildings, grounds or immediate area; educational visits organised within the school day; and residential visits to local open spaces, parks, rivers, lakes, forests, coastlines, caves, mountains.. that take place during the school week, weekends or holidays [Ofsted, 2008; Natural England, 2012].

LINE is significant and involves benefits from educational attainment, awareness of environment and natural science skills, behavioral outcomes and

social cohesion, health benefits, etc. LINE also enables learners to rediscover innate connections with nature and helps them to develop a sense of place and be inspired to take personal responsibility for the environment [Natural England, 2012].

However, it is also important to consider the significant support that **new technologies** may provide in environmental education. On this regard, it is surprising the raising number of apps that are continuously developed as support tools in nature (e.g. My Tracks App; PeakFinder Earth Apps, PI@ntNet etc.) or as didactic tools (e.g. <http://www.educationalappstore.com>). Using new means in ordinary learning experience may attract further final users while providing new knowledge.

Nowadays the society seems deeply connected in and around the media. Portable devices (tablets, smartphones etc.) are of common use and affect the way of learning and knowing things or the space around us.

Norman D. [1994] documents that the technology influences the cognition, transmitting the knowledge embedded in the artifacts that surround ourselves. In this term, **location-based gaming** offers great possibilities and makes possible the implementation of innovative ways of playing, much more different from traditional video games.

A **location-based game (LBG)** is a game designed to be played on a device in motion and in strict connection to the location [Lehman, 2012].

LBGs are suited to convey educational knowledge and to encourage physical activity. Due to the fuzzy border between game and real world, players get a closer connection between virtual and real environments and will get stronger emotions than by video games.

Considering that new information and communication technologies (ICT) like smartphones and tablets are of current use, LBGs profit from these advanced technologies, integrating the players' position conveniently into the game.

In facts, LBGs can be played in a city or in nature being connected to the real world through GPS though they absolutely need of internet connection and coverage. LBGs allow augmentation of the reality with its environmental elements in real-time and in semantic context, in order to get information about the surrounding with digital interaction. Therefore, **gaming and coding** are two important educational themes in this kind of projects, since students learn programming through gaming.

The methodology of the Involen and Raise projects is based on a learning experience in which the students create the LBG from the initial concept to its full completion, with information gathered during the environmental education activities and practical experiences.

In this paper, we describe the methodology and the results from the implementation at the secondary school in San Miniato (PI).

2. Methodology

The main objective of the learning process is raising the environmental awareness especially for a selected protected area, through voluntary actions of

environmental protection and the creation of a Location Based Game with nature conservation purpose.

The methodology developed within Involen project [Papageorgiou et al, 2015] used also in Raise, stands on a participative approach to learning, bringing all learning stakeholders (students, teachers, environmental experts, volunteers, protected area managers etc.) together to plan their learning process, define their objectives and outcomes, and become equal “players” of learning. In facts, there is a re-definition of the roles of teacher and learner by introducing the “learning facilitator”, who mediates the transfer of knowledge and the exchange of experience between the members of the group and external experts. Before starting the learning experience, it is recommended to make sure the assistance of further learning facilitators (either teacher or other person involved) with ICT skills and one environmental conservation expert.

The learning process is made of six work units. Here below we describe the objectives of each unit:

1) Planning phase and individuation of competence needs and skills of the team members. Set up of a draft calendar and meetings schedule.

2) Visit to the area for volunteering activities (i.e. cleaning up path and trails, collecting pictures, things, videos, sounds etc.)

3) Demonstration of an ICT game by an ICT expert or a facilitator who learnt LBGs development, for discussing the potentialities and the possibilities of LBG related to the context and the protected area.

4) Collection of stories, legends, tales by experts, elders who live in or close to the protected area, found in internet, in books etc..

5) Selection of one or more stories and creation of the game’s story that will become the game scenario.

6) Development of the LBG on its editor’s interface and playtesting.

The activities of the work units can be in form of frontal lessons, hands-on activities, environmental volunteering, storytelling, and eventually with the development of a LBG with nature conservation purpose using a platform for LBGs development. In these projects, ARIS games (www.arisgames.org) was the platform used for the game creation.

In 2015, 21 teams of students, facilitators and elder volunteers in Europe, participated to the European Competition of Location Based Games with nature conservation purpose (<https://involeneuropeancompetition.wordpress.com/>), among which the class 1E of secondary school Istituto Comprensivo Sacchetti (San Miniato, Pisa, Italy). More recently (in Raise project, 2015-2017), five classes in the Mediterranean area (Turkey, Greece and Italy) among which the class 1E of the I.C. Sacchetti, has also applied the methodology. Here below, we describe the learning experience of this class of skilled students with their teacher and the archeologists of ArcheoTech Association, that brought to the development of the LBG “A Jump in the Middle Age”.

3. “A Jump in the Middle Age”: design and development

In the year 2015, the class 1E participated to the European Competition on Location Based Games with the game “A Jump in the Middle Age”. They focus on the San Genesio Archeological area (San Miniato, Pisa) in the territorial natural context, from the roman times up to nowadays. The team involved two archeologists of the Arceo&Tech Association but also parents and grandparents. The aim of the project was to increase the knowledge of the territory where the students live (history, environment and traditions) and find the relationships between the acquired knowledge and storytelling. The whole project was structured in the six work units developed in 10 two-hour meetings.

Regarding the work unit 2, the class carried out a voluntary activity at the archaeological site of San Genesio where they cleaned up the area by dead leaves brought there by the winter rains, removed rubbish and obviously made a tour of the area to get information and knowledge about it etc.

Unit 3 was carried out by the teacher who learnt autonomously how to make Location Based Games in Aris, so that she could show students how it works. Regarding the work unit 4, the project focused on several relevant features of the local area, therefore pupils collected information from several sources such as interviews to experts, grandparents, internet etc. on a variety of subjects: i) the landscape, ii) the ecosystem, habitats and traditional recipes of the area, iii) the archeological excavations of the medieval village of San Genesio, and iv) the *via Francigena* (route of Sigeric, Archbishop of Canterbury in the year 990 - Great Britain – who took a long route to Rome, to receive the investiture of Pope Giovanni XV). In this work unit they also integrated the collection of information with experimental activities, for instance seeding and observing the phenology of vegetables used in traditional recipes. Regarding the work unit 5, the students identified the game characters and the main content (Fig.1). They organized a flux of actions and wrote the scenario.

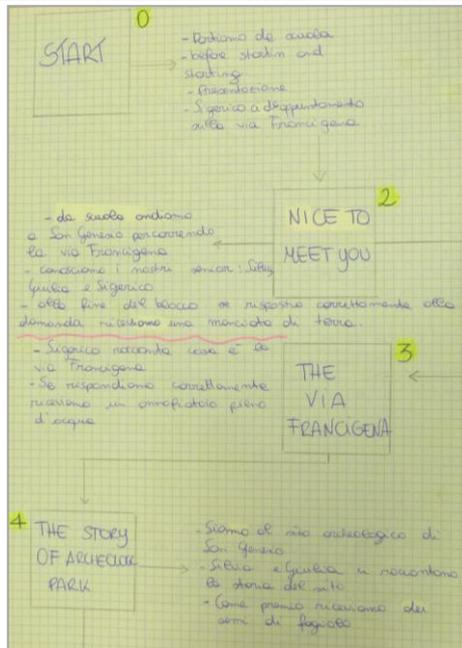


Fig.1 – Game scenario with the flux of the game actions.

They draw the characters, took photographs to the *via Francigena* and step by step, the storyboard of “A Jump in the Middle Age” was defined, ready to be moved in the ARIS platform. In fact, afterwards, the work unit 6 concerned the development of the game in the ARIS platform (Fig.2).

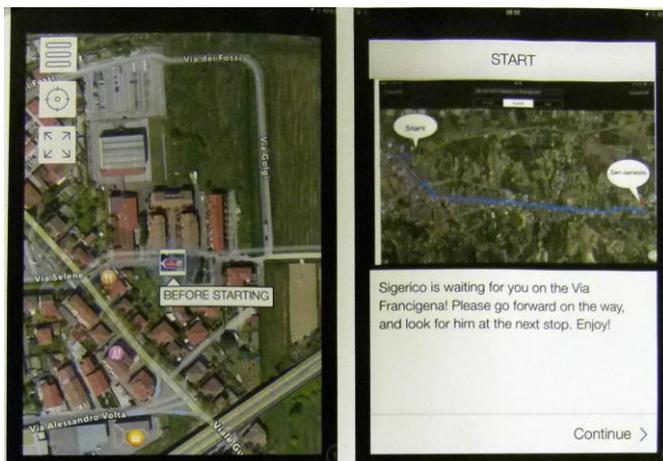


Fig.2 - Example of screenshot of the game on the iPad.

ARIS (short for Augmented Reality and Interactive Storytelling), is an authoring tool as well as an iPhone application that work together to create mobile, locative, narrative-centric, interactive experiences [Gagnon, 2012]. ARIS Editor 2.0 interface (<http://arisgames.org/editor/>) is an internet webpage and works online. The interface allows to build a game on the base of “scenes” or visual organizers (game scenario). The basic elements of ARIS are the game’s *Items*, *Tabs*, *Quests*, *Conversations* between players and virtual characters, *Media*. These elements can be organised in the space and in order of appearance by setting their *Location* (in a map) and their *Triggers* and *Locks*. Moreover, the player can interact with the game through tools like *Notebook* in which he can collect pictures or notes while he plays. Nevertheless, the ARIS games can be played only on Apple mobile devices (iPhone, iPad), on site or from home in quick travel modality, after downloading the ARIS app from the App Store, and searching the game in the Aris game list (<http://arisgames.org/editor/#games/3773/scenes>).

The player is guided on a route identified by the icons appearing on the map: these icons are game objects the player interacts with (e.g. a conversation with virtual character, collection of items, visit to a web page etc..).

So, moving along the route, reading the game plaques (content boards) and answering to questions posed by the characters (Fig.2), the player can get information about the history and the environmental peculiarities of the area.



Fig.2 – The paper board show all the steps of the game, each card is a shortcut of the game played on iPad.

4. Evaluation of the methodology and discussion

The challenging methodology, has demonstrated its effectiveness in achieving a variety of aims and outcomes. An evaluation form was submitted to the facilitator (the teacher) in order to know if the intergenerational learning

experience met its purpose concerning the intergenerational collaboration, the use of technologies and the volunteering experience. The teacher totally agreed and commented that:

“The students showed great enthusiasm during the activity. However, the choice of Aris (available only for Apple devices) highly limited the sharing of experience and the insertion of material in the platform but also the game final test because a few students own iPhones or iPad. However, all people involved are ready for the next experience!”

Seniors involved in the project showed curiosity toward the use of technologies whilst students were both curious and active. In addition, the opinion was that experience was valued worthy to be repeated with all group members enthusiastic of each work unit.

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Seniors	4	4	3	4	4	3
Youth	4	4	3	4	4	3
Facilitators	4	4	4	4	4	4

Table 1 General opinion of the team members about each work unit. (4=They liked it very much; 3=They like it; 2=They did not like this so much; 1=They did not like it at all).

Combining different learning experiences (non formal and informal learning, intergenerational learning, learning in natural environment and gaming with technologies), the methodology has surely strengthened the relationship between generations: seniors and teenagers. This relationship is two way with the knowledge transfer from elders to youngster about local traditions, environment and history of the territory, but also transfer of motivation and knowledge from youngsters to elders. In other experiences, elders recognized the importance of using ICT and learning the technological language, even for communicating with their grandchildren, in addition, the use of technologies and gaming showed many advantages also for the teachers. According to them, it stimulated the cooperation by working in group; enhanced the capacity of working according a multi-phase process, taught to be patient and respect timelines; enhanced the communication capacity and knowledge transfer with hands-on and tales [Ugolini et al, 2015].

The methodology demonstrated that applying ICT in a creative more than mechanical way, supports learning and raises the awareness that technologies can be used not only for playing but also for learning (teacher’s personal communication). Since many teachers argue the difficulty to get the new generations motivated and involved in their classes [Felicia, 2009], the inclusion of *serious games* in teaching could be a proper solution, aiming to match the

new digital native generation's needs and expectation, ensuring effective learning and motivation.

Moreover, integrating LINE, as inquiry activities in natural environment, would also stimulate curiosity and knowledge that can be used in gaming. In Raise project, observation and exploration of nature and natural phenomena are integrated with storytelling and gaming, generating new knowledge for the students but also creating a learning experience for the game's player.

5. Conclusions

In the frame of two European projects "Intergenerational Learning for Nature Conservation Volunteers" and "Raising Environmental Awareness in Young People", the school I.C. Sacchetti has successfully applied a learning methodology for environmental education that integrates intergenerational learning, gaming with technologies and volunteering with learning in natural environment. The complexity of the methodology is simplified in a structured process, made of six work units in which the team of students, facilitators (including teachers, experts external to the school) and elders define their work pace and work together for the development of a main outcome: a Location Based Game to be played in a local protected area. Important results in such experiences can be summarized in i) sharing experience between generations, ii) learning of the local environment by observations and collections of information, iii) helping local associations by volunteering, iv) improving ICT skills.

From the didactic point of view the students appreciate the interactive experience because it combines hands-on approach and work, coding, ideas drafted on paper, skills in **planning**, design techniques, **digital storytelling and game scenario**, **beside game development**, stimulating and motivating the students in the learning process.

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