Innovation in Environmental Education: ICT and intergenerational learning

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INTRODUCTION

This conference aimed to promote discussion on three core topics connected to lifelong learning: ***intergenerational learning***, for promoting the transmission of knowledge and skills between different generations in relation to nature conservation and local heritage; new technologies ***–ICT and mobile game design;*** and ***environmental volunteering*** for enhancing both education and active citizenship.

The conference has been planned and organised in the framework of the INVOLEN project (www.involen.eu), an action co-funded by the European Commission, the Lifelong Learning Programme. INVOLEN aims to promote intergenerational learning through game-based learning, targeting nature conservation volunteers in 5 European countries (Italy, Greece, France, Hungary and Slovenia).

INVOLEN brings together adolescents and senior citizens, encouraging their participation in voluntary activities for nature conservation, and challenging them to work together to design their own Location Based Games to be played in a nearby protected area, preferably a NATURA 2000 site. The INVOLEN project createad a learning methodology concentrating on the three core topics of intergenerational learning, nature conservation and game-based learning technologies. This methodology was pilot-tested successfully providing excellent results in all five countries that implemented the project: five intergenerational teams developed location-based games prototypes freely accessible online, through handheld devices, while they learnt from each other and raised environmental awareness within their communities. Furthermore, the INVOLEN methodology was put to a wide implementation test: the INVOLEN team launched a European competition, inviting intergenerational groups of volunteers to work together with teachers, expers and other learning facilitators, to produce their own location-based games in their chosen protected area. The competition was very successful; it attracted 30 registrations, 20 of which produced completed games that could be evaluated. The five winners of the competition in Italy, Greece, France, Slovenia and Hungary respectively were invited to present their games in the conference, and the European winners (1st, 2nd and 3rd) were proclaimed by an independent jury.

The conference themes, which reflect the conference sessions and correspond to the chapters of this volume include:

- Pedagogical and technological innovation in environmental education; the use of new media
- Game based learning and nature conservation
- Location based games in education
- Defining environmental protection through voluntary actions
- Intergenerational Learning in the context of environmental education
- Social engagement of local communities and students as agents of environmental protection
- European LLL policies and their effect on environmental education and intergenerational learning
- Environmental and science education

The **first chapter** gathers the contributions from the INVOLEN project with an overall view of the methodology implementation, results and future perspectives.

CHAPTER 1: THE INVOLEN PROJECT

INNOVATION IN ENVIRONMENTAL EDUCATION: THE INVOLEN PROJECT

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Abstract

Environmental education plays a critical role in raising awareness on nature protection and conservation, through formal and informal education channels. It has been introduced in various forms in the school curricula across Europe, aiming to familiarise young people from an early age to the need to cherish, value and protect the natural heritage of the earth and contribute to its preservation. The INVOLEN project "Intergenerational Learning for Nature Conservation Volunteers" developed a methodology for environmental education which features two innovative ingredients: the introduction of ICT and game-based learning in environmental teaching so that it becomes more attractive to young people; and exploiting the experience of older generations through intergenerational learning. The INVOLEN methodology is implemented through a sequence of activities, which can be organised and held within the school curriculum or after school hours, inside the school or outside it with the help and supervision of an NGO, and consists of 7 steps, starting with the recruitment of the participants, ICT and environmental training, filed visits, game creation and evaluation. The methodology was piloted in five countries and was then tested more widely through a European competition, which invited schools or NGOs to implement the INVOLEN methodology, create location-based games for protected areas and seek the national and international awards.

Keywords: environmental protection, nature conservation, environmental education, intergenerational learning, location-based games game-based learning, volunteering.

Introduction

The INVOLEN methodology

The protection of our natural environment has been globally recognised as the most salient issue for the survival of our planet. Environmental education plays definitely a critical role in raising awareness on this, through formal and informal education channels. Indeed, it has been introduced in school education across Europe, aiming to familiarise young people from an early age to the need to cherish, value and protect the natural heritage of the earth and contribute to its preservation. Knowledge about the valuable assets of our environment and volunteering for their preservation are two pillars for continuing environmental protection, promoted through environmental education.

The INVOLEN project "Intergenerational Learning for Nature Conservation Volunteers" developed a methodology for environmental education which contributes to the above issues in two innovative ways: by introducing ICT and gaming in the learning methodology so that it becomes more attractive to young people; and by exploiting the experience of older generations through intergenerational learning. INVOLEN targets schools, NGOs and other organisations committed to environmental education, aiming to promote voluntary work for the protection of nature and the conservation of valuable ecological heritage amongst youngsters and senior citizens in particular.

The INVOLEN methodology outlines a learning process that aims to influence the attitudes and behaviour of its target groups towards environmental protection and encourage their voluntary involvement in nature conservation. The INVOLEN methodology takes a special interest in NATURA 2000 sites, wishing to encourage the teachers and learning facilitators who would choose to apply the proposed methodology to concentrate, as far as possible, on these sites (Commission Working Document on Natura 2000, 2002). Such a focus also provides the opportunity to exploit the development model of the NATURA network, which combines the protection of the environment with the invigoration of local communities, while special prominence is given to the role of volunteering in nature conservation (Dower, 2014).

There are two vehicles that the INVOLEN methodology uses to achieve this aim: firstly, joint learning and cooperation between young and older volunteers; and secondly, game-based learning, which involves the creation of location-based games, playable on mobile phones or tablets on site, in protected areas.

Intergenerational learning describes the way that people of all ages can learn together and from each other (www.enil-network.eu). Further to the transfer of knowledge, intergenerational learning fosters reciprocal learning relationships between different generations and is a way of enhancing intergenerational solidarity. The intergenerational activities can be classified as follows, according to the INVOLEN Leaning Guide for teachers and learning facilitators:

- Meet and create a relationship
- Make together
- Make for the benefit of each other
- Transmit knowledge and skills

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 (Avouris and Yannoutsou, 2012). The universal use of mobile devices, and the fast evolution of game technology, has offered ample opportunities to develop place-based games that facilitate the learning process of children and adults. Such games also encourage learning through storytelling and touring of specific locations and routes, introducing the natural or built environment as a participant in the players' interaction with the environment. The ARIS game-design platform has been predominantly used during the piloting of the INVOLEN methodology for the creation of LBGs by the piloting participants (Gagnon, 2010).

Implementation of the INVOLEN methodology

The INVOLEN methodology is based on a hands-on, experience-based approach to learning (Dewey, 1938); and is implemented through a sequence of activities, which can be organised and held within the school curriculum or after school hours, inside the school or outside it with the help and supervision of an NGO.

The INVOLEN methodology is implemented in 7 steps:

1. Establishment of the learners' group, including teenagers and seniors, who have confirmed their wish to learn together, work together as volunteers for the protection of the environment and use IT to produce awareness-raising material for the conservation needs of protected areas. One or more learning facilitators and an environmental conservation expert should assist the learners' group.
2. Assessment of the skill needs and the learning needs of the participants (teenagers, seniors, facilitators) to ensure that the needs of all group members are met. Survey techniques, focus groups and consultation with relevant organisations can be used for this assessment.
3. Planning the course of intergenerational learning activities that are necessary to implement the learning methodology of INVOLEN.
4. Taking part in joint conservation activities in the protected area where the group has decided to focus on.
5. Participating in a number of learning sessions/meetings during which seniors and environmental experts transfer knowledge regarding the conservation needs and the heritage of the selected area; ICT experts teach the group how to create location-based games using their mobile phones or tablets; and the learners design and construct one or more games, through joint work, combining the knowledge of the seniors and the affinity with IT of the youngsters.
6. Visiting the protected area at least twice to get to know it better; and test the constructed games on site.
7. Evaluating the learning outcomes and the personal and community benefits that have resulted from the implementation of the project.

The above methodology has been piloted in five countries and the results point to some interesting conclusions:

The pilot-testing participants have admitted the benefits of the intergenerational learning processes, as they were employed during the implementation of the methodology. The relationships formed between the two groups of youths and seniors and the exchange of knowledge and experiences confirmed one of the core objectives of the project. Moreover, the learning benefits accrued by the piloting participants have been demonstrated in their answers to the evaluation questionnaires completed by them. Such benefits include:

- increased awareness about environmental issues and desire to help solve such issues;
- feeling of being useful to society;
- eagerness to demonstrate to others the problems and solutions that relate to environmental conservation;
- appreciation of the value of working together with seniors and enjoyment of the intergenerational learning process;
- increased respect for the knowledge of older people; being able to rise above the generation gap to come to enjoy the company of seniors; and
- new knowledge of educational gaming and the development of IT skills that are central to such a learning activity.

With regard to the practical aspects of the implementation, the initial planning for small-sized groups of up to 7 youths, 2 facilitators and 3 seniors, including input from conservation experts in the appropriate sessions, has been confirmed as optimal. A regular schedule of meetings every 7-10 days also proved to be the best option, in order to maintain the engagement level of participants and to provide a steady learning pace. However, larger groups and shorter meetings are also possible if a tight schedule is imposed and discipline is maintained during the meetings in order to fully exploit the available time.

A number of supporting products have been developed on the basis of the piloting experience, including a Guide (Papageorgiou et al., 2014), a Toolkit for Learners (Papageorgiou et al. 2014), databases of "stories" narrated by senior learners and conservation experts linked to the pilot-locations; and skill needs assessment questionnaires. These products are freely available in the INVOLEN website www.involen.eu to all those who would like to try out the INVOLEN methodology, i.e. teachers, environmental education providers, youth leaders, adult educators etc.

Wider application of the INVOLEN methodology through the European competition

Finally the European Competition on conservation game development, which was launched with great success in the five participating countries, confirmed the feasibility of the INVOLEN methodology and its suitability for application in secondary schools or NGOs across Europe. 20 games were completed by an equal number of schools and submitted for evaluation. An independent jury in each country assessed the submitted games and a winner was declared per country. The five winners were invited to present their games in the International Conference of INVOLEN.

The teachers/learning facilitators who were leading the competing teams answered an evaluation questionnaire which offers many insights to the application of the INVOLEN methodology by the target groups of the project, without the close supervision and support offered by the project partners during the piloting of the INVOLEN methodology.

The response of the teachers/facilitators was very positive. Although some of them admitted that they had some reservations in the beginning, especially regarding the creation of a game on mobile devices, mostly because this was an unfamiliar activity for them, they became enthusiastic during the process or the "journey" as some referred to it. Most facilitators declared that the game-based learning promoted by INVOLEN revealed to them an excellent pedagogical tool, while at the same time the experience was valuable because it led them beyond the conventional learning methods, and was also exciting and bridged the generations gap.

All target groups particularly valued the intergenerational learning experience. Comments include:

- *"Seniors and youth came closer together, discussed and asked for more meetings. The youngsters asked many questions, and were attentive to seniors. The seniors were really excited with the young people and enjoyed the interaction with them greatly."*
- *"Intergenerational exchanges were very rich. The seniors were really impressed to see young people take an interest in environmental protection, heritage and legends of their local natural heritage."*
- *"The field visits, museums, interviews and exchanges with seniors, have been true moments of pleasure for all !!!!"*
- *"The seniors preferred the storytelling and the activities carried out in the nature. However, they were open-minded for the new knowledge, but they let the youth to take the leading role."*

On the whole, the intergenerational learning experience met its purpose, according to the evaluation of the teachers/facilitators of the competing teams. Without underestimating that the intergenerational interaction was the most demanding aspect of the methodology and a significant proportion of seniors did not become actively involved in the ICT activities, their contribution was appreciated by the students and the senior's "socialisation" with ICT and game-based learning was a benefit that was admitted by most.

Similarly, the gaming process, applied on mobile devices, excited the imagination of the young students and created new prospects and motivation, especially when combined with intergenerational learning and course work, as shown in the comments:

- *"The youngsters discovered the possibilities of new technologies and their applications and developed a genuine interest in this, which opened new career possibilities.."*
- *"The creation of the game was very exciting, because of its technical aspect, but also the human aspect of meeting with seniors and sharing their experiences."*
- *"New technologies motivate the youth; this is a medium that speaks to them and seems more modern than paper, or books to learn. Yet this requires the same skills of reading and writing…"*

Overall, the experience of the teachers/facilitators seemed to be constructive, as this comment sums up:

- *"The experience was very rich. A great atmosphere at each meeting, a pleasure to meet and work together."*

Sustainability

The legacy of the project has been ensured by the wealth of products, including various publications that provide guidance and explain the tools that can be used by learning facilitators and learners to embark in and implement an INVOLEN project. The Guide and Toolkit, the Final Publication, the Helpdesk, the website, the library of stories and the library of games, various reports, assessment questionnaires and power point presentations, provide rich learning material and examples of the process and end results of an INVOLEN project. Moreover, the learning materials and other learning support products of INVOLEN are perfectly suited to promote environmental awareness, cooperation and citizen participation in environmental preservation, while stimulating transfer of knowledge and mutual learning among citizens. In this sense, the project results are offered for wider public use, beyond the formal school system of all grades, to individuals interested in nature preservation and heritage interpretation, as well as to environmental associations, adult education centres, third age universities, public authorities etc.

The sustainability of the INVOLEN methodology has bee also asserted by the follow up to the pilot actions undertaken by the 5 participating schools/NGOs and by the follow up planned by the 20 participants in the European competition. 4/5 of the piloting schools/NGOs have applied the INVOLEN methodology during the next school year, following the pilot course, while 1/3 of the competing schools or youth structures have taken steps to continue using the INVOLEN methodology in various ways:

- By improving their game, expanding its content and offering it for wider use in cooperation with local authorities or education networks (GR, HU).
- By using the game for tourism purposes, making it available to tourists through cooperation with a local tourism office (Carnac tourism office, FR).
- By making new games in public events, such as festivals, to amuse the younger visitors (chocolate festival in HU).
- By using the INVOLEN methodology in higher education: aleast three teacher training colleges are considering introducing the INVOLEN methodology in their training programme (in HU).
- Local authorities wish to adopt INVOLEN as a way of bringing closer youth and seniors in their towns (Association of Local Authorities of Auray, South Brittany, FR).
- Schools are using INVOLEN to build international relations with other schools in Europe and worldwide (GR, HU).

The teachers/facilitators who took part in an INVOLEN project were also very positive about the future use of the INVOLEN methodology. About 80% of the teachers who filled in the evaluation questionnaires when they submitted a competition entry, stated that they would definitely or probably use this methodology again and shared their information about future application. Some comments are:

- *"YES, definitely (.we will use it) - To raise and maintain the interest of the younger generations is getting harder with traditional methods. This is why it is important to adopt new methodologies"* (such as INVOLEN).
- *"The game will be offered to tourists by the Carnac tourist office" (in France).*
- *"We will also discover the game with more of our youth structures this summer" (Youth Centre).*

In several cases the competing teams have made plans to improve their game during the next school year or start new ones. Plans for this were in place in at least two countries (Greece and Italy). This kind of positive attitude is vividly demonstrated by the following comment: *"We would start again with pleasure that kind of experience!".*

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ICT SKILLS BUILDING FOR YOUNG AND ADULTS USING A LOCATION BASED GAME DESIGN METHODOLOGY; THE INVOLEN LLP APPROACH

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Abstract

This paper aims to present a series of learning activities focusing in the development of mobile Location Based Games (LBGs) within the scope of the INVOLEN Lifelong Learning Programme (LLP) and the respective learning material that was produced for its purpose. A course of classroom-based and web-based training activities focused in preparing the participants of the programme to acquire Information and Communications Technology (ICT) competencies and introducing them to the basic concepts of LBG design. The overall design rationale of the ICT training is outlined focusing on the objectives of the programme; parameters such as raising awareness for protected areas, volunteering for nature conservation, and bridging the gap among mixed-age participants were some of the main attributes of the INVOLEN methodology which shaped the curriculum accordingly. The reference tools, methods and learning material used for co-designing the INVOLEN LBGs are showcased along with the constraints that justified their role in the project. An overview of monitoring the learning outcomes from pilot stage to large-scale implementation is presented focusing on the role of the "ICT experts" of the programme. The paper concludes with reflection on innovative features that emerged during the project and outlines some preliminary ideas for a future research.

Keywords: Location-based games, intergenerational learning, ICT skills building, participatory game-design, mobile games

Introduction

INVOLEN- Intergenerational Learning for Nature Conservation Volunteers, is an innovative project, targeting nature conservation volunteers in 5 European countries (Italy, Greece, France, Hungary and Slovenia). A learning process of protection and conservation for NATURA 2000 sites across Europe brings together the target groups of the project: volunteer senior citizens and adolescents. The participants share common experiences as they co-design Location-Based Games (LBGs) for mobile devices situated in nearby protected areas. Young volunteers are mainly responsible for the development of the games inspired by the narrations of the seniors. The games aim to promote environmental conservation and incorporate information about the protected area provided by experts and facilitators. The authors were in charge of the ICT and game design training throughout the implementation phases of the project. The diffusion of guidance was achieved through a network of learning facilitators, who passed on their newly gained skills to the volunteer groups in each partner country.

Background

According to Paay et al. "Location Based Services (LBS) represent an emerging class of information systems providing mobile users with information tailored to their geographical location. LBS have been receiving increasing attention from researchers and the software industry because they open up opportunities for developing new services and experiences for users on the move." (Paay et al.,2008) 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 such as 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 device (Lehmann, 2012).Location-based gaming offers great educational possibilities, as it allows educators and facilitators of learning to create constructivist experiences rich in educational content. The proliferation of LBGs is due to the widespread use of mobile devices, like smart phones, with advanced location sensing capabilities, as for example GPS satellite positioning. LBGs can be compelling for young players as well as adults (Montola et al.,2009). Video games are, by their very nature, built around interaction and participation. Therefore, they provide a tool for designing curricula that offer more than mere exposure to content, aiming to enrich student experience through active participation (Squire, 2006, Gee, 2004, Dewey, 1938, Gagnon, 2010).LBGs offer an additional level of experience: due to the fuzzy border between games and real world activities, and because of the resulting changes in the game experience, players become involved and associate with the LBG, thus gaining stronger emotions and satisfaction from well designed LBGs (Lehmann, 2012).

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 learning (Squire et al., 2007). 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 codes and Rfid. LBGs have another important feature, which makes them valuable for education: they connect places and stories. In a LBG, it is possible to embed extra layers of information and 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 game (Lehmann, 2012).

Methodology used for supporting a training diffusion network

The INVOLEN curriculum included a series of learning activities addressing various audiences according to each project phase:

- a two-day International Workshop in Lorient, France (July 2013) for project managers and facilitators of the piloting phase.
- three follow-up webinars (September and October 2013, February 2014) for pilot facilitators.
- monitoring of the pilot courses in the five participant countries (November 2013- March 2014).
- operating the Online Helpdesk (November 2014-June 2015) providing support to a mixed audience of experienced project staff and a newly introduced group of educators that entered the INVOLEN European Competition.

During the early stages of training the participants got introduced to the theoretical background of game-design and gained hands-on experience of LBGs designed by the ICT experts/trainers exclusively for the purpose of the project. The reference games focused in: a) associating the physical environment to the plot of the game b) establishing a connection among augmented reality and interactive storytelling c) providing a basis for the development of prototype games designed on site by the participants. A training session on game development using the ARIS reference platform followed this step. During the next stage the participants had the opportunity to explore a protected area under the guidance of environmental experts that provided information. The participants concluded the workshop by designing and developing their own games for the specific area incorporating stories and data to the games narrative along with material that they had gathered during the visit.

This approach (i.e. theoretical introduction, hands-on experience, ICT training, field visit, reference material analysis, and experimentation building prototype games) was the basis for the development of the pedagogy throughout the project concerning ICT skills building and game-design. The same sequence of methods was revised and adapted accordingly to address the needs of participants during the training of facilitators phase, the piloting phase and large scale implementation phase of the project.

[The learning methodology of INVOLEN project was based on a model of intergenerational learning which derived through a participative approach. All learning stakeholders decided upon and contributed to the learning process, learning objectives, and learning outcomes. The ICT experts were responsible for drafting a methodology framework focusing on the needs and competences of an extended network of learners of various ages and disciplines. The roles of teacher and learner were redefined by introducing the learning facilitator as a key position in the learning process aiming to "facilitate" the transfer of knowledge between older and younger participants. Learners were able to build their ICT skills through a participatory game-

design process while getting familiar with innovative IT tools. The participants were able to were able to develop their own educational games using open source software. The methodology was designed on the basis of transferability to different locations, settings and audiences.]

The role of the "ICT experts" in the INVOLEN project

The ICT experts' role throughout the phases of the project was to establish a set of guidelines that would help the participants of various disciplines and backgrounds to fulfil the project objectives, i.e. to design and develop a series of LBGs for mobile devices addressing environmental issues in protected areas inspired by local seniors' narratives. The project phases included: a) drafting a methodology outline, b) training the trainers, c) pilot testing and revising the methodology, d) providing content for the learning material, e) supporting the large scale implementation of the methodology during the INVOLEN European Competition.

In order to reach every target group of the project and to address the needs of each group of trainees according to the phase of the project the ICT experts focused on:

- presenting the basic concepts related to game design.
- demonstrating the potential of several open source game design platforms.
- supplying the facilitators with an ICT toolkit to be used as a compass for the game design process.
- engaging the facilitators in active learning through designing and testing prototype games using the ARIS platform.
- sparking discussion on game design approaches and strategies among participants of an interdisciplinary background and various ages.

The ICT experts were involved in building the capacity of facilitators to guide the learning process during the pilot phase of the project. The training activities provided the participants the opportunity to understand the basic principles of game design, offered them a clear view concerning the potential of location-based activities and introduced them to the components of mobile games. After the training participants were able to set a storyboard and design a location based game using the reference platform ARIS and were able to consider upon alternative methods of implementation of the taught material according to the needs of each pilot group.

The ICT experts met the pilot target groups in classroom meetings and demonstrated the features of the ARIS platform. They provided specific instructions in class on how to use the selected platform for the production of the INVOLEN educational games. The authors were responsible for providing support to the Greek pilot group. They provided their assistance to the creators using brainstorming techniques, setting the storyline and helping the participants address technical issues. They provided feedback to the group facilitators and evaluated playtesting sessions. The authors also offered support to project staff in all project countries concerning ICT issues and game design.

The pilot experience was concluded by the production of the Learning material of the project that was made available to prospect participants. The authors were in charge of the technical content of the publications as well as the theoretical background concerning games-based learning and LGB design.

The experience from monitoring and advising the pilot groups was carried forward to the development of a helpdesk for INVOLEN prospect participants. The expert staff of the partners (conservation experts, additional ICT experts that were recruited in each country) and trained facilitators were assigned to answer questions asked by the INVOLEN Competition participants. The authors were responsible for answering any game-design and ICT-related questions that reached the Helpdesk.

Learning Tools and ICT tools to support them

The diversity of trainees needs according to age, discipline and background called for a basic adjustable approach towards ICT skills building. The learning tools that were deployed during training included face-to-face meetings, on-line tutorials, hands on experience, field visits and published manuals addressing volunteers and facilitators. During the training sessions emphasis was given to the process of digital content collection, classification and utilisation in the context of LBGs. Several ICT tools were suggested by the authors for enabling the participants to manage and process the data. The suggested tools were available online free of charge so all participants can have access. Such tools were online collaboration spaces for

sharing digital files (e.g. Dropbox, Google Drive), digital media authoring and processing applications (e.g. Popcorn Maker for video editing and Pixlr for image editing), mobile applications for route tracking and geotagging images (e.g. Google Maps, GeotagMyPic, MapMyWalk).

The reference platform for LBG development was ARIS, however Enigmapp, Taleblazer, NoTours, Huntzz and DIY QR-Code methods were introduced to the participants as alternatives. The game-design process focused in creating the storyboard of the game using input from the senior stories collected during the intergenerational group-work. The content of the game included video, audio, photographs, geolocation data, virtual characters and text information that was gathered either on site, through desk research, or interviews. The training courses used real-life experiences as learning material. Hands on experience, on site collection of material and playtesting sessions were included among the key features of the learning process. The participants were frequently reminded not to fear technology failures such as low GPS signal, 3G coverage or software shortcomings and manage such issues with creativity and resourcefulness.

Learning material

After the completion of the piloting stage and the revision of the methodology two publications were prepared in order to make the INVOLEN learning process accessible to the public. The aim of the publications was to provide knowledge for the INVOLEN European Competition participants and to make the methodology and guidelines available for potential learning stakeholders beyond the duration of the project. The Learning Guide and Toolkit were developed gathering input by all partners focusing on the theoretical and practical aspects of the INVOLEN project. The authors were responsible for the structure, content and editing of the Toolkit for Learners and provided input for the theoretical background concerning games-based learning and game-design chapters of the INVOLEN Guide for Learning Facilitators.

The *INVOLEN Learning Toolkit* focused on offering practical knowledge for the implementation of the INVOLEN methodology. It is designed as a manual that helps the reader understand what a location-based game created in the context of INVOLEN is, what are its components, what steps must be taken to create a new game, how to collect the material for the story of the game, and what are the online platforms available to host it. It includes examples of games created during the piloting phase of the project as well as stories that provided the background for their content. The toolkit is addressing all INVOLEN target groups, i.e.youth, senior citizens and teachers or other experts who act as learning facilitators including a facilitator-oriented section which focuses in volunteer management and practical advice on how to carry out this project

The *INVOLEN Guide for Learning Facilitators* was designed to address the audience of educators interested in carrying out the INVOLEN learning process. The guide presents the methodology developed by the INVOLEN team which was piloted in the 5 project countries The aim of the guide is to present the theoretical background of the project, to introduce learning stakeholders to the INVOLEN methodology, and to showcase examples of implementation that were carried out during the pilot testing phase in schools and NGOs across Europe.

Large scale implementation: challenges and adjustments

Helpdesk groups were created in all project languages in order to provide assistance to prospect competing teams. The following categories were used for classifying users' questions:

- ICT - Game- design
- Intergenerational Learning
- Environmental Volunteering
- Facilitators-Practical Questions
- Frequently Asked Questions: a summary of the most important questions asked throughout the Helpdesks of all the partner countries.

The authors provided support to partners concerning the management of the Helpdesk groups and offered advice in terms of technical issues and membership/role management issues.

Despite the competence of partners to respond to participants' questions, the risk of facing low engagement levels of prospect participants was clear since the early stages of the Helpdesk. The reasons behind the participants' reluctance to use the Online Helpdesk was justified by partners to a certain extent due to the

participants' shyness of public media, partly due to their lack of time for implementing the project which called for immediate actions and partly because of their wish for discretion since an ongoing contest was in progress. However, participants were eager to have live demonstrations, face to face meetings and telephone calls with the organisers of the Competition and responded very positively to these. In order to deal with this challenge all partners agreed to maintain their so far established support via personal contact. Individual help, face to face meetings and e-mail communication were endorsed as a much more effective means for motivating the competing groups and especially for their ability to resolve technological issues that competing teams were unfamiliar with. The ICT experts in each country, including the authors, adjusted their contribution to the needs of the competing teams.

This need to provide personalised help was even more intense in cases where the Competition was held outside school hours. In some countries, such as Slovenia or Hungary, where mostly volunteer teachers were involved there was much additional work compared to an in-school project. In order to keep these groups engaged the Slovenian and Hungarian ICT experts made sure to establish good communication with the facilitators and give them the support they needed.

Dealing with the problem of the immediate contact with the participants through face to face meetings and conversations over the phone, Skype and private e-mails however created issues in terms of: a) monitoring the progress of the participants, b) documenting the participants questions c) sharing the answers and providing common solutions for a broader audience d) maintaining a written record for future participants beyond the life of the project. In order to ensure these parameters were met the partnership decided to feed the national Helpdesks with all questions received as well as keeping a record of their answers in writing.

Learning outcomes: the INVOLEN games

The INVOLEN methodology led to the development of 7 mobile games during pilot phase. These games were used as demonstration material for prospect participants during the large scale implementation phase. The games include video, photographs, geolocation data, virtual characters and online information that were collected either on site or through desk research of the groups and interviews. Real-life experiences and challenges along the course of the piloting were used as learning material; dealing with digital data collection and processing methods, deciding on the appropriate software for each task, managing technical problems and coping with technology failures contributed to the learning guide and toolkit deployment

20 mobile games were submitted during the INVOLEN European Competition out of 31 total entries. The games were created by volunteers with the assistance of facilitators and experts using input from the learning material available with support from the project staff and ICT experts in each country . 8 distinct methods/platforms were used for the development of the games. The majority of the games (7 games in total) were developed using ARIS, the reference platform. An evaluation process is currently in progress as the INVOLEN Competition will be concluded during the INVOLEN European Conference with the awarding ceremony for the winning teams. Facilitators across Europe provided feedback concerning the INVOLEN learning process by submitting an online questionnaire along with the INVOLEN games and stories (Table 1).

Country	**Entries**	**Games**	**Platform**
France	3	2	Enigmapp
Greece	8	5	2 games on ARIS 2.0, 1 game on Taleblazer, 1 game on Enigmapp, 1 game with QR Codes
Slovenia	4	2	ARIS 2.0
Italy	5	5	2 by www.attivarti.org, 3 ARIS 2.0
Hungary	11	6	QR Codes, Taleblazer, Unity 3D&Huntzz, Enigmapp, HTML, Unreal Engine 4
Total	**31**	**20**	**7 ARIS, 4 Enigmapp, 2 Taleblazer, 2 QR Codes, 2 by attivarti.org, 3 various platforms**

Some of the greatest challenges that volunteer groups reported both during pilot as well as large scale implementation were game-design platform weaknesses due to their on-going development process such as the transition from the ARIS1.0 to ARIS 2.0 transition or buggy interaction with clients such as in the case of ARIS, Enigmapp or Taleblazer. Lack of resources concerning the limitation of ARIS being available for iOS was often reported, an issue that resulted in several delays in the groups access of appropriate devices or their decision to switch to other platforms despite their limited features.

However, participants feedback was very positive as recorded after the piloting phase concerning ICT training and game-design:

"When we started I believed we would not succeed, especially because of the development and the coding! Now I feel so good and I would like to create a new mystery game soon!" (youth response, Greek pilot course).

"*My participation in the creation of the game was a very nice experience. In addition to the benefits that we obtained was the use of ICT tools and our awareness on environmental issues. I liked it very much because it was designed by children, for children*", *(youth response, Competition participant, Greece).*

"young people document old stories […] in new and exciting ways"(senior response, Greek pilot course).

Conclusions

Creating interactive stories and associating narrative to locations are not new concepts on their own. However, augmented reality added several layers of information to natural locations with immaterial interventions through LBG-design The INVOLEN games established immaterial networks of information adding up to the experience of players with minimal impact on the preserved natural areas. The training offered throughout the INVOLEN project reached a broad network of trainers, educators, experts, youth and senior volunteers who were able to value the benefits of this technology within the reach of their communities in the context of sensitive places such as local protected areas.

The learning outcomes of the process suggested that co-creation and skills exchange methods through games-based learning can emerge in an intergenerational framework. According to the designers and users, location based games and augmented reality intergenerational storytelling, were used as highly motivational media, promoting cooperation, intergenerational communication, IT and soft skills, while fostering creativity and educational heritage in an experiential and hands-on approach. Concepts and patterns of collateral and experiential learning emerged, requiring further research and evaluation that will be performed in the future.

The large scale implementation phase of the INVOLEN project indicated a very high interest on behalf of learning stakeholders in five European countries towards using ICT and games-based learning in environmental education. Target groups showed an increased level of commitment towards completing their entries for the INVOLEN European competition by achieving a 65% of completed submissions. Future research may also include the feedback gathered from facilitators that participated in the INVOLEN European Competition and their views on further application of the knowledge they gained during the project implementation concerning LBGs for educational purposes.

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ENVIRONMENTAL EDUCATION WITH LOCATION BASED GAMES: THE INVOLEN METHODOLOGY IN TUSCANY

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Abstract

Environmental education is acquiring more importance due to an increasing awareness for environmental protection and the importance to provide the public with the necessary skills to make informed decisions and take responsible action. Youth love nature though they are not so much used to experience nature or volunteering actions for its protection, in addition they are incredibly familiar with video games and mobile applications that are widespread among all generations. INVOLEN project, co-funded by the European Union, targets to youth and elder nature conservation volunteers in five European countries and aims to promote nature conservation and intergenerational learning using game-based learning for specific protected areas. To achieve this aim, INVOLEN has developed a methodology which has been applied, in Italy, mostly in the school context.

The pilot experience was followed by an exploitation phase in which new teams applied the methodology for participating to the European Competition for the best Conservationist's Game.

All the experiences were successful according to the group members and the facilitators who guided the learning process. The methodology improved the environmental knowledge about the protected areas and reduced the skepticism toward technological tools, mostly used for game development.

The activities motivated a closer interaction between youth and elders inspired by reciprocal respect and pleasure. In addition, some members continued their volunteering action after the project plan.

Keywords: education, intergenerational learning, mobile games, protected areas

Introduction

Environmental education is acquiring more importance due to an increasing awareness for environmental protection and the importance to provide the public with the necessary skills to make informed decisions and take responsible action. The awareness of pupils about environmental issues and problems should be raised increasing their knowledge and reflection on environmental concepts, in order to mature feelings, values and respectful attitudes.

INVOLEN (Intergenerational Learning for Nature Conservation Volunteers, www.involen.eu) is a project co-funded by the European Union under the LLP-GRUNDVIG and targets nature conservation volunteers, youth and elders, in 5 European countries (Italy, Greece, France, Hungary and Slovenia).

INVOLEN aims to promote nature conservation and intergenerational learning using game-based learning and for this, it developed a methodology by which an intergenerational group of promising nature volunteers, work together to produce a Location Based Game (LBG) for a specific protected area.

INVOLEN has important objectives:

i. To strengthen the relationship between seniors and teenagers through ICT and nature protection activities,
ii. To encourage youngsters to become nature protection volunteers,
iii. To improve the capacity of NGOs to deliver innovative education both for youngsters and adults.

Figure 1. Youth and elders clean paths during a field visit. Environmental activists and guides lead the group and motivate them to volunteering.

These objectives are hopefully achieved through the application of a Learning Methodology (Papageorgiou et al., 2015) based on an intergenerational group work which includes voluntary activities in the protected area, collection of information and stories told by elders and environmental experts and development of an LBG. In this way, youth can benefit of activities in direct contact with nature and know more about peculiarities and concerns of their local environment through the stories and legends of the elders' memory linked to the area.

The most challenging phases of the methodology (which is described in details in the next paragraph) are related to the creation of LBG as innovative technological tools are used by non experts people. LBGs are games designed to be played on a device in motion and in strict connection to the location (Lehman, 2012). Nowadays the society appears to be deeply connected in and around the media, and portable devices (tablets, smartphones etc.) are so widespread to affect the way things around us are known and learned: for instance, Norman (1994) documents that the technology influences the cognitive way, transmitting the knowledge embedded in the artifacts that surround ourselves.

LBGs are suited to convey educational knowledge and encourage physical activity. They profit from advanced technologies like smartphones and tablets, integrating the players' position conveniently into the game.

LBGs can be played in a city or in nature, they are based on an interaction between the player and the environment around: this allows getting information about the surrounding real world with digital interaction. Mobile media and augmented reality has a unique ability to unite the advantages of educational video games with place based learning (Squire et al. 2007).

The other important aspect of the project is raising environmental awareness in young people. Natural environments and their concerns are often explained by NGO and scientific organisations though also elders can also explain the peculiarities and the facts because of their experience and knowledge. Seniors may bring valuable knowledge of nature conservation models and methods, based on skills, experiences, traditions that are at risk of being forgotten.

The means of knowledge transfer between different actors may play an important role: people of all ages can learn together and from each other (Intergenerational Learning) and in the future this is expected to develop social capital and social cohesion in our ageing societies (www.enilnet.eu).

Field trip is an effective method of knowledge transfer as it integrates the use of simple, understandable and meaningful language and the direct contact with nature, making the understanding of nature characteristics and issues more exciting, thus encouraging people to take care of it.

INVOLEN follows the European Year for Active Ageing and Solidarity between Generations 2012, aiming to raise the awareness for active ageing and posing "the challenge to politicians and stakeholders to

improve opportunities for active ageing in general and for living independently, acting in areas as diverse as adult learning, volunteering, IT services" (Bird, 2007).

In the years 2013-2014, INVOLEN has implemented the pilot phase and in 2014-2015 has launched an European Competition for the best Conservationist's Game, in order to disseminate its model of intergenerational learning for nature protection. The aim of this study is to present and compare the results of these two years application of the INVOLEN methodology in school contexts.

Methodology

In Italy, the pilot phase of the project (2013-2014) was carried out in the context of the secondary school T. Tesei in Livorno by a group composed by 8 students, 4 facilitators (teachers and project managers), 5 elders recruited in local environmental associations and 2 ICT experts (IBIMET staff). In the following year (2014-2015), the exploitation phase saw the participation of four teams (three schools) participating in the European Competition for the best Conservationist's Game. The international competition also saw the participation of a team formed outside the school context, in the Farma valley, lead by the local cultural association Attivarti. This team presented two games aiming to promote the nature and traditions of this small rural isolated community. The peculiarity of this group stood not only in the different group composition but also in the software used to develop the game which was actually an html application; the different way of playing favored the interaction with local people more efficiently in comparison with the mobile app.

All teams followed the INVOLEN methodology, a learning process made of six work units (table 1), which was slightly modified in the work unit order (Unit 5 shifted to Unit 2) during the exploitation phase.

Unit number	Description
Unit 1.	Individuation of competence needs, and set up of a draft calendar and meetings schedule.
Unit 2.	Demonstration of the ICT game for discussing the potentialities and the possibilities of LBG.
Unit 3.	Collection of stories, legends, tales by elders who live in or close to the protected area.
Unit 4.	Selection of one story or creation of a story to be implemented as LBG.
Unit 5.	Visit to the area for volunteering activities (i.e. to clean up the path trails, collection of materials like pictures, things, videos on site etc.)
Unit 6.	Development of the LBG (scenario and implementation in the LBG platform).

Table 1. The pilot implementation of the INVOLEN methodology was organised in 6 work units.

Youth, elders and facilitators (in the suggested ratio 3:1:1) were recruited respectively among the school classes, grandparents and volunteers in local associations, teachers and activists.

The facilitator has the role to create connection between the two age groups, organise the work units and guide the pace of work, until the delivery of the learning outcomes.

The Location Based Game was realized using ARIS (Augmented Reality and Interactive Storytelling) platform, an application designed for iPhones and iPad devices that is freely available in the App store (www.arisgames.org). ARIS work together to create mobile, locative, narrative-centric, interactive experiences (Gagnon, 2012).

Figure 2. Current position of the player on the LBG map.

Finally, the experiences were evaluated by the facilitators and group members who answered a final evaluation questionnaire (see Annex in Learning Guide and the evaluation form for the European Competition https://involeneuropeancompetition.wordpress.com/evaluation-form/) about the relationship between the two age groups and open questions about the learning achievements. For the present study only the results of the activities made in school contexts will be presented.

Results

Though the pilot experience was a guided process and the exploitation phase completely autonomous, the final evaluation questionnaire allowed to get a general idea about achievements and satisfaction.

Pilot phase

The pilot group worked on/for the Provincial Park of Monti Livornesi attending 18 two-hour meetings beside art lessons for game drawings and management meetings. The pilot phase evaluation was particularly focused on the quality and effectiveness of the collaboration among the group members (Ugolini et al. 2014).

Youth were really enthusiastic and surprised by the elders: they recognized how much *helpful* they were, their *creativity* and *sympathy*; then they showed a positive attitude to the environmental protection. About ICT, students liked the game development (it was commented interesting and funny) despite the difficulties due to the platform characteristics. However different opinions were given likely connected to their personal skill and attitude toward ICT.

The collaboration of young volunteers with other members of the group was positive, especially with elders and other students. For some work units it was judged almost excellent (e.g. Unit 6).

Seniors learned especially from the experience exchange about the *environment* and *land use* through their personal stories in relation to the protected area and they were fascinated by the *enthusiasm* and *creativity* of the youngest.

They found difficulties in the technological part of the project, especially because they could not feel comfortable to practice at home by themselves. However, though they felt shy, did not give up and kept the interest to learn.

Seniors were also very positive in the evaluation of the collaboration. The highest score was for facilitators (table 2) and Unit 6 and 4 contributed most to this.

The facilitators evaluated as *very good* the response of students and seniors to the whole activity.

The different work units were useful also to facilitators who learned about environment especially regarding *fire protection*, *protected species*, facts and characters of the *history*. They appreciated the *knowledge exchange* and the *good interaction* between youth and elders. The project was also an opportunity to reflect on the means and methods of *communication* to keep *motivation* and *interest*, and the importance of organisation.

Moreover, regarding the collaboration, they judged generally *very good* the collaboration with students, and *almost excellent* their collaboration with seniors but also between students and elders (table 2).

Some work units were especially positive: unit 5-4 were particularly successful with the students, and unit 6-5-4 with seniors and also between students and seniors.

Collaboration between	and Youth	and Seniors	and Facilitators	Between youth and seniors
Youth	3.5	3.6	3.3	
Seniors	3.1	3.5	3.9	
Facilitators	3.4	3.7	--	3.6

Table 2. General evaluation of the collaboration between age groups given by each group (1 - 4= poor – excellent).

Exploitation phase

In 2014-2015, INVOLEN methodology was applied in the secondary schools I.C. Montenero (Livorno); I.C. Sacchetti (san Miniato) and I.C. Capraia Isola (Livorno).

The number of meetings in these schools ranged from 8 to 12 for the whole learning process.

We report the general results from the evaluation form filled in by the facilitators.

In this phase, since the groups worked autonomously, the evaluation was more focused on the appreciation and effectiveness of each unit by the group members. The experiences showed a *rather good involvement* of seniors in the technological aspect of the project, though in one team, they seemed to prefer other work units. In contrast, students showed mostly *curiosity* and were really *active*.

All members and in particular the facilitators liked the methodology (table 3). Some work units were particularly appreciated by all members like unit 3 (stories, information collection), unit 4 (development of the game story) and 5 (field visits and volunteering activities) (table 3). Only facilitators appreciated very much the work units connected to LBG development (Unit 2 and 6).

	Mean	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Seniors	3.3	2.7	4.0	3.7	3.7	2.7
Youth	3.3	3.0	3.7	3.7	3.7	2.7
Facilitators	3.9	3.7	4.0	4.0	4.0	3.7

Table 3. How much group members liked the methodology and the different work units (1- 4= I do not like it at all – I like it a lot).

Discussion and conclusions

The challenging INVOLEN methodology, tested during a pilot and the exploitation phase, has demonstrated its effectiveness in achieving a variety of aims and outcomes. INVOLEN methodology has strengthened the relationship between seniors and teenagers encouraging youngsters to become nature protection volunteers and making elders more aware of the importance of knowing the use of ICT to better communicate with their grandchildren. Among all the outcomes, this collaboration produced seven Location

Based Games for five protected areas in Tuscany that are available through mobile application and the internet.

The methodology demonstrated many added values like learning to apply ICT in a creative more than mechanical way for learning and raising the awareness that technologies can be used not only for playing but also for learning. In addition, creating a product by working in group and following a multi-phase process, group members learnt to be patient and respect timelines; adapt their own ideas for a successful group work with people of different age and background and enhance the communication capacity and knowledge transfer with practice and tales.

However, some recommendations could help to improve the success of the methodology. Group size should be properly chosen in order to give all the members time and possibility to tell ideas and feel comfortable to express their opinion; the interaction between youth and elders can be enhanced by using physical objects (tools, pictures of the past) and personal stories to foster curiosity; LBG platforms other than ARIS should be test because ARIS limits the possibilities to make practice by themselves and is only available for one mobile type. Finally it's strategic to put a lot of effort in the field visits and volunteering activities because they are essential to make the group more cohesive and involved.

In conclusion, we think that LBGs have multiple functions, e.g. to attract young people to any kind of valuable location and to discover and learn its peculiarities in a funny way, to control tourist load in protected areas creating specific play paths.

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CHAPTER 2: THE CONTRIBUTION OF ICT AND INTERGENERATIONAL LEARNING TO INNOVATION IN ENVIRONMENTAL EDUCATION

EDUCATIONAL MOBILE GAMES AND TOOLS THAT INVITE PARTICPATION INTO ECOLOGICAL INVESTIGATIONS

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Abstract

Over the last few decades, researchers in the learning sciences, cognitive sciences and education psychology have pushed our definition of the mind toward an increasingly complex and culturally situated perspective (Brown, Collins and Duguid, 1989; Hollan, Hutchins, and Kirsch, 2000; Lave and Wenger, 1991; Bruner, 1991). If taken seriously, these ideas pose a great challenge to traditional classroom-based education, calling educators to focus on the design of educational experiences that engage learners in fewer *concepts* and more *contexts* and *activities*. These theories insist that learners be exposed to a complex and ill-defined world, engaging in legitimately with its practitioners and activities, a space often well outside of formal educational environment, and into what James Gee calls *affinity spaces* (Gee, 2003). In response, a number of researchers have explored the promise of mobile, location-aware videogames and the role they may play in providing place-based, community-engaged educational experiences (Squire and Klopfer, 2007).

One such platform to produce mobile locative educational content is ARIS, an open source project for creating games, narratives and field research activities with little or no computer programming skills. ARIS is the result of years of design-based research into educational gaming, design pedagogy and place based learning (Gagnon 2010). ARIS was designed to facilitate a variety of educational design contexts from informal youth workshops to university courses. Deeply committed to open and democratic education, the project has invited involvement by a diversity of educators, artists, storytellers and researchers, continuing to innovate as its community of users broadens and matures (Martin et al. 2013).

Insomuch as the ARIS platform has invited increased participation, it's community of users have produced novel designs that engage ecological and naturalistic topics. As the tool was used in forests, prairies and swamps, effectively outside of urban centers, small usability issues with the tools reliance on internet conductivity and need to have high contrast visuals that would function well in direct sunlight were addressed. As naturalists, horticulturalists and biologists began interacting wit the tool, they naturally began envisioning entirely new features as well, to better serve their own specific needs. The boundaries of ARIS needed to expand. In fact, they needed to expand so far that the development team eventually decided to respond to the ARIS user community with entirely new software tools to address the unique challenges these new ecological disciplines.

In the last year, two offshoots have been produced. The first project, *Nomen*. is a new platform for producing mobile field guides that have been proven to increase a novice's accuracy and efficiency in identifying plant species in context (Gagnon et al., 2003). The second software tool, Siftr, supports what we are calling "field research activities," activities in which the learner is engaged in the collection of original data, in the form of photographs, categorizations and paragraph-length captions Other users are able to review, comment and "like."

Combined, these three software platforms have created a suite of tools that allow non-programmers to create a variety of location and context aware educational experiences that are enhanced by mobile technology and informed by situated learning theory.

This paper describes the meta-design of ARIS, Siftr and Nomen as an iterative process between researcher-developers and research-users. Additionally, case studies in ornithology, horticulture, and sustainability will be discussed in effort to identify key attributes of successful design.

Keywords: ARIS, mobile, video game, situated learning, open source, democratic education, place-based education

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RESEARCHERS GO TO SCHOOL (RGS): SHARING CONTENT AND PROCEDURES OF SCIENTIFIC RESEARCH

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Abstract

In this paper we present a case study of communication and educational proposal developed by CNR in order to promote the collaboration between Education and Research,that are the most important institutions in the production and the revision of the scientific and environmental knowledge. The proposal brings an ongoing CNR project (its steps, subjects, tools, activities) in classrooms, making use of interactive Earth Science workshops conducted directly by the researchers. The ongoing CNR project shared with students is focused on Innovative Methodologies of Earth Observation supporting the Agricultural sector in Lombardy. The proposal involves for 2 years 10 teachers, 160 high school students and researchers from 3 CNR institutions through participative and personalized workshops during which every School, according to its field of study, deepens one of the thematic areas of the project.

Students are co-players of the research project and follow side by side the scientists in their procedures: they can actively participate, giving personal contributions and feedbacks. Furthermore they can freely express their expectations, acquire information, test new approaches and research tools. Some tasks that the students implement concern: the support to the project's communication activities (e.g. production of news, videos and of a specific project's glossary), the organization of scientific events/workshops dedicated to the presentation of the project's developments or first results and, of particular importance, the test of the project's Smart App that the researchers developed during their activities.

The proposal makes also use of qualitative tools for evaluating the involvement of students, teachers and researchers and analysing the communication model implied in the relation among them.

The goal of the initiative is twofold: introducing students to a concrete vision of the scientific process and inviting scientists to reflect on scientific participative models and their implementation.

Keywords: scientific innovation, education, communication, public engagement, participation, exchange.

Introduction

Some years ago a panel of European experts in new didactic concepts for science teaching (de Haan 2008) defined the Research and Education Cooperation (REC), that is the collaborative interaction between a research partner (e.g., public or private science or technology research institute) and an educational one (e.g., schools, individual teachers, pupils or students), as a very promising and comprehensive approach, able to significantly contribute to renovate science education and communication and to overcome the gap between young people and science (Gerloff-Gasser et al. 2007; European Commission 2004; GRID 2006).

REC allows a direct contact among pupils, researchers and teachers, bringing different benefits to each of them. Students experience Research in its context and get an authentic and up-to-date picture of science, scientists and the scientific work; researchers receive an insight into the reality of the School and learn how to better communicate and share their knowledge; teachers, who act as mediators between the scientific and the pupils' world, are given opportunities for further qualification. The panel's conclusion was that REC initiatives, at the moment still isolated and sporadic, should be robustly and systematically supported as an integrated part of the European educational systems and as an effective approach to make all actors cope with the challenges of the modern high-tech knowledge societies (de Haan 2008).

A more direct and inclusive collaboration between Research and Education must take into account possibilities, perspectives but also critical issues still persisting in the relationship between the two systems. In many surveys scientists elect students and teachers as two of the audiences to which it would be most important to relate to (L'Astorina 2011). However they often propose a traditional unidirectional

communication model when dealing with them, and seem not to be aware that the scientific knowledge is continuously revised by the school and its protagonists. On the other hand, science taught at school is frequently too abstract and far from the daily life of students; not always, in fact, the ministerial programs, the media, and the textbooks adopted by schools seem to be able to grasp the content and the procedures of the scientific knowledge as it is today being developed (Valente 2006). Also the modality of teaching is often criticised, being mainly deductive, only somewhat participative and allowing little room for inquiry-based learning (European Commission 2007).

A participative proposal of REC by CNR

In this context, a proposal has recently been developed by the Italian National Research Council (CNR) aimed at fostering a mutual exchange between Research and Education starting from the critical issues above mentioned. In the proposal, called “Researchers go to School” (RgS), students and teachers follow side by side a team of CNR scientists involved in an ongoing research project based on the use of innovative methodologies of aerospace Earth Observation (EO) for supporting the agricultural sector in Italy. Nowadays most of the scientific activities is carried out by team groups within funded projects and programs; following a concrete research project from its first steps can help schools understanding the content and the procedures of research, that has not only to deal with scientific and technological aspects but also with economic, social and ethical ones. A research project has its own life cycle and calendar; its workflow is generally divided in activities called “Workpackages” (WP) where objectives, tools and expected results are strictly scheduled monitored and evaluated. In a project, scientists interact with several actors beyond the scientific community, such as private and public stakeholders, users, policy makers, media and the general public. Projects are almost always carried out in collaboration with researchers from different disciplines and give students insight into the dynamic of team research (Antunes 1998); they are also good indicators of the level of cooperation and communication existing within the scientific community and with the entities outside it. Last but not least, following a research project gives an interesting opportunity of understanding the main challenges affecting the society and the way in which science and technology try to answer them.

The approach of RgS engages actively all participants, enhancing the cultural dimension of producing and sharing knowledge. The goal to test new models of science teaching and communicating is twofold: while introducing to a concrete and critical vision of the scientific process, RgS also invites all participants to reflect on PCST (Public Communication of Science and Technology) activities, on participative models and their critical aspects. Are the Education and Research systems ready to collaborate each other? What are the constraints and the limits of such a collaboration?

The CNR research project introduced at school is called “Space4Agri” (Innovative Methodologies of Earth Observation supporting the Agricultural sector in Lombardy, S4A) and aims at the development of downstream services for the agrifood sector. According to the directions provided within the European Program Copernicus, S4A makes use of Earth Observation technologies in order to “promote technological and scientific research, stimulate industrial innovation, contribute to economic growth and produce benefits to all citizens” (Copernicus Program 2012). The project implies a strong interaction with many stakeholders such as local administrators and policy makers and the agrifood sector. Considering all these components, the project S4A was considered particularly suitable for testing the approach of RgS. It is also a way to introduce at school subjects linked to the space research, which is considered as a way to encorage students to choose scientific careers and help pupils to better imagine the society of the future (European Commission 2014).

Methodology

RgS involved for 2 years (2013-2015) 10 teachers, 160 Lombardy (in Northern Italy) high school students and a group of researchers from 3 CNR institutions through participative and tailored workshops during which every school, according to its field of study and interest, deepened one or more topics of the project. Also a network of Italian schools, Science Under 18 (SU18), joined the proposal contributing with its reflections on the relation between students and teachers in the education process. In particular SU18 suggests to overturn the one-way traditional model of teacher-student communication where pupils are simply expected to give (good) answers to the questions teachers ask them (AAVV 2007). Furthermore, some University scientists contributed to the development of the proposal, bringing a model of co-production of knowledge based on sharing the academic research with students (Confalonieri R. et al 2013).

In order to consider the proposal RgS as an integral part of the project Space4Agri, it was scheduled as a task of the project's WP dedicated to Dissemination and Capacity Building activities starting from its very beginning. Dissemination activities are always present in a research project and are considered as mandatory, however they rarely involve actors considered external to a project, such as schools, neither consider an active role to stakeholders. RgS was instead a way to overcome the traditional approach and to propose a "Dissemination for Action" model (Harmsworth et al 2001), where all partners act as "networks of practitioners and academics" and contribute to improve the quality of knowledge (Hughes 2003).

The proposal RgS was presented to all participants in a Kick off Meeting, according to the traditional procedure of every international project where the scientific purposes and expected goals are presented, project members introduced and their role discussed. The Kick off was held at the premises of the CNR Research Area in Milano, and for many students it was their first time in a research institution. The meeting was also the moment where the main steps of the proposal RgS were introduced and following steps were planned. Here we just summarize some of them:

1. Motivational workshops: during a series of preliminary workshops participants could exchange ideas and expectations on Research and Education systems and try to define the possible relationship between the two. What are the specific fields of research/education? Is it possible a mutual exchange and stimulation between the two? What are the main components of a research projects? were some of the questions discussed during these workshops. As already tested in other projects, participative methodologies adopted by CNR researchers (such as the Metaplan) aimed at motivating participants to the whole process and also at gathering perceptions on scientific research and technology of all actors (L'Astorina A., Valente A. 2011).
2. Tailored meeting with S4A researchers: Here are some of the topics developed by the classes in a number of meetings: Remote sensing and Earth Observation for Agriculture; aeronautic technologies such as Unmanned Airmobile Vehicle (UAV also known as drones) for monitoring the environment; use of smart technologies for collecting and diffusing information (App); Citizen Science and VGI (Volunteer Geographic Information) as a new approach to produce and deliver information on the territory Goodchild, M. F. (2007); communication strategies of a scientific research project.
3. Implementation of S4A project's tasks: during the 2 years of lifetime of the projects students and researchers were asked to decide those aspects or products of the S4A project that could benefit from the collaboration between them, among them the students chose the implementation of the S4A App and the organization of the final S4A project's event.
4. Inquiry on perceptions of participants on science, technology and society. In addition to proposing and testing new models of communication, the CNR group carries out surveys, using both quantitative and qualitative methodologies, aimed at investigating the perceptions of science and its values (Valente, 2009). Also in this CNR proposal, questionnaires were submitted to all participants at the end of the Project. Some first results are here presented.

Results

The proposal had impact on the reciprocal understanding of researchers, students and teachers, on the didactic and on the research project S4A itself

As a general result all actors appreciated the possibility to be involved in the initiative. Many students had never met a researcher before neither had the opportunity to understand the real process of research or visit a laboratory. As already emerged in a recent Eurobarometer study, also Italian students had a positive view about the image of Science and Technology but appeared to have less clear insight into the work of the scientist (European Commission 2010).

Students and teachers followed side by side the scientists in their procedures and actively participated to S4A, giving personal contributions and feedbacks. During the process they could freely express their expectations, acquire information, test new approaches and research tools.

A clear didactic achievement was the introduction at school of new extracurricular subjects (such as Remote Sensing, VGI, Citizen science, etc.) presented through a multidisciplinary approach.

Students gave great impulse to the S4A project, in particular to the dissemination activities, bringing it outside their own school and presenting the research during external science exhibitions (http://space4agri.irea.cnr.it/it/news/scienza-under18-monza-e-brianza). The project was thus introduced to other visitors, students and teachers; it was a remarkable result in terms of scientific communication. Still

remaining in this context, another form of collaboration given by the schools was the contribution that students gave in updating the official project's website where they supported S4A researchers in publishing news and events related to the project's developments or its educational initiatives. A special section of the site was specifically dedicated to the relationship between Space4Agri and the School (http://space4agri.irea.cnr.it/it/scuola).

One of the goals of S4A was to face the lack of updated on field agriculture information and the necessity to deliver it in real time during the season. To this purpose a special smart App dedicated to the collection of in-field crops was developed by S4A researchers. The App was partially edited and tested by the students and teachers. The smart App test was launched in April 2015 through a public event that the Schools named "Bioblitz" (http://space4agri.irea.cnr.it/it/news/lagri-blitz-visto-dagli-studenti); during it, researchers and students tested together the application for the first time making some agricultural observations on corn and rice fields surrounding their school.

In the motivational workshops and in the answers collected from to the questionnaires emerged relevant information that give an idea of what students think of Research and of Education and on the possibility to relate each other.

Conclusions

Researchers often complain that communication activities are time consuming and lack of institutional consideration (L'Astorina 2011); on the other side, schools have specific constraints that limit the possibility to introduce in class projects that go beyond the official program due to scarce time and resources. The CNR initiative RgS tried to overcome such critical aspects, giving all participants the opportunity to develop activities during a long period lasting 2 years: in this way researchers could plan activities as a part of the project's workflow and schools could choose the topics to discuss with researchers according to didactic curricula, subjects and student's interest. Making the relationship between schools and researchers less sporadic and more continuative is considered an essential condition to make the reciprocal understanding of these two worlds possible.

The whole approach here presented promotes the cultural exchange between students, teachers and researchers and encourages a new form of science communication that moves from the direct transmission to participation and elements of science co-production. This news paradigm of making science well encounters Responsible Research and Innovation (RRI) process that has been described, from H2020 research guidelines, the EU's Framework Programme for Research and Innovation 2014-2020, as a transparent, interactive process, by which societal actors and innovators become mutually responsive to each other, with a view on the acceptability, sustainability and societal desirability of the innovation process.

However, some critical points come to the attention during this initiative implementation. Not all teachers (often due to precarious positions) and researchers give their availability in implementing such a challenging proposal; they tend to give priority to their main educational or research purposes and deadlines. Every participatory and dynamic approach requires time, ideas, co-planning sessions and a certain amount of resources that sometimes are not available by the participants.

Notwithstanding, we think the methodological approach of the RgS can be a model to be better improved and further tested in the future, in order to engage new and external stakeholders in the scientific process, considering that not only the CNR but the entire system of Research today is mainly based on team research projects.

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SOCIOLOGICAL PERSPECTIVE: INTERGENERATIONAL LINKS IN VOLUNTARY ASSOCIATIONS

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Abstract

Sociology is the study of human societies and human behavior and one has to look to occurrences and transformations of social life. Division of labor is a sociological fact, division of generations has to be examined. The field of volunteering is specific: people are not paid, they work for free, they are free to choose where they want to be involved in an association and they work for other people – they are altruist – (Ferrand-Bechmann, 2013).

Volunteers are acting in voluntary associations, they work for common aims and mainly “entre soi”. Young people for young people; elderly for old people. Their fields of work are culture, health, poverty, human rights and more and more environment due to the fear of risks, etc. They develop more and more activities through ICT.

What motivations give way to involvement as volunteer? To become volunteer in an association results of a choice of affiliation : choice of the project and sometimes choice to meet people often from the same generation sharing their tastes and interests. In the case of young people especially those under 18 years old they need the support of adults and therefore develop intergenerational links.

Voluntary associations are not to be compared to other social structures such as enterprises, administrations, public services or lucrative organisations where the characteristics of the members are various and don't result from an individual and free choice.

Intergenerational links are not very strong in many voluntary associations. We are trapped in social patterns and personal experiences of division of generations. Perhaps also sexual and friendship attraction tend to increase an “entre soi” affiliation (Jaulin, 1974).

We have few quantitative or qualitative data to show how much different age groups are in the same voluntary organizations. But many observations in vivo do reveal that the seniors act in groups of seniors and the young people act with other young people as gangs.

But in environment, it seems that one can observe new forms of relationships and common learning especially through the use of ICT.

Keywords: intergenerational relationship, empowerment, youth, involvement

Introduction

The sociological eye concerning clubs, informal groups, self help groups and voluntary associations would show mainly 3 types of grouping:

- Seniors as caregivers and young people as helped (example: network of junior associations).
- Whereas in other ones the young people stay in « gangs » closed in a homogamy of age group and often gender (an association around a practice of skateboard) as well as seniors remain « entre soi » (walkers' association who walk but feel concerned by the fight against pollution).
- The few groups with intergenerational links and common projects, shared housing, remedial courses, seniors readers (Ferrand Bechmann, 2006) (“read and make read”).

I have chosen to speak about a case I have studied young adults choosing to become active in non-governmental and non-profit organizations in youth activities such as sports, leisure, cultural, humanitarian, environment and “solidarity” actions. They are supported by a network RNJA: national network of youth associations (Ferrand-Bechmann et al., 2003).

Experience gained from creating and managing projects is intended to help them master the knowledge, skills and abilities they will need to become active participating citizens once they are adult.

This action mainly takes place within the participants' own age groups and gender, although adult coordinators provide them with needed support and open doors for them. Since responsibility of voluntary associations is not formally or legally permitted in France for young people under the age of 18, these associations may be considered as a "game" or a stepping stone to paid work. The projects created by youngsters are collective and are often extensions of their childhood and adolescent leisure activities.

In this study (RNJA), we have studied the activities and projects undertaken in it, as well as the aims, motivations, representations, self-image and problems the youth face, including how they may be restricted and how they gain power. The question of empowerment is at the core of my work since years. Nevertheless, we have also taken a look at how young participants are congratulated, recognized or stigmatized by adults. What do these young people learn and what do they teach to their younger friends and to the adults around them? To whom are they transmitting their projects? What are the effects of their activities on their neighbourhood and on local development and environment? How do teachers and parents react? What may be the lessons of these experiments especially in terms of empowerment?

Empowerment, as we define it, addresses the issues of the control of one's life, the capacity to have one's actions valued and thus to gain status and power in society despite one's age or gender. However, it will also address broader research questions such as knowledge in action (Schön, 1983), a youth's ability to be the actor of self, as well as different sociological analyses of the participation and "autonomization" of young citizens.

This kind of knowledge held out the prospect of the transfiguration of life by improving man's control over the resources of nature and overt he powers that weaken his body; it offered the prospect of better understanding of society which it was thought would lead to the improvement of society" wrote Shils (1978) quoted by Donald Schön (1983).

Our hypothesis concerning the production of knowledge (i.e. the educational role) of organizations as well as the "autonomization" of their members is supported by our observations. Like with the French "Education Populaire" (Ferrand-Bechmann, 2005) movement, this role is often hidden, passed over in silence.

People from Quebec, define "empowerment" as a consequence of collective community action. Surprisingly there is no french term for *empowerment*. "To be able to act" (*capacité d'agir or capication)* might be one possible translation of this concept but in France as in other French-speaking countries, sociologists and other academics have not yet come to consensus on an accepted expression. To "empower" somebody entails a system of action that is far from assistance or support, or any tutorial form of help. It means to enable the obtaining of power by somebody unaccustomed to it: power to do but also power to define self and one's own purposes and needs on one's own terms.

Power of action… "to be able to act"… empowerment allows empowered people to be confidant, to have a better self-image and to find a better identity. In helping relationships founded upon empowerment, people trust those who empower them and those who empower trust empowerment's beneficiaries. In "Rules for Radicals", Saul Alinsky (1976) describes how deprived people in poor areas have been helped to react collectively to landlords. This social educator explains empowerment within grassroots movements.

Some authors criticize voluntary action in social work on the grounds that it is often envisaged as the consequence of, or the solution to, a reduction of public expenditures. In countries and societies where family and primary links, neighborhood and community links have declined as a consequence of emigration or changing norms and ways of living, Young adults would help their own age group or older people on an unpaid basis in a complementary role to welfare state and paid services.

One of the outcomes of involvement in non-profit organizations is the reinforcement of the social fabric including intergeneration links. Even in societies where the welfare state is powerful and even when it is wealthy, the production and benefits of community action is important in the long term as a source of conviviality. Community action binds individuals and furthers partnerships between citizens.

Young adults who give their time, are also giving their energy, their life, "*Ils se donnent en gage:* they commit themselves".

Eventually, because a part of this generation is taken into care by the welfare state and local authorities at high cost for the society (in France the "missions locales" are public agencies giving jobs, counselling and training to young people between 16 and 25 years old), the prestige of those who take care of themselves and who "serve" society is reinforced. One can point to the contrast between, on the one hand, public

programs that provide leisure, environment, sport activities, cultural ones, education and training and, on the other, the sorts of self help groups or autonomous organizations where users are actors and have responsibilities. The latter act on a horizontal basis with mutual and non-hierarchical relationships. In the former type of organization, young adults are consumers; in the latter they are actors.

All societies have divided responsibilities between adults and young people. Perhaps gift relationship (Titmuss, 1970) finds a new dimension in the voluntary association. It is a non-compulsory action but whereby young adults may find pleasure, affiliation, identification, knowledge and empowerment. Young people often are more enthusiastic in their projects than their elders.

Young people take on responsibilities themselves, even though they accept or seek the help and support of adults who serve as the middlemen in regard to the administration and financial establishments. They learn how to become responsible and committed to it, while at the same time learning to manage it.

Young people get involved for pragmatic and practical reasons (Caillé, 2003); however they develop a sense of civic responsibility once they have spent some time working together within a group. And if they take root in the community or neighbourhood, they then, thanks to the networks of connections, have the possibility of entering into the greater community, and even into life itself, like part of an initiation ritual, as stated in the first part of the title of a book by Georges Lapassade “L’entrée dans la vie…” (Lapassade , 1963).

Youth involvement ?

“Children have the right to freedom of expression” as is indicated in the International Convention for Children’s Rights. However, French law does not necessarily allow for children to associate. The 1901 Act “postulates the incapacity of a minor” without however providing more details.

In general, “associations” do not open their boardroom doors to young people due to distrust, for traditional reasons and to keep jobs and tasks for older people and for people who have seniority within the establishment. Even though “associations” are the structures that usually provide services to the youth, they are more often managed by adults, who are both volunteers and salaried workers. Young people are neither allowed to give their opinions and not allowed to take on responsibilities within these structures and thus cannot take action.

Furthermore, successful initiatives are seldom studied by sociologists (Roudet, 2009) and not even noticed, since they are often “out of the norm” and considered as “not standard”. They are not valorized by the media which dwells on a negative image. Little is known or said about knowledge and learning, the extra-curricular training and experience that is acquired within the framework of “associations”, and which should be validated. Our study have noticed that parents and teachers often ignore and do not promote the experience young people obtain from these “junior associations”.

The image of the youth given by the media is often negative and conflicting. The media and certain politicians stigmatize young people, and preferably, those who come from the suburbs and from low-income neighbourhoods. These young people are accused and victimized. A finger is pointed at them.

The young president of an association once said that he was happy to have federated a certain number of young people together so as to prove that “young people aren’t just ‘good for nothings and scum that hang around the streets’”.

Yet these views on disgust, on receding altruism and on an environment of anxieties, does not really and truly depict the youth that we saw and who we would qualify as being inventive, strategic and creative, and who are struggling to gain new rights.

For example, they aren’t really perplexed by the paperwork and administrative procedures. According to our study, only half of them seem to be discouraged by the administrative paperwork and the slowness of bureaucracy and only a fourth of them by the responsibility entailed and by the fact that they have to open a bank account.

Dissidence, innovation and creation

Their first meeting at town hall, which represents an establishment and another world - the adult world, often makes them aware of the need to be structured, and of the necessity to formalize their ideas into an “official” organization. Becoming part of an organizational network provides them with recognition and self-esteem (and finances), and the groups also mentioned that they became more at ease in their relationships

with adults.

Creating, managing and building a “1901 association” may be discouraging for young people even with adult's support. Yet, we were struck by their sense of responsibility, their maturity, the energy and activity that they put into their project as well as their seriousness including the accounting aspect. Even though groups complained about the slowness of bureaucracy, and the tedious nature of certain tasks, they were proud of what they’d done. The association to which they belong, gives them the satisfaction that they may not always get from Public Education and they invest the energy and creativity which are often stifled in their schools.

Some of them are good students, others have “given up” (cause or consequence?). For the good students, the association takes away from their free time, but not from classes. There is a type of self-reliance that comes from the appropriation of knowledge, as we’ve already seen in organizations where adults are involved.

As we have analysed in the study on European volunteer service (expertise made on the french part of the European structure in 1998), we have realized that young people invent their own forms of learning, and the results are often unexpected since the knowledge obtained is sound and significant.

The need to express themselves, to carry out a temporary or durable project, to search for partners, the need to be seen, to be recognized, to affirm their identity and the need for socialization and empowerment. The youth would like to make a certain practice official; they want to perfect their skills for work purposes or for a project based on solidarity. There are a multitude of reasons between what they say and why they actually do it.

Conclusion

We saw the emergence of new and innovative practices from young people and their will for self-sufficiency and their desire to act. For certain groups, a “junior association” is simply a way to obtain equipment, a place to meet, support, or something else, but once they are “caught in the net”, they establish and implicate themselves in some of the most open-minded and interdependent projects. The network that organizes junior associations is located at the cross-roads of the adult and youth worlds, and is caught between the desire to “laissez faire” and at the same time the desire to be available, to listen, and to simply be side by side with them.

Certain practices should be considered in terms of acquired knowledge. We find that it would be interesting and beneficial if the public education sector were to consider the know-how of its youth. We need to take a look not only at the standardized knowledge that is learned in school, but also at the competencies and skills that certain young people acquire through their extracurricular activities. We feel that elementary and middle schools should better consider the fact that these youngsters bear civic and civil knowledge and competencies.

Traditional structures, sports groups that are the most attended and the “associations” from the “Education Populaire” movement certainly play their role since we noted that junior associations developed themselves even more in innovative fields such as musics, culture, environment etc.

Even if we can’t see the protests behind this, we do note their solidarity which demonstrates their rejection of certain forms of inequality. The tendency to invest oneself paradoxically on a day to day basis both locally and on a global level can be found in this category.

There’s a lot of talk about individualism and tribalism (even gangs). These youngsters form groups together where individuals find themselves in the same project for which they share a common representation that is specific to their age group. Groups are indeed a way to social integration; however they are limited in time and social space and territory.

Some of the youth are users, others are actors; some of them are innovative and others just copy the modes and the modes of being an actor.

All of them need intergenerational links. Adults help them to develop their activities and to enter in the real life.

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ENVIRONMENTAL PROTECTION: THE VOLUNTEER'S ROLE

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Abstract

Meanings of '**ENVIRONMENT**'?

Metaphorical/physical?

Abstract/concrete?

The extension of the environment is, regardless of the particular context or meaning, delimited, circumscribed, finite even though it borders on and may be an integral part of other environments.

When we refer to environmental protection we generally intend the Earth and its atmosphere.

Its extension, too, is delimited, circumscribed and finite, at least in our connotation of the word – there isn't a spare Earth for us to overflow onto. The Earth implies the mediums which support all living organisms: the land, the water, the air. But the variety of terrains and waters, and to a lesser extent airs, is almost boundless and it is thanks to this variety that we live in a world of such abundant diversity.

Those who respect this environment hold dear the goal of preserving it for future generations and hence innumerable '**ENVIRONMENTAL PROTECTION**' agencies exist to preserve the diversity of species and habitat, and by so doing necessarily also preserve human well-being.

The '**VOLUNTEER'S ROLE**' is likewise extremely diverse depending on the organisation, the type of service undertaken, the background, experience, expertise and training of the volunteer including the time available to dedicate to voluntary work (or voluntary '*pleasure*' as it should be called!), etc..

Besides actively promoting the campaigns launched by both the International and Italian WWF head offices, my local WWF group has at present three particular ongoing projects:

'**Occhi sulle Colline**', loosely translated as 'Keeping an eye on the hills', which aims to protect the extensive hilly area around Livorno, and to develop a healthy, sustainable, safe and enjoyable utilisation of the area;

'**Pandaciclisti**' which encourages the use of the bicycle and promotes a new approach to urban transportation to reduce carbon emissions;

A Butterfly Garden as an example of biodiversity in an urban environment.

Keywords: aim, delimited, diversity, Earth, preserve, project

Introduction

What do we mean by '**ENVIRONMENT**'?

What is our 'environment'?

It could be metaphorical or abstract: a stimulating environment, an intellectual environment, a poor or wealthy environment, a cold, closed or cosy environment and so on.

It may be physical and concrete - our immediate surroundings: our room, our home.

Our place of work or study.

Our street or local area.

Our town, city.

The extension of these environments, regardless of the particular context, connotation or meaning, is delimited, circumscribed, finite even though they border on and are in fact generally an integral part of other environments.

The physical or geographic area may, of course, be extended to a county, region, state or country.

It may be a climate zone, a continent or a hemisphere.

However, when we refer generically to environmental protection we more often than not intend our world, our planet, our earth, *the* Earth and its atmosphere.

Its extension, too, is delimited, circumscribed and finite, at least in our connotation of the word – there isn't a spare Earth for us to overflow onto. Of course the Earth is in turn part of the Universe, and indeed we are already talking about the debris we have been leaving scattered around outer space, but, since we already have more than enough on our hands we'll concentrate on stabilising our own backyard in the hope that future generations may be able to extend their efforts further afield!

Yes, our world: the land, the water, the air.

The mediums which support all living organisms.

Mountains, plains, deserts, forests, ice- and snow-covered areas, jungle, savannah, oceans, seas, lakes, rivers, streams, ponds, wetlands, coasts the list is potentially endless. What an incredible variety of terrains and waters, and, to a lesser extent even airs. Such is the diversity and abundance which we are lucky enough to have inherited and to be part of.

So there we have it.

Our environment which, as we all know and recognise needs respect, care and attention. Those who respect this environment hold dear the goal of preserving it for future generations and to this end innumerable registered environmental organisations have sprung up worldwide. Many are specific to certain areas (both metaphorical and geographical) of environmental protection but there is one which symbolises ENVIRONMENTAL PROTECTION in capital letters because it has at heart our entire Planet, every single aspect of it. You all, without any doubt whatsoever know which one I'm referring to!

The World Wide Fund for Nature, commonly known as the WWF, was founded in 1961 and is the largest international non-governmental conservation organisation. It has around five million subscribers in one hundred or so countries and the most easily identifiable and universally recognised symbol.

It exists internationally, nationally and locally.

So let's look at the second word of the title of this presentation – '**PROTECTION**'.

What does the WWF aim to protect?

SPECIES, HABITAT, HUMAN WELL-BEING

Four words which sum up our entire world and its atmosphere – our entire *environment*.

That indeed is a lot to protect! A huge gigantic objective!

If you preserve the diversity of species and habitat, by so doing you necessarily also preserve human well-being. Much of human strife and struggle is directly linked to the state of the environment.

The WWF's mission is to stop the degradation of our planet's natural environment, and build a future in which humans live in harmony with nature.

In order to try to realise its mission it necessarily has to set shorter-term aims and longer-term goals.

Its present-day efforts are focussed on two broad areas: BIODIVERSITY and FOOTPRINT.

The **2050 Biodiversity Goal** is to conserve the integrity of the most outstanding natural places on Earth, thus contributing to a more secure and sustainable future for all. ***Critical places*** and ***critical species*** i.e. those which are particularly important for the conservation of our earth's rich biodiversity, have been identified.

The **2050 Footprint Goal** is to keep humanity's global footprint within the Earth's capacity to sustain life, and to ensure that the natural resources of our planet - land, water, air - are shared equitably. The negative impacts of human activity – our ecological footprint – need to be reduced.

We can all name the species of animals which are commonly known to be endangered from the emblematical giant panda to tigers, elephants, rhinos, gorillas, polar bears and turtles, but there are endless others and all these species are divided into two groups:

Flagship **species – iconic animals like those mentioned above, which provide a focus for raising awareness and stimulating action and funding for broader conservation efforts.**

Footprint-impacted species **- species from both the plant and animal kingdoms whose populations are primarily threatened because of unsustainable hunting, logging or fishing.**

Strategially focusing efforts on these species will also help conserve the many other species which share their habitats and/or are vulnerable to the same threats.

Now we'll look at the second part of the title: 'the **VOLUNTEER'S ROLE**'.

What a volunteer does varies enormously depending on the organisation, the type of service undertaken, the background, experience, expertise and training of the volunteer including the time he or she has available to dedicate to voluntary work (or voluntary '*pleasure*' as it should be called!). Yes, because the term voluntary work in English sends a message which is perhaps not entirely stimulating. If it's *voluntary* it shouldn't seem like *work*. It's not undertaken by necessity or obligation. It's something you do by choice, as a pastime or out of interest, for the community and the common good. It should be stimulating, productive, gratifying and indeed pleasurable.

It may be an occasional commitment, for example a holiday camp of some sort. Other than WWF numerous charitable organisations, both strictly environmental and non-, offer such opportunities. It may be short term as in the case of community service. Or it may be an ongoing and constant commitment.

I've been a member of the WWF for many many years and actively support the group in Livorno, an industrial and tourist port on the coast of Tuscany just south of Pisa. Our group, like other WWF groups, follows the campaigns launched by both the International and Italian WWF head offices, which entails publicising them in the local press and also organising events to heighten public awareness, to fundraise and to attract new members and new activists. Whenever possible we also integrate these campaigns into our ongoing activities which at the moment are:

- a project conceived in 2011 called '**Occhi sulle Colline**' loosely translated as 'Keeping an eye on the hills', which aims to protect the *Monti Livornesi,* the extensive hilly area around Livorno, and to develop a healthy, sustainable, safe and enjoyable utilisation of the area;
- a project begun in 2009 called '**Pandaciclisti**' which encourages the use of the bicycle as a means of getting around and promotes a new approach to urban transportation to reduce carbon emissions;
- **A Butterfly Garden** in a city centre public park called Villa Regina. This is an example of biodiversity in an urban environment.

Besides these three ongoing projects there are two WWF Reserves in the Province of Livorno: the Padule di Bolgheri (the Bolgheri swamplands) and the Laguna di Orbetello (the Orbetello lagoon), and a Wildlife Rescue Service in Val di Cornia, all on the Tuscan coast south of Livorno.

Examples of volunteering activities

I will now briefly describe the three main activities mentioned above which have been created, developed, realised and are now carried forward entirely by volunteers.

OCCHI sulle COLLINE

This is a project centred on protecting and safeguarding the approximately 4600 hectares of hilly area around the city of Livorno and developing a healthy, sustainable, safe and enjoyable utilisation of the area. This project was formally ideated by WWF Livorno in 2011 and in fact it was through this project that the connection with INVOLEN came about. One of the interesting, and unfortunately unusual aspects of this project is that it involves numerous other voluntary groups. I say 'unfortunately unusual' because often groups work in isolation rather than in collaboration which may in the short term be easier and more straightforward, but is undoubtedly less productive. The appeal of the project soon attracted many participants and 18 cultural associations formally adhered representing a wide range of interests including walking and hiking, horse-riding, mountain biking, Nordic walking, botany and zoology, archaeology and paleontology, bio-architecture and open source information technology. The project is open to new participants, whether associations or individuals.

The principal aim of the project is to share and circulate all the information available from both those who work in the area in a sustainable manner and those who live in, explore or study the area.

The first phase of the project required an interactive web platform as the virtual meeting point for the 'community', to collect and select information and as the starting point for creating work groups which then physically operate in the area. There was clearly a lot of work for the IT volunteers in the early days both to set up the site and to train others how to use and interact with it.

This interaction and exchange of information, the knowledge and expertise which transpires from so many different sources, the common objective of defending and treasuring one's own territory serve, by collecting all the different input and elaborating it together, as the basis for creating a *map of the community* which portrays the present state of the area and which can work towards a shared view of the future.

It is, of course, absolutely necessary to talk to and to deal with the public authorities i.e. those of the Province of Livorno and the three municipalities concerned: Livorno, Collesalvetti and Rosignano Marittimo. The principal activities thus far have been finding, verifying, correcting, clearing and marking footpaths both on the web platform and in reality. The first and longest footpath marked was the 00 which runs north-south parallel to the coast for about 40kms. and is suitable for walkers, horse riders and mountain bikers. Since then numerous other footpaths have been cleared and marked and large-scale maps have been printed each including information on particlular aspects of the flora and fauna to be found in the mapped area and also historical and archaeological information of sites of interest along the route. We regularly organise walks and other activities in the local hills to attract and to encourage more locals to become acquainted with them and to revitalise them. The more people frequent the area the easier it is to bring abusive behaviour such as the presence of motorized vehicles (off-road motorbikes and quad bikes), illegal dumps and so on under control.

PANDACICLISTI

The theme of this project, which began in 2009, is sustainable urban mobility. It aims to encourage local inhabitants to walk, cycle and use public transport and to discourage the use of private motorised vehicles especially those which use fossil fuels.

Habits are gradually changing, more rapidly and more efficiently in some areas and countries than others, but the results are already extremely clear: a reduction in traffic pollution (both air and noise pollution), in particular in carbon dioxide emissions, contributing to the battle against climate change and global warming.

To become a Pandacyclist you enrol on the site and you receive a registration number and a small plaque which you attach to your bicycle. With the aid of a counter you insert the kilometres you cycle on the site which are added to your personal total and also to the overall total of all the Pandacyclists registered. Besides that you also see the amount of CO2 which you have saved by not using a motorised vehicle. The Livorno Pandacyclists have cycled well over 500,000 kms. and saved well over 75,000 kgs. of CO2. The group is on facebook which since 2012 has replaced the earlier forum. The Pandacyclists collaborate with other cycling groups and also cycling shops in the organisation of events to promote sustainable mobility. Another positive aspect of the kilometre count on the site is that it gives us, the WWF Livorno group, more weight when talking to and dealing with the local authorities. We are able to show them how the number of urban cyclists is increasing and therefore need more protected lanes, bicycle racks, lowered speed limits and so on in order to make cycling safer and therefore more attractive. In 2014 we collaborated with other groups to produce and promote '*The 10-minute Campaign – the Italian Manifesto for Urban Mobility*' which aims to encourage the local authorities to adopt new and better practices for urban mobility. We organise both short and longer cycling trips and work with the authorities to attract more tourists to the area for cycling, walking and horse-riding holidays.

THE BUTTERFLY GARDEN in Villa Regina public park

The creation of this educational butterfly garden in a small area of the Villa Regina park in Livorno began in 2003. It consists of four separate beds containing dozens of selected plants and trees which attract butterflies due to the quantity of nectar they produce or because they are good host plants for caterpillars. The plants are generally typical Mediterranean shrubland plants which can survive the hot dry summer. There are also some educational boards to explain the purpose of the garden with illustrated information of the flora and fauna to be seen.

Green urban areas such as the Villa Regina park offer an excellent setting for urban dwellers to become more sensitive to nature's cycles and seasonal changes. It also offers a home to a wide variety of species who have to share the ever more problematical urban ecosystem with us. Besides the butterfly garden this double function of green urban spaces is highlighted by the numerous other events and activities which we organise in the park.

THE FIREFLY SHOW

Each year in the month of June this city park surrounded by apartment blocks becomes the setting for an amazing evening display more typically seen in the countryside. We open the park gates after dark and using only small nightlight candles to illuminate the path we guide small groups in the silence of the summer evening to the darker areas of the park away from the light pollution of the nearby lamp-posts and explain the interesting cycle of fireflies and their incredibly efficient way of producing cold light. Its a very popular event for local families.

BAT BOXES

In 2010 we installed three bat boxes on trees in the park for the purpose of offering daytime refuge for bats. In the evenings they can commonly be seen flying around hunting for insects in the park and the surrounding neighbourhood.

DEFENDING GREEN URBAN SPACES

By maintaining contact with the local authorities, writing to the local press and coordinating with other voluntary associations we try to raise the problem of poor maintenance of the parks, inappropriate and often excessive pruning of the trees and hedges and the risk of losing important ecological corridors as cities relentlessly expand.

Through our events we try to educate and inform the public of the importance of maintaining and protecting the ever-reducing green urban areas which are home to a wide variety of insects, birds, small mammals and plantlife – biodiversity in the city centre.

LIGHT POLLUTION

Lighting up the night sky is inefficient so urban lighting should only illuminate downwards not only because light dispersion disturbs bird life and causes the serious reduction of fireflies and numerous other insects in urban areas but also because it's an unnecessary waste of energy. It also becomes impossible to observe the sky by night so for this reason we organise evening events in the summer outside the city in the local hills with astronomy associations to observe the stars and constellations.

Conclusion

As can be seen from reading the descriptions above of the local WWF's activities the volunteer's role is an extremely important one and involves a great deal of commitment and responsability. It should perhaps not be so but the volunteer's role is also to put pressure on the local administration to ensure that the reducing natural environment is preserved and protected as much as possible.

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Campagna Dieciminuti

CHAPTER 3: USE OF ICT IN ENVIRONMENTAL EDUCATION

ENVI-MOBILE: A PROJECT FOR ICT INTEGRATION INTO ENVIRONMENTAL EDUCATION IN EUROPE

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Abstract

Five educative organizations from Slovakia, Czech Republic, Italy and Spain are cooperating since November 2014 on promoting an educational methodology aiming to develop 45 min lessons for 10 -15 years old students and their teachers plus a mobile database of exercises focused on integration of environmental education into learning processes. Its aims are to bring more innovative activities into environmental education through using Information and Communication Technologies (ICT) and increase the interest and participation of local people in their communities' life and related environmental issues. Primary and secondary school teachers are being provided with relevant and innovative teaching and learning materials focused on environmental education, combining general subjects and foreign language teaching (CLIL) during three international workshops. Pedagogical materials are being designed to integrate cross – subject environmental education concepts into the teaching process. Expected Project outcomes are 50 pedagogical materials ready to use and database of 500 interactive exercises aimed to improve key competencies of key educational target groups in science, technology and support of digital skills. This project carried out a needs analysis to identify key areas of environmental education finding at least 7 main topics and 50 related key themes for all 5 countries. Envi-mobile will end by August 2016, improving people's understanding of the necessity of environmental protection through innovative teaching and learning, while enhancing their capacity for being engaged in environmental decisions implemented on the local level. Also, project will contribute to enhancing international dimension of education and training through promotion of mobility and cooperation between targeted countries, supporting their capacity building in the area of environmental education. Overall, Envi-mobile will offer to EU educational community a valuable Open Access Teaching Resource: a Database of exercises for environmental education and teaching materials in 5 different EU languages.

Key words: Open Access Resource, ICT, Environmental education, App, Teaching Materials

Introduction

There is a need to promote learning that will change the way the local authorities and communities design their small economies, businesses and products. To bring European aspiration on the grounds, it is needed to improve the learning and teaching about environmental education at school level.

Based on international needs analysis (Medal, 2011); the environmental education in Slovak republic (and also in other EU countries) is facing several problems - e.g. it doesn`t comply with its elementary mission and it`s more symbolical or theoretical than practical or real. Young people are not able to undertake the responsibility for their own impact on local environment quality, because they are missing the linkage between general information and knowledge presented at schools and real life in local community (Rickinson, 2002). One of the key roles of environmental education should be not only to deliver the knowledge about the environment but to change the attitude of people and to increase their activities towards sustainability and local communities' development. Students and broad public were taught to think globally, now they should learn to act locally.

Envi - Mobile project will bring more innovative activities into environmental education and will lead the project participants towards increased interest in local communities' life.

Project, involving 5 partners active in the area of environmental education from 4 countries, Slovakia, Italy, Spain and Czech Republic, will be focused on development of innovative teaching and learning materials for environmental education targeting teachers and students at primary and secondary schools, while integrating foreign language learning (Content and Language Integrated Learning Concept, CLIL) into teaching process.

CLIL methodology was selected because, at European level, there is a growing interest towards this approach which, according to various experts, carries with it many benefits for pupils and students that should be more effectively prepared for the (multi)lingual and cultural requirements of an Europe in which mobility is expanding (Eurydice, 2006).

The aim of the project is to provide teachers of primary and secondary schools from Slovakia (SK), Italy (IT), Spain (SP) and Czech Republic(CZ) with innovative teaching materials, nowadays missing on the educational markets of the mentioned countries, combining general subjects and foreign language teaching (CLIL), while integrating cross – subject environmental education concept into the teaching process, and at the same time, improving the level of key competencies and skills of target groups in science and technology.

Through development of innovative teaching materials, project will help to:

- Increase the environmental awareness of students and to improve their language and ICT key skills, relevant to their future careers in local community or other areas.
- Guide students and teachers to understand the impact of their actions upon the landscape, the latter being a constituent part of everyday life.
- Improve people's understanding of the landscape character in terms of natural and cultural values and enhance their capacity for being engaged in policy development and implementation decisions.
- To develop innovative approaches to sustainable development that builds the capacity of schools (and organizations working with young people) to prepare students to take an active role in building the green economy and society.
- To support the students` self learning in the field of environmental issues and foreign languages via providing them with open access to innovative learning materials.

Also, project will support sharing of best practices, enhance ICT uptake in teaching and learning, enhance international dimension of education and training through promotion of mobility and cooperation between countries and targeted capacity building in the area of environmental education.

Methodology

Project implementing methodology is based upon basic Project Management cycle/needs analysis, solution development, design intervention, activities implementation, progress monitoring and evaluation.

The main activities and milestones of the project are:

- Development of a project webpage with basic project information for exploitation of project ideas
- Information leaflets and posters for project dissemination
- Needs analyses and its outcomes (available on project website)
- Development of pedagogical materials for cross-subject teaching of environmental education – 50 concrete methodologies for school lessons with the ideas how to integrate the environmental issues into general subjects
- Development of mobile application with simple exercises to increase their ICT skills and also the interest for environmental issues
- Three Short - term joint staff training courses for teachers (held in: March 2015 in Slovakia, April 2015 in Italy, May 2015 in Spain)
- National Conferences in Slovakia, Spain, Czech Republic and Italy
- International Conferences in Slovakia and Italy (2016)

Shortly after the project starts, a needs analysis had been carried out on each country for an international base line.

The most interesting environmental topics are dealt in the outcomes of the projects that are:

- a database of interactive exercises freely available on a mobile-app
- pedagogical materials developed according the Evocation, Appreciation and Reflection methodology (EAR).

EAR is a method of dealing with an environmental topic following three steps:

- *Evocation*: raise the interest about the topic and find what they know
- *Appreciation*: keeping them focus on the topic and stimulate active participation to the lesson (experience learning
- *Reflection*: the meaning for themselves of what they learnt

These outcomes are being developed with the help of trained teachers that attended short-term training courses. Each course was structured in five days where teachers were trained to these main following topics:

- Introduction of the innovative methodology EAR for planning the lesson/topic structure
- Description of lesson structure and how to fulfil it in a Microsoft Word template
- Introduction to different methods for teaching, sharing good practices and online sources of training and inspiring material (e.g. Lesson from Nature website: www.lessonsfromnature.org)
- Introduction to a web platform to create an online database of interactive exercises on environmental topics
- Introduce and practice of the design of the public place in a participative way

Results

At present, need analysis and training staff activities were completed, while the teaching methodologies and the database of exercises are still under development.

Need analysis

In order to identify precise topics and themes of the teaching materials, a detailed study based on a questionnaire with the aim to identify and specify the missing linkage between the local environmental problems and communities development, to guide people to understand the impact of their actions upon the landscape and to enhance their capacity for being engaged in policy development and implementation decisions in terms of natural values, was carried out shortly after the project start.

The questionnaire focused on more than 50 themes on actual environmental problems grouped by 7 key topics: air pollution, water pollution, waste, energy management, biodiversity, natural and cultural heritage and human environment.

Altogether there were 106 respondents from 4 countries – Slovakia (55 responders), Italy (9 responders), Spain (24 responders) and the Czech republic (18 responders) actively participating in the research. The results of the analysis were presented in Table 1.

Topic	Percentage	N. of themes
Waste	82%	9
Water pollution	67%	7
Air Pollution	64%	7
Biodiversity	62:%	7
Human Environment	61%	7
Natural and cultural heritage	60%	7
Energy	53%	6

Table 1. Percentage of interested teachers and number of themes for each topic.

Database of interactive exercises through mobile application

Teachers and students of primary and secondary schools will be provided by innovative ICT tool for mobile learning focused on key questions in the field of environmental protection, fostering pro - environmental thinking, supporting, at the same time, learning of foreign languages and developing ICT competencies.

Database will be placed on project web page for better dissemination among the teachers and will consist of 500 easy to handle/use exercises accessible also via mobile learning, focused on environmental education fostering local communities' development (Figure 1).

Multilingual exercises in SK, EN, IT CZ and ES for the use and benefit of all the involved partners, teachers and other potential beneficiaries, are being created now. Some of the exercises will be in English language only, while others will be multilingual. Database will be placed on project web page http://envi.stromzivota.sk/en/ for better dissemination among the teachers.

Database of interactive exercises targets:

- Teachers of general subjects in primary and secondary schools in Slovakia, Italy, Czech Republic and Spain, providing them with innovative tool for environmental education, indirectly fostering local communities development through supporting pro – environmental behaviour.
- Teachers of foreign languages (EN) in Slovakia, Italy, Spain and Czech republic – providing them with the content orientated innovative ICT based tool to support CLIL learning methodology while integrating environmental subjects.
- Pupils and students of primary and secondary schools in Slovakia, Italy, Spain, Czech Republic providing them with innovative tool for mobile learning, motivating them to use educational materials, to learn environmental content and foreign languages.

Figure 1A. Data base of exercises for Envi-mobile App.

857	Germany, Austria and Belgium are the best in Europe in waste recycling (2013).	40 - 50 % 50 - 60 % 20 - 30 % Add answer	Waste - Level IV.	Teacher33	NO	
856	In what possibility are the wastes correctly arranged according the intensity of their recycling - from the most to the least recycled?	multi - layer packagings, chemical waste, paper, plastics, metals paper, plastics, metals, multi - layer packagings, chemical waste Add answer	Waste - Level I.	Teacher33	NO	
855	What causes decomposition of organic waste in dumps without presence of oxygen?	formation of dangerous chemical substances which help to increase the greenhouse effect nothing, it is like a fertilizer which can be sold reproduction of weeds Add answer	Waste - Level II.	Teacher33	NO	
854	Which European country produces the largest amount of waste from the paper?	Denmark Slovakia Albania Add answer	Waste - Level II.	Teacher16	NO	
853	Which country has the largest program involving renewable energy from biomass (from sugar cane)?	Australia Brasil Slovakia Add answer	Energy - Level IV.	Teacher16	NO	
852	What type of roof is considered to be the best insulation?	a shingle roof a green roof a black roof Add answer	Energy - Level II.	Teacher16	NO	

Showing 1 to 10 of 768 entries First Previous 1 2 3 4 5 Next Last

Figure 1B. Data base of exercises for Envi-mobile App.

Pedagogical material for cross - subject teaching of environmental education

The goal of this output is to offer the teachers appropriate educational materials - methodologies for cross-subject teaching, focused on environmental education fostering local communities' development, concretely 50 pedagogical materials / methodologies as examples of school lessons for the different school subjects. Some of the lessons will be focused also on English lessons, while integrating CLIL methods to motivate students and support content orientated learning and language learning.

Methodology will be focused on concrete general school subject, e.g. maths, literature, geography etc. while integrating environmental topics and, for practising, using interactive exercises. As an activity output, 50 methodologies, ready to use in concrete school lessons, providing innovative teaching approach, will be available on the website for the public use.

Short - term joint staff training events

Teachers of primary and secondary schools and staff of the partner institutions participated at a 5 days training course (Table 2).

Location	Date	SK	CZ	SP	IT	Total
Trencianske Teplice (SK)	March 2015	5	2	5	5	17
Florence (IT)	April 2015	10	5	5	3	23
Murcia (SP)	May 2015	12	6	5	5	28

Table 2. Number of participant for each country to the short term staff trainings

One key argument of the training was linked to the development of innovative tool for mobile learning focused on key questions in the field of environmental protection, fostering pro - environmental thinking,

supporting, at the same time, learning of foreign languages and developing information technology competencies.

During the training teachers learnt how to create new exercises and how to upload them into the web platform.

The training was also focused on introduction of the way how to develop appropriate educational materials - methodologies for cross-subject teaching, focused on environmental education fostering local communities development. Within the trainings teachers were trained to several education methods that could be used to create a lesson according to the EAR methodology. They selected the environmental theme for which they will provide the lesson and then they produced a sketch of a lesson according a predefined format and discussed it with the trainers and the other participants

Figure 2. Working in group

Teachers were also trained to design a concrete public space for improving its appeal to citizens and worked in group in a concrete case study (Fig 2).

The goal of the trainings was also to encourage the teachers and vocational experts to be more active on local level and participate on local communities' development. Each training participant was asked to propose the design of the public place in their neighborhood and think about possibility, how to make any place a bit nicer, or even more ecological friendly. The ideas about the design of the public places created by training participants will be placed on project website to motivate also the public.

All project activities and outputs will be disseminated through the project website (http://envi.stromzivota.sk) and promoted to primary and secondary schools through 4 international conferences – held in Slovakia, Italy, Spain and Czech Republic.

Discussion and conclusions

In this paper the structure of the ENVI mobile project and its first results are presented. The most demanding and important activities were related to the preparation and provision of the short-term training events. This activity required strong commitment of all the partners in the preparation of the didactic material, in the provision of high quality and up to date lessons using the CLIL methodology and fostering active participation and team working and in all the organisational issues related to the events.

One issue called attention while analysing data from initial need analysis, once seven (7) key topics has been prioritised. Waste, with its 9 themes (illegal dumping, 3 R's, Type of waste and possibilities to separate and recycling, Zero waste, controlled land fields, incineration, toxic waste, consumer lifestyles and responsible shopping) was ranked and perceived as the most important local problem (82%). Second following most relevant problem topic ranked was water pollution (67%) very near with third ranked problem topic Air pollution (64%) and Biodiversity (62%) and Human environment (61%), and the last ranked topic was Energy (53%). Since Climate change is one of the most relevant challenges nowadays (Pope Francis I, and President Obama from USA, recent news release), one can notice that proximity make a real difference from people perception about what the major environmental problem is. However since web of life is an interlinked network, all these identified topics will be related fully with Climate change, Biodiversity loss, Economical and social crisis.

Our hope is that this modern educational tool will be used for teachers all over Europe and further on to improve environmental awareness and actions towards improving community environment at local level.

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Strom Zivota www.stromzivota.sk, Slovakia

INAK, www.trochuinak.sk, Slovakia

IBIMET-CNR. http://www.ibimet.cnr.it/, Italy

Vita XXI slp. www.vitaxxi.com, Spain

ZČ HB Modrý Kámen, www.svycarna.eu, Czech republic

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UNISCHOOLAB GOLAB: AN EXAMPLE ABOUT ITC LEARNING

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Abstract

This paper concerns a methodological research on science teaching, experienced between 2008 and 2014. These experiences (SISS-A060-A013- 2005-2009 and TFA first – second cycle) have involved 42 student classes with students aged from 14 to 18 and aspiring teachers aged from 26 to 48. We have worked using an engaging teaching that makes students main actors of the learning process using new technologies and we focused our attention on the relationship between teaching and learning as a part of PBL (problem based learning) methodology. This experience was born during a PhD attended at University of Perugia and which was continued as research and action plan until 2014. The main objective of this process consists in giving to students the basis to have a holistic approach concerning important environmental issues as, for example, earth climatic variations or the hydrogeological aspect of our country. We have applied a "bottom-up " process that lets students to start from local realities (climatic and hydrogeological) to finish with global concepts as global warming and the importance of the Earth's hydrogeological aspect. In order to make learning process easier and faster we have chosen to use ICT, this has allowed us to experience virtual labs and to participate to European projects such UniSchooLab, Golab and Future Class Lab. We have used smartphones to take pictures and to make short movies before moving to applications such as Google Earth, to study topographic and geological issues, Aurasma for classification of flora, fauna and rocks. During the lessons we used LIM with applications as pedlet, to compare opinions, mind map, thinglik, as e-learning object, and also: YouTube. The integration between ICT and teaching has allowed students to actively participate in the discovery of their surroundings and to go deeply in most serious environmental problems that Earth faces. These experiences have educated to students to be more conscious of the academic aspects and also more environmentally friendly in an easier and funnier way.

Keywords: PBL Problem-Based-Learning, global warming, Earth Science, ICT

Introduction

This work was born as PhD continuation (Post DOC cycle number XXIV ciclo at Università egli Studi di Perugia "Geology teaching" Problem Based Learning and integrated science 2008-2011) and it has been experienced since 2008. This experiences have involved 42 students' classes (Liceo Galileo Galilei) with students aged from 14 and 18, but have also involved Science and Chemistry teachers learning group aged from 24 to 48 years. In details this projects can count:

- 10 pilot studies and/or case control studies
- 1050 students
- 6 pivotal teacher groups related to SISS (High school Teaching Specializing School 2005- 2009) and TFA experiences (Active Learning Internship 2012-2014 at Università degli Studi di Perugia).

We have tried to answer to following questions: Can science teaching encourage students to have a mind of one's? Can PBL methodology make easier the learning process in students? Can ITC simplify the learning activities? Can students really realize how is important to respect and protect Planet Earth and they are really conscious of how many issues are jeopardizing our Planet?

Methodology

We have created and managed several pilot PBL projects and case control studies with stimulating questions, concerning environmental issues identified with local realities and we have study, using real data, we have made hypothesis and we have verified them (Bolte, 2008). The first rule to solve a problem is: know, as accurately as possible, which and what your study's object is and how does it work. Students became main actors of learning process because they have the responsibility to "solve the case". According to an enactive didactic (Rossi, 2011) we have used the relationship between didactic and other educational sciences, between general teaching education and teaching in a single discipline, between teaching and learning, between sentimental and cognitive, knowledge and relationship. Students have been involved emotionally using didactic trips in the surroundings like rafting down the Corno River (Fig.1) or looking for mineral rocks in the ex-quarry of Elba Island, discovering volcanos in the Aeolian Islands or simply a ferryboat trip in the Trasimeno Lake.

Figure 1. Students during rafting downhill in Corno River

Thanks to ICT we have taken several photos and we have made some short movies, using smartphones or cameras, and we have given to students another point of view to analyze real data. We have tried to apply *Morin's* "*tetralogical ring*" in the relationship student-teacher-learning.

Problem-Based Learnig

The methodology used in student's classes is the Problem Basing Learning, it is organized in seven phases (Savoie and Hughes, 1994): Setting, Identify a problem suitable for students, Connect the issue to the real world and to student's realities, Organize lessons concerning the project's subject but not related only to a single subject, Give students the opportunity to define their own learning experience and plan a way to solve the problem, Encourage collaboration by creating cooperating groups, Ask students to present the results of what they have learned through a project or a performance.

Each module has been developed in two stages: the concept phase and the operational one. Students, starting from the question, have defined the problem, they have chosen the part of the problem on which they will have worked, they have analyzed it in all aspects and organized knowledge (what I already know), defined what they have already to discover in order to formulate possible solutions to the problem and they have formulated hypotheses. The search path consists of collecting data and information online and from literature sources. In this phase they have used Unischoolabs, Go-lab tools.

Unischoolabs

UniSchooLabS website http://unischoolabs.eun.org was born in the namesake project, ended on September 30th 2012. In the main page you can find: Toolkit activities, where students can find: documents to study and remote or virtual laboratories with whom they can collect significant data at the end of learning process (Fig. 2).

Figure 2. Unischoolabs Website Homepage.

We have especially used the toolkit Temperature - Kinetic Theory of Ideal Gases and Thermodynamics. We have also used NASA website www.grc.nasa.gov/WWW/K-12/airplane/atmosi.html with the virtual laboratory to study atmosphere and to study physical and chemical atmosphere's properties. We have also used the remote laboratory of University of Berlin to study the ideal gas laws by using the "Remote Farm TU Berlin" and the thermodynamic PT-PV tool. Students, by using the Boyle law, have measured volume and pressure's variation for all the gas available (H2, He, CO2, N2, Xe, CCl4). At the end they have compared data and graphs obtained. Students have performed the same experience for the Guy-Lussac law. At the end of these experiences students have learned the atmosphere concept, green-house gas effects and they have answered to questions like: What Atmosphere is? Why there are temperature variations by changing altitude? Which gases impact mostly on global warming?

Google Earth

Students, using this software, can find parameters like longitude, latitude, and other parameters related to physic geography but, mainly, let students to identify itinerary, river courses, landscapes, topography and also to see amazing pictures of far places (Fig.3).

Figure 3. The Corno River course

Go-Lab

Golab project (www.go-lab-project.eu), evolution of the previous Unischoolabs, is still ongoing and there are 1000 European schools participating. The students use Data sets; they are databases which contain scientific data gathered in real experiments. These can be used directly in place of real experiments and measurements when access to such experiments is limited. The prerequisite for adding any online lab in the Go-Lab repository is that the students need to be able to manipulate at least one variable. To achieve this aim, the Go-Lab project creates the Go-Lab Portal allowing science teachers finding online labs and inquiry learning applications appropriate for their class. In particular we have used virtual laboratories for subjects like solutions, concentrations, bonds, pH, acids and bases, states of aggregation (http://phet.colorado.edu). Teachers and SISS and TFA attendee's activity has been implemented by two main projects: Scientix and Future Classroom Lab.

Scientix

Scientix (http://www.scientix.eu) is a European project that promotes and supports cooperation between STEM (Science, technologies, engineering, Math) teachers and pedagogic assistant professors and other STEM professionals. Scientix's activity can be resumed in two main phases: the first one (2009-2012), during which it has been created the online portal to collect and present European projects concerning STEM education and their results. The main networking event has taken place on May 2011 in Brussels.

The second phase (2013-2015) is to extend Scientix at national level by using the PNC (National contact points).

Future Classroom Lab (FCL)

Created by European Schoolnet, the Future Classroom Lab (FCL, http://www.fcl.eun.org) is an inspirational learning environment in Brussels, challenging visitors to rethink the role of pedagogy, technology and design in their classrooms. Through six learning zones, visitors can explore the essential elements in delivering 21st century learning: students' and teachers' skills and roles, learning styles, learning environment design, current and emerging technology, and societal trends affecting education.

PBL pilot

Ten didactic itinerary have been elaborated and for each of them it has been edited a teacher sheet, a student sheet and a learning storing. All of them start with an engaging question:

1. Mum, I've lost my compass, how can I orient myself?
2. South Pole call KT: absolute and relative history
3. Why frogs will become extinct, is the sixth mass extinction already started?
4. The barrier reef in Venice it will be saved?
5. Natural, Sparkling or Ferrarelle?
6. How much rains have to fall to have our school collapse?
7. The Corno River is still there or not? Why Corno River does not overflow as Tevere River does?
8. Does Race exist? What is your race?
9. Fine dust, legend or reality?
10. The Trasimeno lake through time and space

For example to answer question number 4, we have talked about tropicalization of the climate and weather. This weather causes hydrogeological collapses, river flow and, in this case, the water level increase in Venice. In the meanwhile we have also artic glacier melting with a consequently sea level increase.

This subject seems to be linked with four research areas: Sedimentology, Paleontology, structural geology and astronomy. To enter deeply in these issues students have watched a video showing Venice with an exceptional high tide and Venice's Mayer, Cacciari Massimo, interview.

After this video we have made our hypothesis about the issue, in particular, the new climatic and weather conditions show an increase of the average earth temperature, this impact on glacier melting and consequently on sea level increase. Students have been involved by visiting the Ignazio Danti Planetarium, in Perugia, and the astronomic observatory Coloti, in Montone (PG), and also the University of Perugia. We have been supported by ICT, in particular by you tube, google earth and Go-Lab.

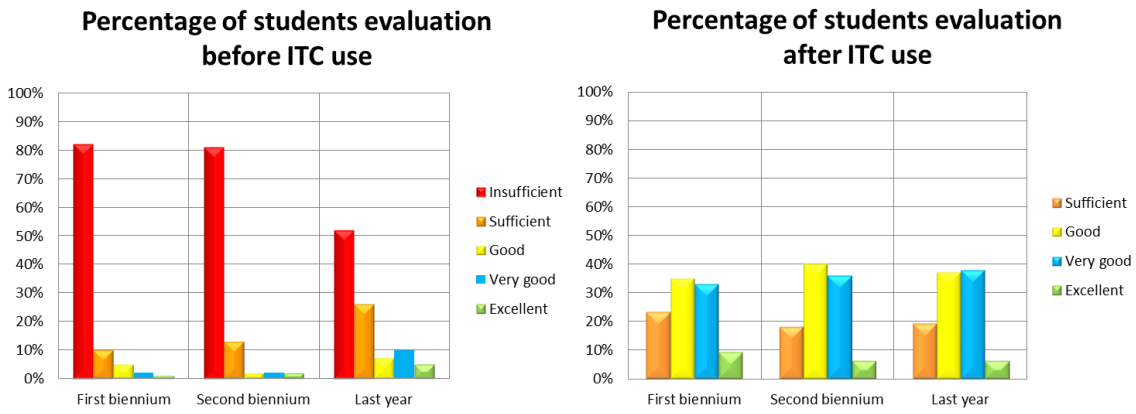
Results

All subjects have the characteristic of linking school subjects to real situations and trying to show at local level the bigger global environmental issues. We have taught themes related to Biodiversity evolution and Antarctic organisms adaptation.

Earth sciences (glaciology, environmental contamination, explorations, rivers and lakes), Atmosphere and Space Sciences (climate change, monitoring of the atmosphere and the ionosphere, astronomical measurements), technology (technologically advanced instruments for atmospheric measurements and

geological) permanent observers (weather- climate, astronomy, geophysics). Data collected have been evaluated by the administration of tests and questions made using concepts reported in the manuals more widely used in high school. Those tests have been provided to students at different times, at the beginning of PBL, at the end of the process, after six months and if applicable, after a year.

Learning process has been evaluated in terms of content, abilities, skills, motivation and satisfaction in the field of science and knowledge of environmental issues related to climate change. We have compared learning results before and after a project and we have also evaluated the differences between projects supported by ITC and projects managed without using ITC.



Graphic 1. Learning process evaluation results percentage before and after the project implemented with ITC

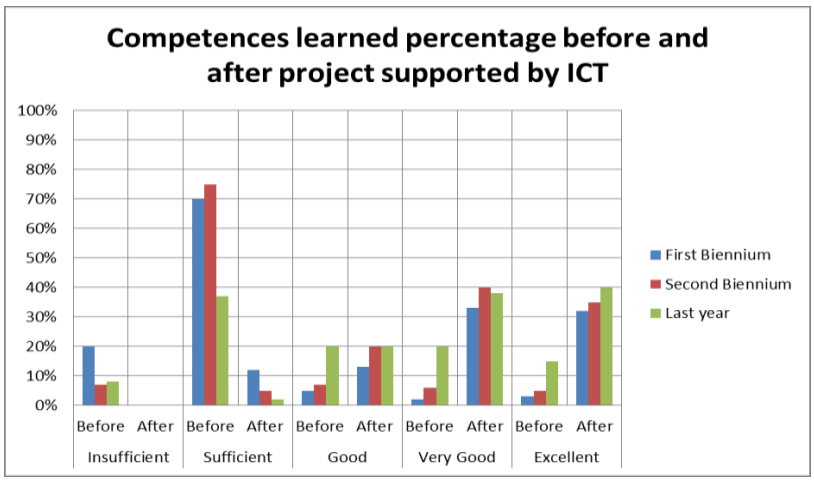
We have also compared evaluation before and after a project managed without ICT support and we have compared with the data collected and showed in Figure 4.

	Insufficient	Sufficient	Good	Very good	Excellent
First biennium	-43%	-17%	-18%	-23%	-19%
Second biennium	-45%	-3%	-9%	-16%	-23%
Last year	-10%	-57%	-22%	-23%	-22%

	Insufficient	Sufficient	Good	Very good	Excellent
First biennium	-82%	13%	-30%	-31%	-8%
Second biennium	-81	5%	-38%	-34%	-4%
Last year	-52	-7%	-30%	-28%	-1%

Figure 4. Evaluation increment or decrement before and after the project implemented or not with ITC

We have also evaluated citizen's competences by a brief questionnaire before to start the activity and at the end of the same activity in order to evaluate the effective competences variation concerning these important themes, as reported in the graph below:



Graphic 2. Competences learned percentages before and after project supported by ICT

Discussion and conclusions

Can science teaching make students able to free exercise their mind? Can the PBL method facilitate significantly learning process in students? Can ICT support and make easier learning? Can students understand the importance of respecting the Earth planet and the impact of weather changes?

The scientific method has revolutionized the history of man in the last four hundred years and is a valuable means to try to understand the reality.

Starting from observation of reality we proceed through a qualitative data collection and data elaboration in order to make a hypothesis. These hypotheses must be verified and validated, if this does not happen we have to continue with new questions and hypotheses formulation. This exercise of thought inevitably leads the individual from one side to the analysis and the other to the validation of the assumptions. Popper's falsification becomes the ordinary way to work. The use of ICT strengthens this method of learning and encourages the student to becoming inquiry learning and to be a little scientist. The added value is provided by the ability to make an analysis of reality and this is a necessary condition for every exercise. This work is inherent within this optic of European citizenship.

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INTERNATIONAL PROJECT FOR COMMUNICATING ECOLOGY AND NATURE PRESERVATION USING ICT

Schools located in different biomes cooperate, using modern technology, to further their ICT skills and knowledge in ecology and European nature conservation strategies.

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Abstract

In this international project involving a school in Stockholm, Sweden, and one in Ankara, Turkey, students research and analyse local ecosystems. The students explore different ICT tools (e.g. making short informative films, PowerPoint and Prezi presentations) to present and communicate their findings to each other in real-time via Skype. This project is now running for the fourth consecutive year.

The Swedish students study local, national, and European legislation and publications on Natura 2000. They prepare and realise a field trip to a Natura 2000 protected area in the Stockholm region where they take samples and analyse the ecosystems. The students organise their findings, make an informative short film in English with the aim to communicate their data and information about Natura 2000 to the Turkish students. To make the filming and editing process as straightforward as possible, smartphones and a basic film editing program are used.

The Turkish students also prepare and realise a field trip to a protected ecosystem in the Ankara region, where samples are taken and analysed. The region is located 20 km south of Ankara and characterized by a lake. The students work in groups to take plant and animal samples from the lake and its surroundings. Among the animal samples are both aquatic and terrestrial invertebrates (mostly Arthropoda) and aquatic vertebrates (fish and amphibia). They then try to identify the samples by using dichotomous keys. The students consult with experts from Hacettepe University for further understanding. The findings are presented in PowerPoint format via Skype to the Swedish students.

The project develops the students' knowledge in ecology and different biomes, their ICT skills, and their networking abilities with international contacts.

The project is part of the European Network for Climate Change Education in Schools – GREEEN.

Keywords: international networking, Natura 2000, ICT, communication, ecology, making short films

Introduction

Since 2007, the European Union (EU) has funded different kinds of educational development projects through the Comenius program. The objective of the Comenius program is to enhance the quality of school education through transnational collaboration (Education, Audiovisual & Culture Executive Agency, 2007).

As a part of the Comenius program, the GREEEN (Green Environment Education European Network) project was launched in 2014, building on a previous Comenius financed project called CLIMES. The intention of GREEEN is to pursue the Comenius' objectives, with focus on climate change and sustainable development (GREEEN Network 2014).

This paper reports an international collaboration between two upper secondary schools, one in Stockholm, Sweden, and one in Ankara, Turkey, which are both partners in the GREEEN Network. The two schools shared the ambition to have a meaningful cooperation to enhance the quality of ecology education, and to let students explore different information and communication technology (ICT) tools (e.g. making short

informative films, PowerPoints and Prezi presentations) to present and communicate their knowledge in ecology. This project has now run for fourth consecutive years.

The two schools share the same three motivational drivers (see figure 1) for participation in and development of what they call the Ecology Project, namely: membership in the GREEEN Network, the national curricula of Sweden and Turkey, and the learning process of the students.

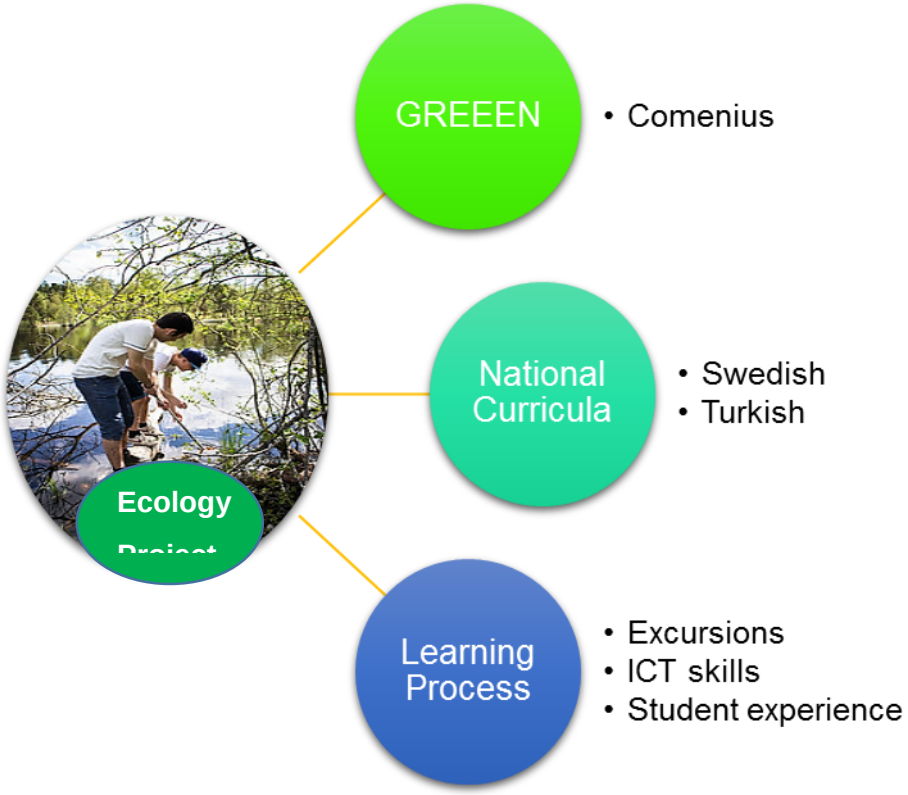

Figure 1. The motivational drivers of the project; the GREEEN Network, the schools' respective national curricula, and a shared view of the students learning process.

Swedish and Turkish curricula both state that general ecology studies and ecological sustainable development are part of the core content in the Biology course in upper secondary school. The curricula also mention that the students, within the Biology course, should have the opportunity to develop their ability to plan and carry out excursions and to communicate their knowledge of biology using a scientific language (Skolverket, 2011a; Talim Terbiye Kurulu Başkanlığı, 2013). Furthermore, for the Swedish students, using computerised equipment for presentations is mentioned in the general aims of the subject Biology as well as in the subject English (Skolverket, 2011a; Skolverket, 2011b). In the curricula for the subject English it is also stated that the students should have the opportunity to develop their ability to adapt their language for different situations and recipients. The students should also read a variety of formal and informal texts, for instance governmentally issued documents (Skolverket, 2011b).

Two key didactical tools important for the project are field excursions and ICT. There is strong evidence that excursions are one of the most effective place-based activities that help teachers achieve learning outcomes related to most subjects, including biology, chemistry, geography, environmental science etc. Although it takes time and money to prepare these types of activities, most teachers still perceive field trips to be highly valuable educational experiences for their students (Anderson & Zhang, 2003). Sobel (2003) states that these real-world learning experiences are very valuable for enhancing academic achievement, and letting students create a stronger connection to their local community.

More and more students have access to computers, smart phones, and other digital devices in their schools (European Commission, 2013); this access to ICT opens up new possibilities for learning. In the Ecology Project, the objective was for the students to learn about Natura 2000, and ecology, and then present their

knowledge in informative films in English. These had to include video clips filmed in a Natura 2000 area, maps, pictures and other applicable modes.

According to McDermott (2010), it is advantageous to adapt a multimodal approach in teaching science. This involves incorporating many aspects of the subject and different ways of delivering the information, for instance by using charts, graphs, pictures, or mathematical equations. The students need to learn strategies to embed their different modes in their texts in order for the multimodal approach to be valuable.

A key part of the Ecology Project was to have an authentic audience for the student produced films. What is the importance of having a real recipient, as opposed to just the teacher and classmates, in order to further develop students' knowledge of theory, as well as their communicational skills? Many studies state that it is very important, and that it is highly beneficial for student learning, especially when the recipients are younger (e.g. McDermott, 2010; Chen, 2013). When students are required to adapt their language to an authentic recipient, they have to explain a concept in their own words. McDermott's (2010) results regard text-based outcomes and not short films, yet his conclusion - that students learn more by having to convey their conceptual understanding to a real audience - is relevant to us. With ICT, the possible authentic audience can be anyone, and anywhere, in the world.

Making an informative film about a specific topic in school, intended for an audience besides the class and the teacher, the students need to consider more than one aspect. They need to think audio-visually, they have to adapt their language to the recipient, and they have to make sure that the results they are to present are easily understood by the audience. All of this allows the students ample opportunity to develop their understanding of the topic, as well as give the students a different way of showing their knowledge. Furthermore, for dyslexic, or verbally strong students, together with those who might have a fear of public speaking, a recorded presentation gives the teacher a good material to evaluate.

What we wanted to achieve in this project was to develop the students' knowledge in ecology, ICT, and international networking. By combining all the above-mentioned modes, the students had to make the knowledge their own, they had to adapt their language to the intended – authentic – audience, and they had to incorporate pictures, film-clips, maps and other visual elements in their presentation.

Methodology

In both Turkey and Sweden, ecology is studied in the first year of upper secondary school when the students are between 16-17 years old. In both school systems the students need to learn about ecological sustainable development, how to plan and carry out excursions, and to communicate their knowledge of biology using a scientific language (Skolverket, 2011a; Talim Terbiye Kurulu Başkanlığı, 2013).

By combining all these elements, the Ecology Project was created. A class of 30-32 Swedish students attending the Biology course, and a Turkish group of the same size involved in an extracurricular activity, joined the project. The students were divided into teams consisting of 4-6 students in each; these were not mixed between Swedish and Turkish. For the Swedish students involved, the project was an obligatory part of the biology course, whereas the Turkish students had already finished the ecology part of the course, and the project was an opportunity for those who showed extra interest to further enhance their understanding of ecology.

The Ecology Project entailed that students gathered information and data through literature and an excursion, and communicated this to the students from the opposite country. Everything was administrated and coordinated by one biology teacher from each school. In Sweden, the excursions involved, besides the students, one teacher, and in Turkey, up to 4 teachers and university expertise. Previous years, the project has had a timeframe and a set date for presentations, agreed upon by the teachers, however, since this years' - 2015 - products were short films uploaded on Youtube, a set date was not necessary.

The Swedish students were evaluated in accordance with the Swedish curricula, based on the working process and the project output, i.e. the film. A matrix (appendix I) was used to grade the students individually and in groups. The film was graded regarding two different aspects; one, how well they had understood the theoretical material, and two, how well they communicated the content.

The Turkish students were not graded as the Swedish students since the project was implemented as an extracurricular activity and included only 1/6 of the 10^{th} graders in the school. The certificates that were exchanged at the end of the project was an important motivator for them since they could be used as part of their CV for further studies.

Results

To enhance knowledge about ecology, and European nature and biodiversity policy, the students of each country were given the task to communicate and explain about a local ecosystem, using formal and scientific language. To enhance ICT-skills, the students had to present their findings digitally to an authentic audience, consisting of people their own age that they get to know through this project.

The Swedish students were given official documentation and received the following instructions for the 2015 Ecology Project:

You are to make a short informative film in English with the following content:

- What is Natura 2000?
- Who is responsible for Natura 2000 in Sweden?
- Present the area, it's nature and importance to the local community
- Present the eco-system with example of characteristic and typical species
- Present the management plan for the area

The content has to be understood by someone who has never heard about Natura 2000 before, and the audience is Turkish students in the same age group.

The timeframe of the project was about 8 hours in school divided on 6 occasions, and 8 hours for the excursions divided on two occasions. The Swedish students had to make a plan for the execution of the project. The timeframe and planning turned out to be a problem, only one group managed to present a film in time.

The Swedish students, with only little knowledge of ecology prior to the project and no knowledge of Natura 2000, managed to produce informative films of varying quality. The quality of the theoretical content and the quality of the ICT skills did not necessarily correlate. Some groups managed very well to convey their understanding of ecology and communicated this well by embedding the different modes – footage, pictures and narration – thus making an actual informative film. It was clear that the Swedish students had their audience in mind when making their films since they, for instance, addressed their recipients. The two best movies, both regarding theoretic content and ICT, were made by the students who payed extra attention to the recipients.

Below are two representative films. The group who made the first one managed very well to combine the theoretical content and the footage to make a comprehensive film. The second one have interesting content but the footage is not in sync with, or even supporting, the narrative.

Natura 2000 Film 1

Natura 2000 Film 2

The Turkish students were instructed to include the following in their films:

- Types of plant and animal species that were observed in the area
- The habitat of observed species
- The abiotic factors that influence their lives
- Different pollination and seed dispersal methods seen among plants
- How this field work influenced the students' understanding of nature
- Human impact on nature

The Turkish students did an excursion more similar to previous years, however, they also made a film. During the excursion, experts in botany and entomology guided the students and gave information about the plant and invertebrate species in the area. The students took notes that they later used for preparing their informative film.

The time frame for the preparation of the movie was 4 weeks, starting with the excursion. Then students gathered notes in order to determine the content of their narration, and collected visual footage taken by different individuals. During the process they were given feedback about their progress.

Prior to the project, the students had knowledge of ecology and classification on a basic level. The ones who created the video were able to integrate this knowledge to what they observed during the excursion, thus their product met the criteria set by the teachers.

Film: METU Field Trip

Discussion and conclusions

This paper is a description of a project and not scientific research. It would be interesting to study how making films affects student learning and whether, as we suspect, an authentic audience is decisive for the outcome. This would include having different groups of students studying the same core content, where some make films for students abroad, some make them for their classmates/teachers, and some not making films at all, and finally evaluate their knowledge of the core content. We consider that when students have an authentic, and unfamiliar, audience in mind for their presentation, they learn more. This didactic methodology is interesting in another context, i.e. when age groups are mixed, this would, according to studies, give extra good results.

For the Swedish students the Ecology Project gave extra meaning to the excursion part of the biology course. This was partly because the official documentation presented by Natura 2000 and Swedish authorities is very comprehensive and provides a good tool for understanding ecology.

Also, the project forced the students to explain and illustrate their explanations with footage and excursion data. For basic knowledge of ecology, this later statement is not as well represented in the films as we would have wished for, however, this knowledge is shown in other ways throughout the Biology course. Conversely, the understanding of European nature and biodiversity policy are well represented in the films. As for the Turkish students, this study helped them to look at their environment from a new perspective as well as providing them with an invaluable learning experience. They had a chance to observe many species in their natural habitat and their interactions with both biotic and abiotic environment. They had the opportunity to learn the basic characteristics of many plant families and invertebrate taxa in an authentic context. Not all but most of the outcomes are evidenced in the film.

As the schools are located in different biomes, the project gave an interesting perspective on ecology and it also made the students realize that the scientific language gives them a platform for communication. Having to use English, and to embed photos, maps etc. forced the students to make the information their own, and incorporate different modes in their presentation - everything in order to help the students enhance their learning in ecology and ICT.

For the students, the opportunity of networking with other students in a different country can be both highly motivational, yet sometimes frustrating. This is especially the case for students who do not feel confident in their English proficiency. On the other hand, since the presentations were prepared in advance, or recorded (thus making retakes, in case mistakes were made, possible), this anxiety can be countered.

Even though the evaluation process of the students' performances were very different in the schools, it was not a hinder for a fruitful cooperation. The project itself was not dependant on grading a final product, although this was a possibility. A networking project like this can easily be done between countries with different school and grading systems, and course curricula.

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MARINE LITTER IN THE PELAGOS SANCTUARY: ALONE WE CAN DO SO LITTLE. TOGETHER WE CAN DO SO MUCH!

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Abstract

SeaCleaner project aims to involve and raise awareness in students and citizens about the environmental problem of beached marine litter. During this project's course Middle and High school students take part in a real scientific research and acquire skills to understand and try to solve this environmental emergency. SeaCleaner allows an intergenerational approach in educational issues: the High School students act as teachers for Middle School students. Moreover, students involve their families and other citizens in the monitoring activities, and researchers work together with volunteer association to pursue the goals of the project.

Keywords: intergenerational, peer education, citizen science, marine litter.

Introduction

One of the problems affecting our seas is marine littering, i.e. anthropogenic wastes floating on the sea or spread over beaches and coastal areas, recently included amongst the 11 descriptors of the Marine Strategy Framework Directive (MSFD) (Galgani et al. 2014).The rate of accumulation of anthropogenic marine debris (AMD) in the Mediterranean sea is increasing (Suaria and Aliani, 2014), and this issue could have severe consequences on marine and coastal communities [3], especially those belonging to special protected areas, such as the Pelagos Sanctuary (http://www.sanctuaire-pelagos.org/en/) in Ligurian and Tyrrhenian sea. At the moment, the available data about beached (and floating) litter per unit of surface for the coasts surrounding the Pelagos Sanctuary are still very scarce (Suaria and Aliani, 2014; Fossi et al.,2014; Galgani et al.,2013; http://www.legambiente.it/marinelitter/). Given this context, the urgent need of long-term data series can be satisfied through the so-called "citizen science", i.e. by favouring the involvement of citizens, as indicated by the UNEP/IOC Guidelines (Newman et al., 2012; UNEP, 2012;Cheshire et al., 2009), which suggest how researchers may increase the number of collected data. Citizen participation in these kinds of programs has been demonstrated to be effective both from the scientific and social point of view since it brings people closer to science and fills the gap between science, technology and those who benefit from it (Cerrano et al., 2013).

SeaCleaner project was launched just to satisfy these needs. In detail, in 2013 ISMAR (Istituto di Scienze MARine - Consiglio Nazionale delle Ricerche) decided to involve students in a project concerning monitoring programs of beached marine litter. Currently the SeaCleaner network includes two research centres (ISMAR-CNR, Istituto Nazionale di Geofisica e Vulcanologia – INGV), a technological cluster (Distretto Ligure delle Tecnologie Marine - DLTM), the biology department of Pisa University, the Municipality of La Spezia (involved through LABTER, the laboratory for environmental and territorial education), and five protected marine areas (Cinque Terre National Park, Porto Venere Regional Natural Park, Montemarcello-Magra Regional Park, Migliarino, San Rossore, Massaciuccoli Natural Park, Tuscan Archipelago National Park) in Ligurian and Tyrrhenian sea surrounding the Pelagos Sanctuary. The main aims of the SeaCleaner project concern both educational issues and scientific outreach: the first aim is to

involve the students in a new pedagogical approach (i.e. peer and intergenerational learning) to build a critical attitude towards scientific discipline and trying to improve their science perception; the second one is to monitor beached marine litter, estimating their typology, quantity and accumulation rates, and providing tools for the correct management of the issue.

Methodology

The methodology used in this project allows a direct involvement of the students, with a didactic and non-conventional approach, in a real scientific research, making them aware of current environmental problems and teaching them the possible strategies to solve them.

An added value of the project is to use the peer education strategy (Cerrano et al. 2013), creating and improving the student-student interaction. Such a process of shared communication goes beyond the educational moment and becomes a real opportunity for the peer group to freely discuss and develop new didactic-playful methodologies and competences confrontation. This approach allows the students to test their own skills and to create a relationship between peers (Catarsi and Ciardi, 2010).

In particular, participation and co-working of students coming from different schools of different grades and different regions, have been considered essential to foster social skills and intra and intergenerational communication. This kind of communication in the SeaCleaner project is ensured by a big network that includes: research centers, public and private institutions, teaching and non-teaching staff, students as participants of the activities also involving their families and volunteers; in brief, the whole community (European Commission, 2006).

The students have been prepared by researchers and teachers to monitor beached marine litter through to use of a special protocol realized for the SeaCleaner (Merlino et al., 2015) project in line with IOC/UNEP classification program (UNEP 2012; Cheshire et al. 2009): counting, classification and volume estimation of beached marine litter; analysis and post-processing of data collected through the use of web-GIS system.

The project was carried out with different methods: short or long periods of stage, *in situ* activities and *in office* activities.

Finally, the students attitude toward science has been tested through a questionnaire carried out by the Working Group for Science and Education (WGSE) established by five research centers (ISMAR, INGV, ENEA - National Agency for New Technologies, Energy and Sustainable Economic Development, CSSN - Science and Technology Organization, Centre for Maritime Research and Experimentation and DLTM, with headquarters in La Spezia (Locritani et al. 2013). The questionnaire aimed to evaluate the perception of science in the students taking part in the scientific project or in outreach events organized by the WGSE (Locritani et al. 2015).

Results

The first didactic and educational result of the project is students' participation in monitoring activity and outreach events. In detail, students work together with researchers during the monitoring period in the selected marine parks and during the didactic activities.

High school SeaCleaner students acted as tutors for primary and Middle School students during the European project "Research Night 2014" and other *edutainment* (Corona et al. 2015) events, a neologism for education and entertainment actions. In particular, the didactic path "Riders of the lost litter", provided the use of *diorama* representing both a polluted beach and an uncontaminated one where the children could simulate the experience of the SeaCleaner project. These experiences and other ones lead High School students to consolidate the acquired scientific concepts and the specific competences in science communication (learning by teaching). For example, the students realized owns seminaries and documentaries to illustrate the project to their classmates and schoolmates, experiences and output products that have been evaluated by teachers and researchers (INDIRE, 2013). Students cooperate with volunteer organizations such as during the Clean-the-Med event and cleaning of San Rossore beach (Fig.1) and, last but not least, they realized a special android-app named "SeaCleaner App", easy-to-use and, at the same time, methodologically sound and comprehensive, that should support volunteers during scheduled trash removal campaigns (Merlino et al. 2015).

Figure 1. SeaCleaner students during activities; cleaning of San Rossore beach with the special collaboration of two camels.

In 2014/2015, 82 students of Middle (59) and High School (23) involved in the SeaCleaner responded to the questionnaire, projected by WGSE to test science perception before and after the activity period, to test the possible personal variation of students perception of science after the activities; in 2013/2014 the questionnaire has been administered only after the activities, to 18 High School students. In both cases, the results of the SeaCleaner have been compared with ones of a pilot study concerning the science perception in a representative sample of La Spezia students (Locritani et al., 2015). The data analysis discerns female and male attitudes.

	Percentage of satisfation (%)					
School	Middle level					
Project	SeaCleaner				SeaCleane	Pilot Study
Administration	First		Second		Second	First
Gender	Female	Male	Female	Male	Mean	Mean
Interest in science subjects	59,5	69,4	54,3	69,7	62,0	62,9
Future projection of the personality	60,6	60,4	61,4	58,3	59,9	58,7
Science perception	60,0	58,0	55,6	57,2	56,4	61,0
Scientist perception	53,9	58,5	52,8	58,3	55,6	56,6
Frequency/interest in extracurricular activities	24,8	24,4	27,5	24,2	25,9	41,9

Table 1. Results concerning the degree of interest in science issues of Middle School students involved in SeaCleaner.

The Middle School students (Table 1) don't show a marked interest in scientific issues, but for both genders the percentage of satisfaction doesn't go below 50%. During the first administration in Middle School, males showed more interest (about 3%) in science issues with respect to female. After the project, for Middle School students, the interest in science decreased with a greater decrease for the females. The final mean value (females and males, total) is lower than the one obtained in the pilot study performed for WGSE. This fact demonstrate that in the Middle School period it is more difficult to capture the interest of the students. Probably this student sample was initially formed uninterested students in science topics, especially for female students, as shown in table 1 (note that the participation of these students was decided by their teachers). On the contrary, the post-activities results for the High School students (Table 2) are positive in the sense that the mean (considering both females and males) value for the interest in scientific issues is higher (5%) with respect to the study pilot, perhaps because in this case students themselves decided to

be involved in the project, which indicates an initial major personal interest in the treated argument. Moreover, the longer time the High School students spent with experts involved in the SeaCleaner project (80 hours) allows them to become more conscious toward scientific research and environmental problems, with respect to the Middle School students (only 3 days involved). Note the difference between females and males responses, with a major interest for science in males (about 5%); note that the science interest values of both the SeaCleaner and pilot study High School students are lower than the correspondent values for Middle School students. These percentages show, in general, that the interest for science decreases with the age, confirming previous results (Locritani et al., 2015).

	Percentage of satisfation (%)			
School	**High level**			
Project	**SeaCleaner**		**SeaCleane**	**Pilot Study**
Administration	**Second**		**Second**	**First**
Gender	**Female**	**Male**	**Mean**	**Mean**
Interest in science subjects	45,6	52,0	48,8	44,7
Future projection of the personality	64,0	72,0	68,0	62,1
Science perception	63,6	67,6	65,6	57,3
Scientist perception	65,0	72,0	68,5	64,7
Frequency/interest in extracurricular activities	44,2	44,1	44,1	41,2

Table 2. Results concerning the degree of interest in science issues of 41 High School students involved in SeaCleaner, after the second administration (post activities).

Table 3 shows results emerging by comparing a group of students working on beach monitoring (*in situ*), and another group working only in data analysis (*on office*).The *interest in science* is increasing (about 5%) for students who participate in the *in situ* activities, and decreasing (about 4%) for the students engaged in office work. Note the opposite trend for females and males: females prefer the *in situ* activities, while males prefer to work on office. It would be useful to investigate the reasons for these differences, and especially the reason for the great grow in female interest for science during "*in situ*" SeaCleaner internship (starting from 33,3 up till 63,5). A possible explanation that also takes into account the steeper decrease detected in female science interest passing from primary to secondary school (Locritani et. al 2015), could be found in the family and environment influence. Female students are generally less stimulated and involved about scientific issues by their parents and relatives (science books or documentaries, scientific laboratories/environmental activities, etc.) and external inputs (mass media, TV, science-movies etc), which explains the general decrease of interest in science with age and, also, the decrease detected for our middle-school sample of female students: a very short and not contextualized activity that does not differ so much from the standard scholastic activities (class lectures, theoretical exercises etc.), and it is not sufficiently stimulating to change the low perception that these girls have of science. So, female high school students participating in the "in situ" internship probably begins the stage with very few "expectations", but, instead, they realize how interesting the proposed scientific activities are and they change their science perception and interest in it.

	Percentage of satisfation (%)							
School	High level							
Location	in situ				in office			
Administration	First		Second		First		Second	
Gender	Female	Male	Female	Male	Female	Male	Female	Male
Interest in science subjects	33,3	57,1	63,5	58,3	50,0	56,4	33,3	57,1
Future projection of the personality	69,1	78,9	73,2	69,6	78,6	69,4	69,1	78,9
Science perception	62,1	74,5	77,3	67,1	72,7	71,9	62,1	74,5
Scientist perception	53,9	58,5	52,8	58,3	75,0	79,8	62,5	76,2
Frequency/interest in extracurricular activities	62,5	76,2	81,3	76,6	43,3	41,0	36,7	44,8
Mean value (Female/Male)	56,2	69,0	69,6	66,0	63,9	63,7	52,7	66,3
Mean value (All)	62,6		67,8		63,8		59,5	

Table 3. Results concerning the degree of interest in science issues of students involved in SeaCleaner, for the first and second administration and for two sub-sample of High School students.

In any case, as the questionnaire has been submitted to a restricted number of students, the results are, so far, only qualitative. We need a higher number of students to statistically support these results.

Conclusions

In the framework of the SeaCleaner project, the participation and the collaboration of students of different ages and geographic regions allows for experiment education through peer and intergenerational learning. First results of the administered questionnaire about the perception of science show that long period activities have more effectiveness with respect to shorter ones. It emerges that extracurricular activities are attractive for students and, in particular, females prefer field activity while males prefer the in office one. These, and other remarked differences about males and females preferences, could be due, possibly, to the different educational influence on the two sexes, both social and familiar. More data is needed to confirm this trend. Lastly, scientific results emerging from the 3 years of survey are indeed interesting, but are outside the specific topic of this work.

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CHAPTER 4: APPS AND GAMES IN ENVIRONMENTAL EDUCATION

USE SERIOUS GAME DESIGNS TO IMPROVE EDUCATION EFFECTIVITY OF COMPLEX ENVIRONMENTAL ISSUES: FLOOD CONTROL AND ECOSYSTEM SERVICES

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Abstract

The issues of ecosystem services, flood control and its social and economic impacts rank among the most complex and difficult disciplines in environmental education. For an effective interpretation and education it is necessary to choose an appropriate teaching methods. This paper presents the game design and game use experience of a two interactive serious games based on the principles of constructivist pedagogy and heuristic education.

Both games are inspired by actual Central European environmental issues and both are based on similar education methods, but there are thematic and functional differences between them. The game called "Beware of the flood!" is focused on the flood-control systems in the landscape and are the main target group are primary school pupils. The second game called "ESLAND" (Ecosystem Services LANDscape) deals with ecosystem services, sustainable landscape management and stability. It utilizes our experience gained using the game „Beware of the flood!", but it widens its aim to the secondary school students, landowners and general public. It enriches the ways of game evaluation and game flexibility as well.

Both games are focused not only on increasing environmental awareness in fun and interactive way, but also want to improve evaluation methods of multimedia learning and to contribute to intergenerational and interdisciplinary learning.

Keywords: ecosystem services, flood control, serious games, multimedia learning, pedagogical constructivism

Introduction

The "Simulation-Gaming" expression (Duke's, 1974) and the oxymoron "Serious Games" (Clark Abt, 1970), both abbreviated as SG, represent with no doubt modern education tools efficiently used, especially for understanding complex and difficult topics. Environmental issues such as Flood control and protection of Ecosystem Services are characterised by a huge range of complexity and integrate a wide range of natural, social and economic aspects. Comprehension of interconnections is essential in the current economic-based world where economic considerations play the main role in a decision making and landscape planning. Concept of Ecosystem services shows both positive and negative influences of nature on human society and the economy. Provisioning Services (e.g. food, freshwater and fuelwood production), Regulating Services (e.g. climate, disease, water regulation) and Cultural Services (e.g. aesthetic, cultural or educational values) (Fisher, 2009) provide financial and non-financial benefits to society. On the other hand ecosystem malfunction, represented by floods, droughts, illnesses or soil dysfunction, can cause big losses not only directly decreasing money income but also endangering welfare and even lives.

A pair of interactive SGs has been developed with the purpose to improve social impacts of environmental education and to enhance the evaluation methods of multimedia learning.

Methodology

Our SG games are designed as a simulation of a realistic landscape representing the examples of a land management. A player is placed into the role of land manager and on the base of his/her decisions the landscape stability is influenced. Economic aspects are considered as an important game indicator, however the landscape stability and its consequences plays a crucial part affecting game results.

The first game is called “Beware of the flood!”, and it has been used over the last 2 years for education with high success. The second game called “ESLAND” (abbreviation of Ecosystem Services LANDscape) has recently been developed using approved methods from for more complex topic. Comparison of both games is drawn in Table 1.

	Beware of the flood!	**ESLAND**
Topic	Flood control	Ecosystem Services (including flood control and others)
Context	Interaction with the software (with or without tutor)	Interaction with the software (with or without tutor)
Learner specification	Primary school students working singly or in groups	Secondary school students / landowners working singly or in groups
Pedagogic considerations	Constructivist Teaching and Kolb’s Experiential Theory	Constructivist Teaching and Kolb’s Experiential Theory
Mode of representation	High level of interactivity represented by playing as a multiplayer role playing game with discussion	High level of interactivity represented by playing as a multiplayer role playing game with discussion, enables Content management and sophisticated evaluation

Table 1: Comparison of developed games

Didactic approach

The didactic basis of our serious games is based on Constructivist Teaching Theory (Richardson 2005, Cooperstein, Kocevar-Weidinger 2004, Bílek 2008) and Kolb’s Experiential Theory (Kolb 1984) where learners learn through conceptualisation and application into practice learning. It uses the term of “naive preconcept” – the learner has to remake his own ideas on the basis of his experience gained through the game playing. To be successful he/she can´t simply accept new information, but to understand it. Constructivist Teaching requires a different role of the teacher – instead of a tutor he´s becoming an advising mentor and instructor. A practical example of such use is a method of “Blended learning” (Macdonald 2006) using the combination of e-learning and lectured face-to-face education for multiple players (e.g. classroom).

Games description

Beware of the flood!

The SG “Beware of the flood!” is turn-based Adobe Flash game focused on the relation between landscape management and flood control. It has been created as a didactic activity of the Museum of Moravian-Wallachia region, but it exceeded museum´s province (Husák 2013) through the cooperation with universities (Palacky University Olomouc, University of Edinburgh) and other institutions (Ministry of Environment in the Czech Republic, River Morava basin). The main target group are primary school pupils, but it can be used for general public, secondary school and university students as well. Its theoretical background was derived on the basis of literature (Hladný 2004, Langhammer 2007, Brázdil 2011) and consultations with experts. Graphical base and game principles are derived from natural and cultural features of the Moravian-Wallachia landscape.

The goal of the game is to protect a town in the valley against flood. Players are placed into the role of a municipal council and on the base of their decisions the flood resistance of the landscape is changed. Each turn they can invest money into one of 6 options (flood control systems), which are randomly chosen from

6 flood control options (Table 2). Each option is explained and after purchasing it influences the flood resistance of the landscape (Table 3). After several turns (the player doesn´t know exactly when) comes a flood testing the efficiency of current flood control. The amount of financial losses and casualties is proportional to the level of flood resistance.

A (excellent)	B (good)	C (suitable)	D (not-suitable)	E (profitable)
Wetlands revitalisation	Flooding polder	Small reservoirs	River regulation	Clear-cut felling
Grove revitalisation	Levee construction	River shore vegetation planting	Draining canals	Selective-cut felling
Infiltration belts	Stream bank revitalisation	Little weirs construction	Spruce monoculture planting	Supermarket building
Contour lines ploughing	Bridge renovation	Dam construction	Converting meadows to potato fields	Housing development
		Mixed forest planting	Wood roads asphalting	Bottomland forest felling
		River grit mining		

Table 2: Flood control options

Package	Option	Flood resistance	Finances	Description	Explanation
A	Grove revitalisation	+15	-3	Let's plant green vegetation in the landscape, especially in the slopes. Planting cost is 3 mil. £.	Excellent! Groves can lower the erosion rate and slow down torrential rains outflow..
D	Draining canals	-10	-10	Agricultural adjustment enables to drain the water from fields and meadows. Acquisition cost is 10 mil. £.	Unfortunately, draining canals enable to fasten the water outflow.

Table 3: Options description and rating example

SG "Beware of the flood!" is available in Czech and English language versions and both versions are available on the Internet (http://www.ursus.cz/soubory/povodne/beware_flood.html, http://www.ursus.cz/soubory/povodne/pozor_povoden.html).

ESLAND

"ESLAND" is a game designed as a web-based SG game with content management and evaluation system. The name is an abbreviation of "Ecosystem Services LANDscape" thus it is focused on Ecosystem Services and sustainable landscape management.

The Player takes the role of land manager – who has to take care of estate for the next 20 years maintaining economic prosperity and ecological functioning. Each year he/she can choose between 4 different activities; the activities are based on different land use choices (farming, grazing, forestry and built development). There are different kinds of resources: crop, livestock and wood production generating money each year (Provisioning Ecosystem Services). Each activity will usually consume some money, but it will also generate some annual income. Activities can affect the landscape stability (Regulating Ecosystem Services) – soil fertility, pollution resistance, water retention and biodiversity. Each year some natural or social phenomena can occur depending on the landscape stability. There can be negative phenomena such a natural disasters

(flooding, drought, forest fire), pollution problems, environmental penalties and other hazards; there can also be positive events such an organic farming or ecotourism income. These events can significantly influence the money budget and the player can understand positive or negative feedback of his deeds. Game over occurs after 20 turns or in the case of bankrupcy.

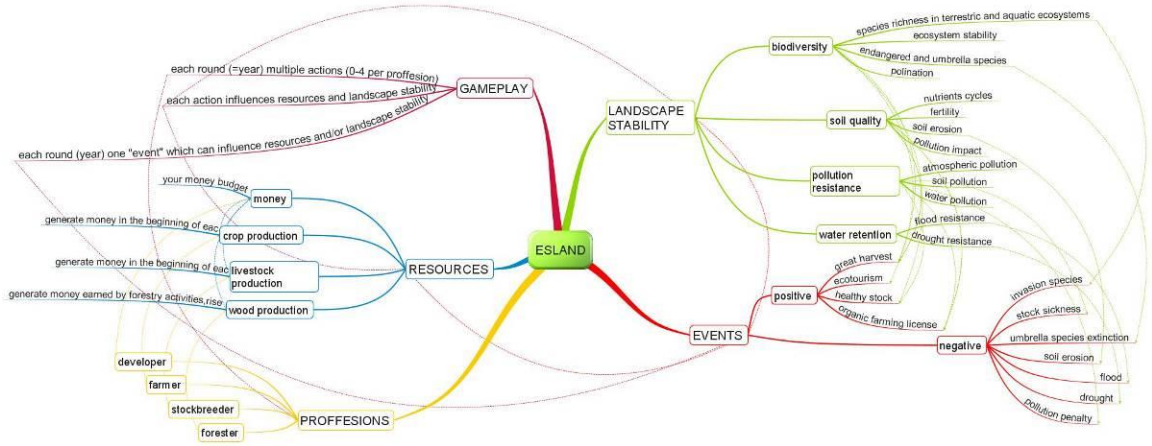

Fig. 1: Mind map showing the principles of ESLAND game

The game development is in progress; we are also creating a card version of ESLAND game. The content management system is being created. This will enable us to create various game combinations and the evaluation system capable of recording important information about game playing and users.

Results

The game “Beware of the flood!” can generate different outputs depending on 3 main methods of use:

a) solo single player (exhibitions, Internet),

b) lectured single-player,

c) lectured multi-player.

The game finds its use as an interactive tool in the environment-focused exhibitions in the Museum of the Moravian-Wallachia region and due to the availability on the Internet it can be used by the general public. We have limited options in getting an output from solo single-player games due to the absence of a sophisticated evaluation system. A concrete result is the number of visits in the website http://portal.muzeumvalassko.cz/povoden/, where the game is placed for the use of museum exhibitions. Since August 2013 until now there are 2 746 visits with an average time spend on the page 3:13 min. We can interpret visitors are trying to play at least one game on average per visit.

On the other hand we have an extensive experience with the lectured single-player and multi-player version – since August 2013 the game has been used for more than 60 education activities such as lectures, shows, competitions and conferences.

Pupils of primary schools prevail as the main target group, but we have very good experience using the game at secondary schools and at the universities. Surprisingly, the lectured game version is also comprehensible for very young pupils, around the age of 8.

Blended learning has been proved as a very effective education method. Blended learning is a combination between e-learning and lectured face-to-face education for multiple players (e.g. classroom). The instructor can choose a few players a special roles (mayor, engineer, developer, environmentalist, etc.), the rest of players are becoming members of a municipal council (the role-playing game principles). They have a collective game quest – to prevent flooding of a town. According to their roles they have to discuss about the options and finally they vote and purchase “flood control system”. The Instructor explains the consequences, he serves just as a facilitator and a game guide. Players acquire knowledge on the basis of their decisions and mutual discussion.

Quite remarkable is frequent player behaviour – during the first game they try to have as good anti-flood result as possible. But the next game they do the opposite, usually they enthusiastically choose the worst

options to find out the catastrophic game scenario. We consider it as an efficient learning from good and also bad examples with a high level of enjoyment.

Observation of change of player behaviour and additional questions enable us to verify gained knowledge and attitude. A feedback from professionals and university students is enriched by discussion.

In the case of ESLAND game we are designing the Evaluation system capable of getting important information about the player and his answers. Such results will improve our understanding of the education impact significantly. If this evaluation proves effective, we will implement it to the SG “Beware of the flood!” as well. Unfortunately we can´t evaluate the educational impact of the ESLAND game yet, because it hasn´t been used up to the present.

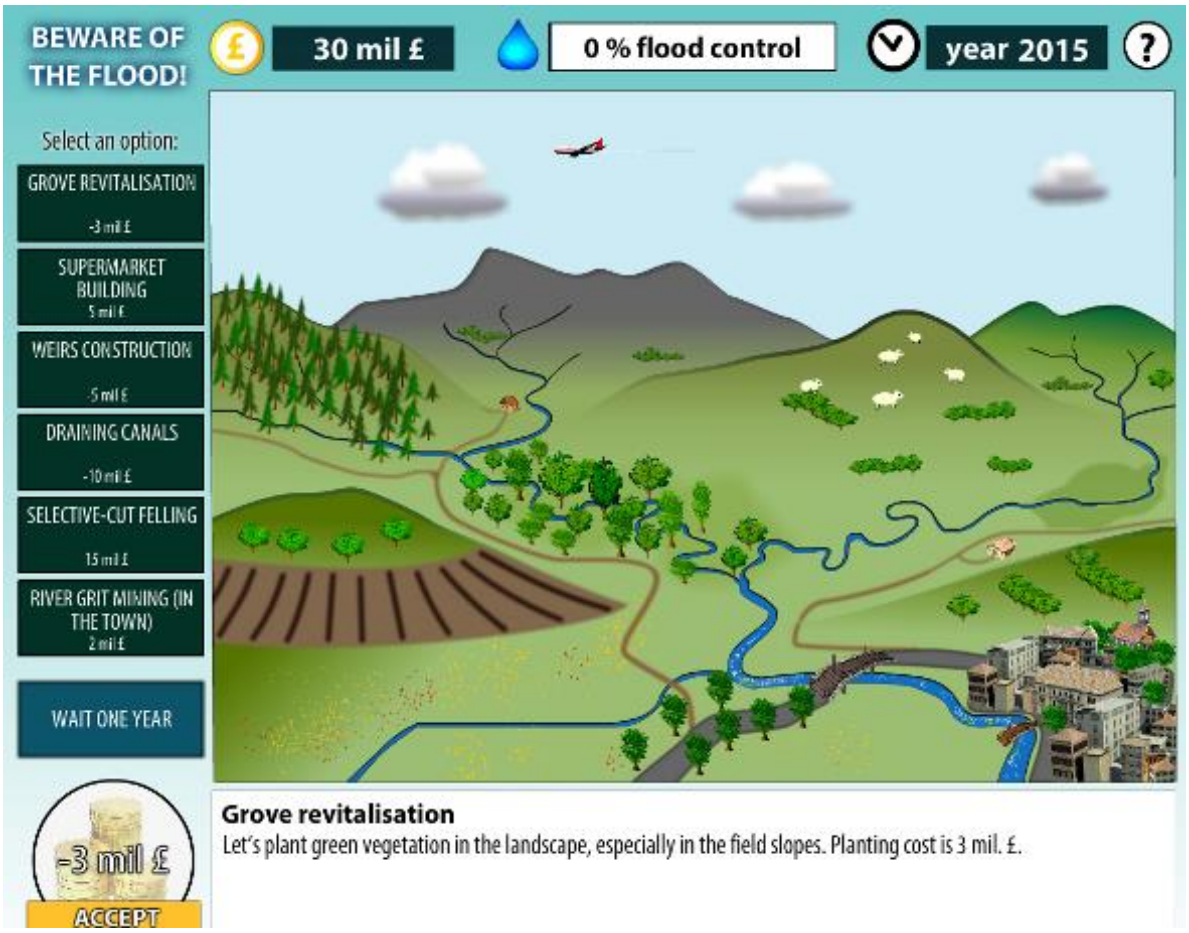

Fig. 2: Beware of the flood game interface

Fig. 3: Schoolchildren playing non-lectured version of the SG "Beware of the flood!"

Discussion and conclusions

With no doubt current environmental issues pose a big challenge for an environmental education. In recent years some efforts using SGs have been made in this field (ISDR: Stop disasters!, CGIAR: Ecosystem Services game, Facebook: Farmville, Cenia: Vítejte na Zemi), but still there is a lack explanation of the of interconnection of issues in practical examples and lack of methods for evaluation.

Our games don´t try to build exact models of a real landscape. They try to simplify complexity, to capture the fundamental mechanisms, to show practical examples and to raise environmental awareness. We put the accent on quality of enjoyment – players are identifying with the game goal after obtaining special roles, they also appreciate when they can see the change in the landscape. The last but not least – game design can attract and maintain the player´s attention.

After two years of using the game "Beware of the flood!" we can say that the education effect is much more comprehensible and entertaining compared to classical school methods as verbal, text or illustrated explanation, especially when using Blended learning method.

On the other hand there are still imperfections (availability, evaluation) and many challenges for improvement, concerning content (different regions, landscape types, periods of time) and graphical design. After starting up the Evaluation system in the ESLAND game we will be able to collect quantitative data of knowledge and attitude change of players. We want to make our games accessible not only for teachers and other facilitators of learning, but for nature conservation professionals, policy makers and land managers.

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RE-THINKING THE ENVIRONMENT THROUGH GAMES. DESIGNING LOCATION BASED MOBILE GAMES IN HIGHER EDUCATION FOR ENVIRONMENTAL AWARENESS

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Abstract

The scientific aim of this contribution is to explore the topic of Location Based Mobile Game (LBMG) design in higher education as a way to raise environmental awareness, giving further research a push. The cross-national cooperation of Germany and Italy pays respect to the international occurrences of urban and hybrid games and their large applicability in the field of social innovation. This paper shows the design process on the ground of two workshops operated on a binational basis, presenting an overview of the tools used to design games, and some of the results collected. Its primary contributions consist in (1) an analysis of the game design process as a learning experience, and in (2) the assessment of the LBMGs designed, answering to a current need of experience assessment and comprehension, both from game design and research perspectives.

Keywords: location based mobile games, urban gaming, meaningful play, higher education, environmental learning, hybrid space.

Introduction

LBMGs offer the possibility to navigate in hybrid spaces bridging digital and physical spheres through communication and mobility (de Souza e Silva, 2006). They are engaging activities that give players the chance – as well as the reasons – to explore uncommon and original paths in their environment and to perceive well-known places in a different way initiated by the fictional layer and the game mechanics overlapping the everyday space (Montola et al., 2009). Additionally, they can versatilely cover several issues, suggesting civic and social reflection.

The concept of *experience* is deeply linked to the Game Design practice. Taking part in a game, the player dives into a *fictional world* that has rules, conventions and characteristics that separate it from the real world and the everyday life. However, dealing with urban or hybrid games, the boundaries of the *magic circle* tend to blur and become a membrane (Zimmerman, 2012; Juul, 2008; Walther, 2005). Through their narrative and gameplay, such games interact with the surrounding, for example by retrieving historical situated meaning, recovering local traditions and culture, and/or empowering social as well as civic action (Flanagan, 2009; 2014; Bertolo and Mariani 2014). In particular, LBMGs endeavour to modify the environmental perception, to transfer knowledge, and also push players for reconsidering certain behavioural patterns (Ackermann, 2014). Like with environmental theater (Schechner, 1973), LBMGs demand players and spectators to acquire the awareness that a certain playground means and represents a setting different from the ordinary one (Frey, 1946), which exists only for a certain time period and follows self-referential rules – a space of *otherness* that is simultaneously neither here nor there, just like Foucault coins it in his concept of *heterotopias* (1967). This opens up a time slot of increased opportunities for environmental learning. The fact that LBMGs ask for physical movement in the space conceives the body as an interface (Sielke and Schäfer-Wünsche, 2007) and enlarges the learning processes from the cognitive to the corporeal sphere (Prades, 2013). In creating LBMGs designers not only shape such experiences for their players but they also come across them, as one part of the iterative process of design is the playtesting phase.

In the light of the reasoning so far, our research questions are:

RQ1: What kind of experience is generated when a LBMG suggests players to enter a fictional world and perform in a *space of ambiguity*, dealing with an issue of social/civic matter?

RQ2: Can the iteration of the design process activate learning processes, triggering reflections about the environment as well as about the importance of testing and experimenting?

Methodology

We applied a multidisciplinary approach to enhance environmental awareness and appreciation, showing how LBMGs function as powerful, intercultural tools to be meaningfully integrated into higher education classes addressing different subject areas. Between 2014 and 2015 two workshops (WS) were held in Germany and Italy leading students to design hybrid-space experiences to share their own view of the communitarian context they live in. The aim was to suggest a change of perspectives telling stories from fresh points of view. The students worked with the free online editor ARIS, which gives an easy entrance into game design for mobile devices, as it does not require a prior knowledge in programming and allows to intuitively work with geolocation using google maps.

In Germany the design activities were integrated into a weekly course of the BA in Media Studies. 22 students designed LBMGs for the town Siegen in groups of up to four persons, realising 9 different games. The activities included intense location scouting, creation of narrative and rules, regularly plenary sessions to mutually update on the progress of the projects, and playtesting of the prototypes. The location scouting was meant to raise awareness for the spatial specialities of the environment, following the approach of *environmental theater* to "*start with all the space there is and then decide what to use, what not to use, and how to use what you use*" (Schechner, 1973, 25, emphasis in the original). The final games were curated and performed in the International Urban Games Festival playin'siegen. A qualitative enquiry conducted one year after the WS (n=13) scrutinised the persistence of meaningful (longtime) experiences related to the game design process and the alteration of the designers' perception of their environment.

The Italian WS was an intense one-week course with 50 participants of the MSc in Communication Design. Students were told to design hybrid reality games specifically addressing social issues: social norms (n=4), re-appropriation of the space (n=4) and multiculturalism (n=1). They were asked to focus on the performance aspects of gaming and encourage interactions with passers-by enabling reflection processes not only in the players but also in non-playing people. The design process included cyclical periods of presentations and group reviews. To critically observe the playtest of their own games and to collect data for the research, designers were asked to do rapid ethnographies (n=52), while playtesters had to self-evaluate their game experience in the form of a questionnaire (n=62) we supplied.

The questionnaire was built to evaluate the play experience and its aspects, the feelings perceived, and the relevance/pleasantness of the interactions with the game elements. As a consequence, the results obtained gave the designers important insights into games' playability and the way they met the initial aims and expectations. We drove students through an iterative process of design and playtest to enable designers to assume the potential transformative dynamics they expected to solicit in their players and also check their occurrence.

Results

The data shows that during each WS the students created appealing games with interesting play experiences. As documented in the enquiry, the creation of appealing hybrid reality experience generated both a feeling of satisfaction and a strong bond between designers and their artefacts, facts supported by the large amount of pictures shared on Facebook and Instagram. The development of a fictional layer overlapping with the common environment led players to access a secret additional meaning of the space, shared only by those who participated in the games. This strengthened the bond between designers/players and their environment. Furthermore data from the German WS shows how the game design process affects students by altering their involvement with the surrounding, and by activating multiple learning processes: students were pushed for trying out new ways inside the city and by that discovering otherwise unknown sides of it.

Even a year after the German WS, students report that passing through some locations inside the city frequently reminds them of their own game or of the games they played. This is partially due to the fact that some existing places/parts of the city (e.g. fountains, shops) were transformed into game elements, and partially triggered by some of the games' materials still present in the urban space (e.g. qr codes and markers). In short, designing a game for a specific urban environment led students to an intense cognitive

analysis of the environment followed by outlasting changes of its perception. This statement is pointed out in all the questionnaires we collected from the German students.

This reasoning partly answers to RQ2 since the design process and the play experience altered designers' attitude towards their environment: the tendency to recognise game elements in the real space confirms the existence/persistence of the space of ambiguity LBMGs created. The game elements call to mind past experiences and jog students' memories about the fictional world they experienced.

Other than in Siegen, the investigation in Milan specifically took into account players' perspective, evaluating game aspects, enjoyment and feelings perceived. The questionnaires prove that 79.9% of the players enjoyed the games "pretty much" or "a lot", while 18.8% "quite enough". Considering all games the aspects players liked the most were: (1) completing tasks 58.6%, (2) being part of a group 57.1%, and (3) being immersed into the story 51.4%. For each game, Fig. 1 presents the details of the most enjoyed aspects, defining a spread interest on common aspects such as completing tasks, but also some peculiar responses on specific items, as the fact of running into new situations within habitual spaces. The figure shows how the two items connected to the definition of the fictional world (story and character) raise together the highest interest into players, attesting their importance for the overall experience. We believe that the fact of physically taking part to a narrative, concretely experiencing its ludic fictional world and sharing it with others (group item) defines a very effective way to move players to reconsider some points of view they use to take for granted.

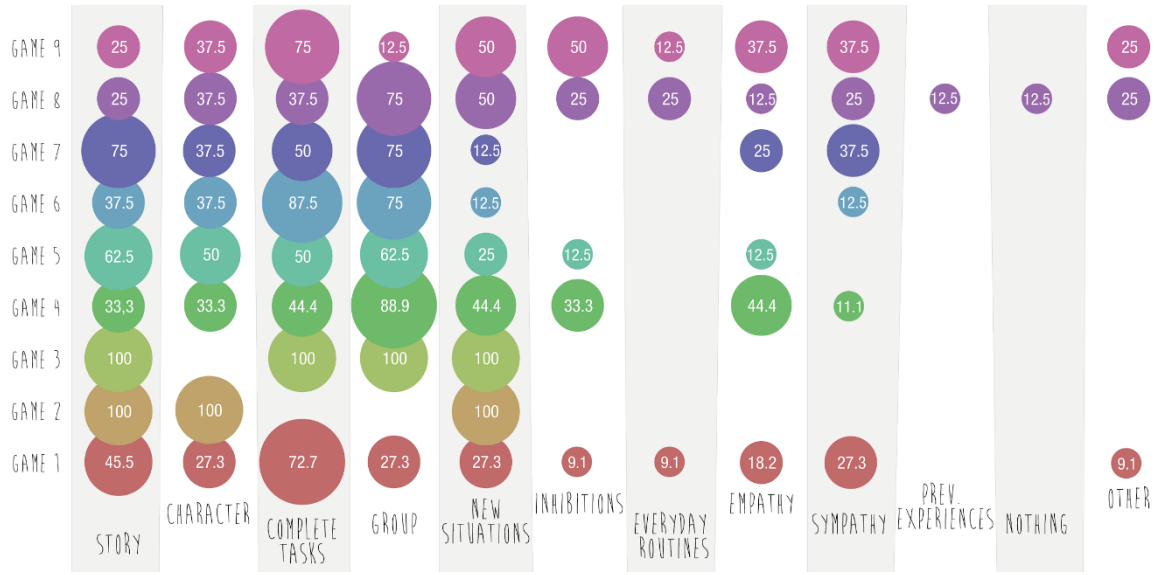

Figure 1. Aspects of the game players enjoyed the most. All values are in percentage.

Questioned about the feelings they experienced during the playtests, players were allowed to measure 15 different items on an interval scale from 0 to 3 (see Fig. 2).

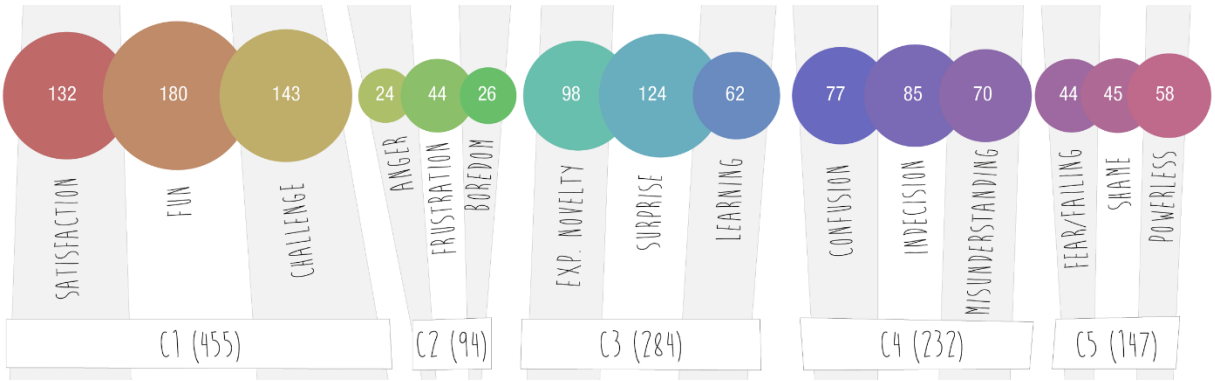

Figure 2. Feelings players perceived during the game experience.

By classifying the single items into broader categories it becomes clear that the interactive experiences functioned really well in the level of game enjoyment (see the difference between C1 and C2). The presence of C2 values is noteworthy: anger and frustration could be indeed feelings the designers intended to elicit; on the contrary, the presence of boredom usually identifies the need to modify some parts of the game. The origin of the feeling of "boredom" should be tracked in the corresponding ethnography that the game designers did. By intertwining data and observation, it is possible to consciously intervene on the game and apply the required changes. Answering to RQ2, the awareness that comes from this data intersection activates a learning process on the design process itself, highlighting the importance of the playtest as a design process phase. In addition, the high load of C3 which tends towards the experience of new situations connected to a familiar environment (built from learning, experiencing novelty, surprise) is quite striking and heavily supports RQ2. Also the quite high load of C4 and C5 – which both aggregate feelings of insecurity even if in different ways – can be explained on the one hand by the combination of digital and physical spaces that leads for instance to insecurity according to the orientation, and on the other by the *occupation/invasion* of serious spaces wherein players had to perform and behave in playful and bold ways. Dealing with both kinds of insecurities, while being and navigating in a certain familiar environment initiates reflection processes on multiple levels.

As a pattern, the fact of wearing masks or identifiable objects seemed to have helped creating a sense of belonging to a group, and of clearly taking part to a performance (Fig. 3). It also contributes to make tangible the presence of a protective frame and the message "this is a game" (Bateson, 1972).

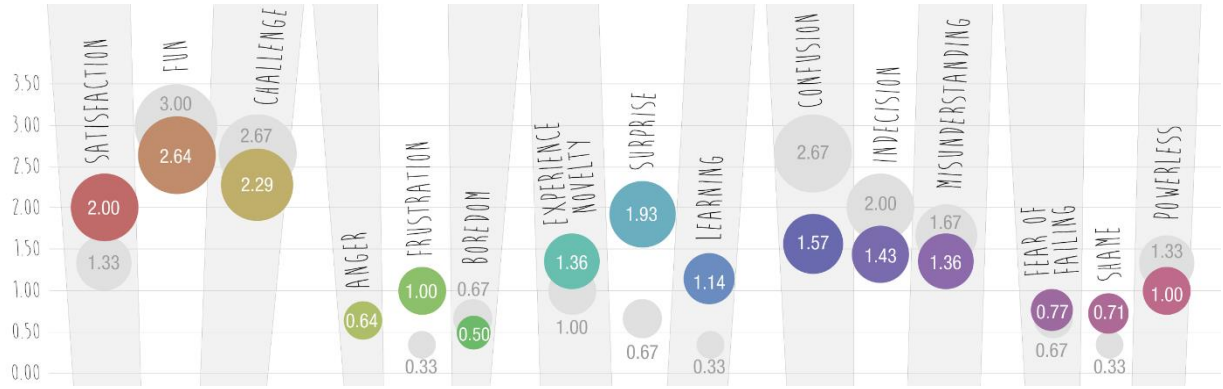

Figure 3. Considering the importance of the fictional world, the figure shows a comparison between feelings players experienced and the fact that players were wearing masks or other identity objects (coloured spheres) or not (grey spheres). The values are the average of the values gathered.

Another crucial feature supported by the data collected is the immersion into the fictional world and its story. Analysing the players who stated to have particularly appreciated the story of the game they played (rating the item with 2 or 3 out of 3) we found an interesting intersection with some of the feelings perceived: high levels of fun, good levels of satisfaction and low levels of shame, even if most of the games designed required embarrassing performances in crowded places and interactions with strangers. Good stories and coherent fictional worlds helped players to awkwardly perform in the space without feeling ashamed. In addition, as shown in Fig. 4, the games whose stories were measured with high scores (2 or 3 out of 3) were connected to a stronger feeling of learning (44.4%) – compared to the overall average (31.4%).

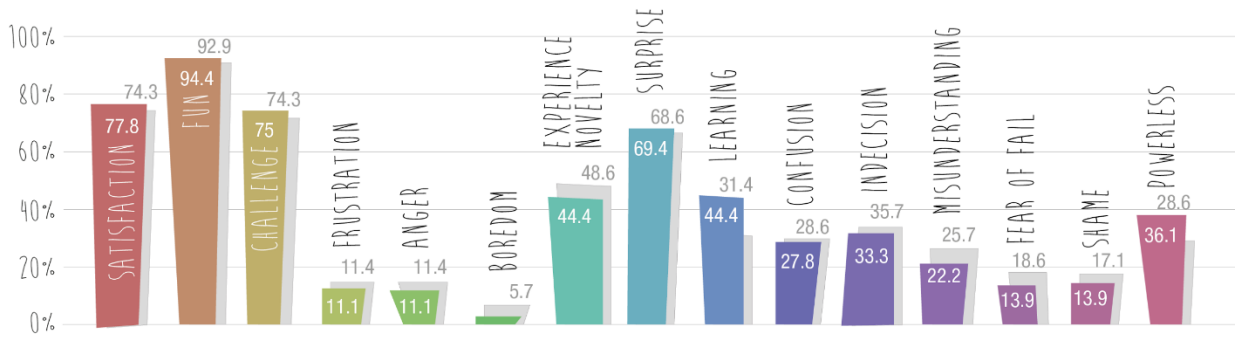

Figure 4. Focus on players who said the story is one of the game aspect they enjoyed the most, intertwined with the feelings they perceived during the game experience. All values are in percentage.

Discussion and conclusions

The explorative study clearly outlines the potentials of applying LBMG design in higher education to raise environmental awareness. The research on the two WSs and their outcomes shows how connecting games to certain spaces initiates multiple cognitive and corporeal analysis with the surroundings, and creates long lasting memories that are inextricably linked with a specific environment. The increasing availability and user-friendliness of free game-editors enabling people to self-create LBMGs (like ARIS) without programming knowledge, allows to extend this kind of WS from media related studies to other fields of higher education. The creative process empowers designers to become an active part in shaping urban experiences reflecting how they want players to perceive a certain environment, its elements and meanings. In so doing, such tools provide a crucial step in yielding participation by action in a performative culture perspective (Volbers, 2014). Still research in the field is very rare.

Our contribution is to highlight the relevance of the topic, by giving insights into a first explorative study in order to give future research a push. As visible in the presented data, designing LBMGs produces various learning processes in the field of environmental awareness for both, the designers and the players. In particular, data showed how an appealing story and fictional world seem to increase the players' feeling of having learned something through playing. Creating an LBMG means to shape imaginary worlds out of scratches (Wolf, 2014). The surrounding as a real space coincides with the fictional space wherein players move, and the game world is communicated essentially through the game identity (written text and images). In these cases, it becomes fundamental to involve players into an activity that *makes sense* within its specific frames, and enhance their condition of immersion with masks and identity objects. Even if these objects look funny or ridiculous, they yield a safe embodiment in the fictional world, and give players the *power* to play other roles, wearing a real or symbolic mask that acts as a protective covering.

These observations highlight that those who play are largely influenced by the fact of wearing a mask and also by the sense of belonging it engenders. It results in a condition of openness that suggest players to become more inclined to acquire knowledge and learn in general, as well as to address sensitive and complex matters (Bertolo and Mariani 2014).

Furthermore, we focused on the knowledge students acquired during the WSs. The ethnographies they ran in the urban space allow students to understand the role of experience analysis in the design process; then they learnt about games' potentialities as systems of knowledge transfer. Both outcomes are founded on the questionnaires and the rapid ethnographies during the design process, functioning as tools to generate awareness on what it means to design experiences situated in the city, and test their effectiveness. Through the WS activities students understood the importance of observing the play experience to understand if the games they designed were performing as expected. Additionally, collecting information through the interdisciplinary tools we delivered (formats for questionnaires and rapid ethnographies) they could compare the resulting play experiences with their own expectations and as a consequence comprehend what improvements each game needs.

To conclude, we observed that LBMGs activate environmental awareness, as well as a process of knowledge transfer lead by experiences. Independently of the games' contents, data assumes that the initiated modification of the designers' perception of their environment triggered by (1) the intense analysis of their surrounding required for the design process and (2) specific reflections due to the fact of being situated in an active and inhabited environment go far beyond short-term effects. Unfortunately, research

in this field is totally missing, yet. That is why the paper intents to encourage researchers from different fields of study to undertake especially longtime studies in the domain. As documented, workshops on LBMG design not only function as a good basis for further analysis and research but also activate interesting learning processes in the students comprehending the role and the importance of the observation activity in the iterative process of design.

Acknowledgements

We thank the University of Siegen and Politecnico di Milano for hosting the WSs. A special thank goes to the students who put themselves to test by participating in the design and evaluation activities, giving us constant feedback through questionnaires and interviews; but also analysing their own projects via rapid ethnographies.

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MOBILE GAME BASED LEARNING FOR ENVIRONMENTAL EDUCATION

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Abstract

This paper discusses harnessing mobile services and game based learning concepts in environmental education. Nowadays, waste management is quite a cumbersome challenge, primarily due to low level of environmental education. The main goal is to foster mobile learning about waste management and to increase awareness of importance of nature conservation. Detailed analysis about possibilities of using mobile applications and newest technologies for environmental education were provided. In practical part of the research an iOS mobile game was developed. Several concepts were combined within the game: quizzes, lessons and game based learning. The mobile game enables users to learn about waste management, waste disposal, sustainability, classifying waste, recycling different types of waste and impact of these concepts on biodiversity and whole ecosystem. The main contribution of the application is twofold. Firstly, large amount of information related to the environment protection and benefits of waste management is available to learners within the application. Furthermore, through playing the educational game the learners are enabled to apply theoretical knowledge on real problems in practice. The application was tested among student population at Faculty of organizational sciences, University of Belgrade. The students evaluated the mobile game application as an interesting and useful tool for learning about environmental protection. In addition, the mobile game can be used not only for students, but for all other types and groups of learners. Main aspects of the mobile game integration with formal learning environments and courses are discussed, too.

Keywords: Game based learning, nature conservation, iOS mobile application.

Introduction

This paper will discuss use of Informational Technologies in education of youth, especially though mobile games. Nowadays Information Technology is very fast-growing industry and its use is diversiform. In the field of education, gaining and keeping students' attention has been much of a challenge, especially in the last decade. Many changes were needed in order to successfully overcome this obstacle. One of which was use of modern gadgets and devices that are known as "smart" devices – from computers, mobile devices and tablets to interactive classrooms. These changes were followed by new methodologies of learning among which "Game-based learning" gained much popularity, because of its numerous advantages and positive effects and results. Another great problem for global society is environmental pollution. Despite major efforts to reduce pollution consequences, decrease pollution and eliminate the source of it, it is a slowgoing process. It has become large-scale issue that requires using all means available in order to fight against it. Crucial aspect of fight against nature pollution is environmental education.

Environmental education includes all activities that as a result have raising awareness of people about pollution problem existence, ways of preventing it and way of forwarding this knowledge on other people.

Because young people are the ones that need to take care of the nature for future generations it is important to reach those people and transfer this knowledge and awareness to them. The easiest way of doing this is using possibilities of Internet and Informational Technologies. These include following and many more:

Internet marketing – Youth spend hours on the Internet daily, which makes it perfect place for advertising nature protection behaviour and classes or activities for environmental protection

Social media – Creating social profile of an Environmental organization or event is a low coast way to reach numerous publics and call them to action or make a social media ad that will spread the needed message

Online classroom – There are many organizations that provide services of hosting online classes, where people that are on distant locations worldwide can gather and learn or do any activity together. Many universities provide an online service to their students where they can learn, read various materials and solve tasks.

Games – Games is a very good way to reach all ages youth. Any topic can get interesting and fun if its presented through a well designed game. Games vary from simple online games to complex offline desktop games. Games can be part of student lessons. Educational games for mobile and tablet devices are gaining more and more popularity.

The main goal of this paper was to develop an iPad game which would be used in educational purposes of youth about environment, waste management and importance of nature conservation using "Game-based learning" concepts. The application would be tested on a group of students and its effects would be noted and analysed in one section of this paper. The goal is to create a game that would help students of any ages understand seriousness of environment pollution problem and importance of applying proposed practices for reducing pollution effects in everyday life. The goal is also to encourage introduction of environmental education for everyone.

Literature analysis

Since ecology problems are not something new, there are many organizations and institutions that have developed programs, projects and applications that as a goal have environmental protection and education.

EPA Green Apps

EPA (United States Envirnmental Protection Agency) is an agency of the U.S. federal government which was created for the purpose of protecting human health and the environment by writing and enforcing regulations based on laws passed by Congress. Their activities involve:

- Air protection
- Water protection
- Land protection
- Endangered species
- Hazardous waste
- Other

EPA association conducted many program, among which is one called "My Green Apps". This program resulted in 290 developed apps that help people understand and protect the environment. These applications include web, mobile apps and games. This program include contest "Environment Challenge", firstly launched in the summer of 2011, where software developers and engineers can propose new ways to combine and deliver environmental data in new apps and if the idea is accepted, EPA finances the project. Also anyone can suggest already existing app that could be improved and upgraded.

More about My Green Apps can be found on their webpage.

Currently, there are 18 mobile games developed through the partnership with EPA, among which are: EcoChallenge, Green Schools Revolution, iRecycle, Recycling Truck, Green Up and others…

Sustainable U

Sustainable U is a project piloted in Spring 2014, at the Wisconsin-Madison University.

Sustainable U includes various activities such as criss-crossing the UW–Madison campus with twenty levels of place-based and experiential activities and simulations to showcase underlying systems of sustainability across the four themes outlined on the We Conserve initiative: water, energy, materials, and transportation. As a part of the project a mobile game has been developed. The premise of the game is that a visitor from the future shows players a bleak future for Madison unless they take action on

environmental challenges. The app directs players to find signs posted in campus buildings and scan a code with their mobile device to pull up information, videos, or games related to waste, energy, water or transportation. By completing each site, the students can change the course of the future. This educational game makes things that are abstract in a book or lecture become really concrete. With feedback from the pilot testing, MLI is now refining and expanding the game for a full rollout, which will be available this fall to anyone on campus with a mobile device.

Location based mobile applications

There are numerous games and applications that are aimed at nature conservation of a local community, specific area or country. "QuestaGame" is a typical representative of such apps. QuestaGame works across all Australia, using nationally verified data on over half a million species of animals. QuestaGame takes the user outdoors -- to a local park, a hiking trail, anywhere. User can submit sightings and compete with other players to photograph species in the wild. By playing the game and mapping conquests, users are also helping scientists record and protect Australia's biodiversity.

Games like this can be a powerful weapon in the hands of the government, and can help animate the target public and invite people to help government reach environmental protection goals.

iPad mobile game EcoQuiz

We have developed an iPad game application and named it "EcoQuiz". This application has been designed to help students master the lessons of Ecology Management course held on the Faculty of Organizational Sciences, University of Belgrade. EcoQuiz contains knowledge database and lessons that follow same lectures in the book that is used on the course. Besides that there are number of quizzes that students complete at the end of each lesson and though playing the game. At the end of each game students are shown number of points won. The following screenshots show game, quiz and lesson that teach about waste management.

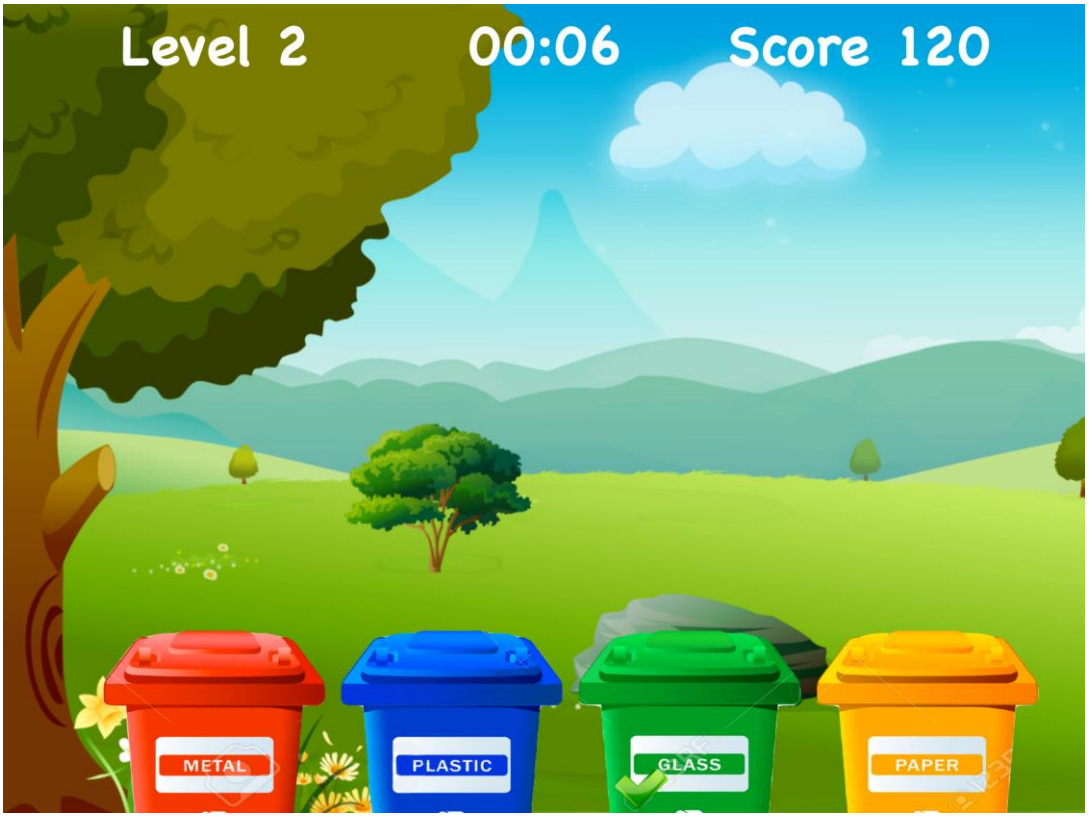

Figure 1. EcoQuiz Game where user has a task to classify waste to one of the bins

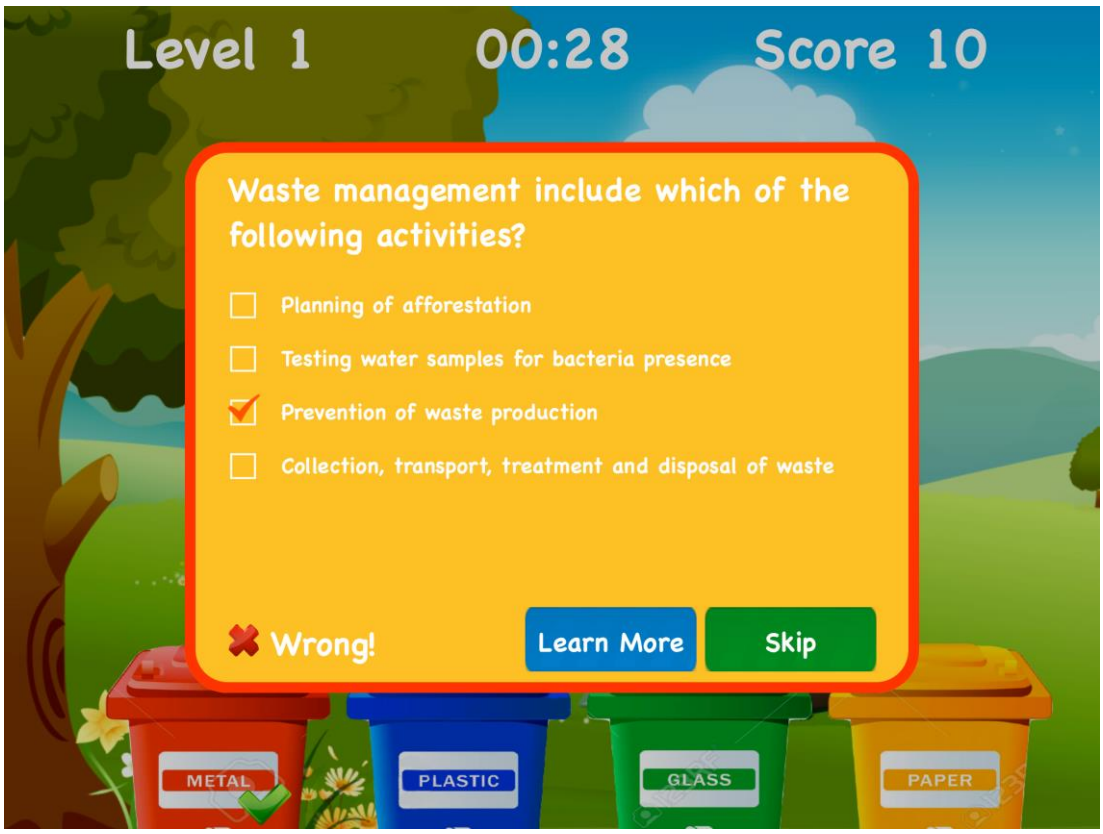

Figure 2. User has classified the waste successfully three time in row and can earn extra points by answering the question

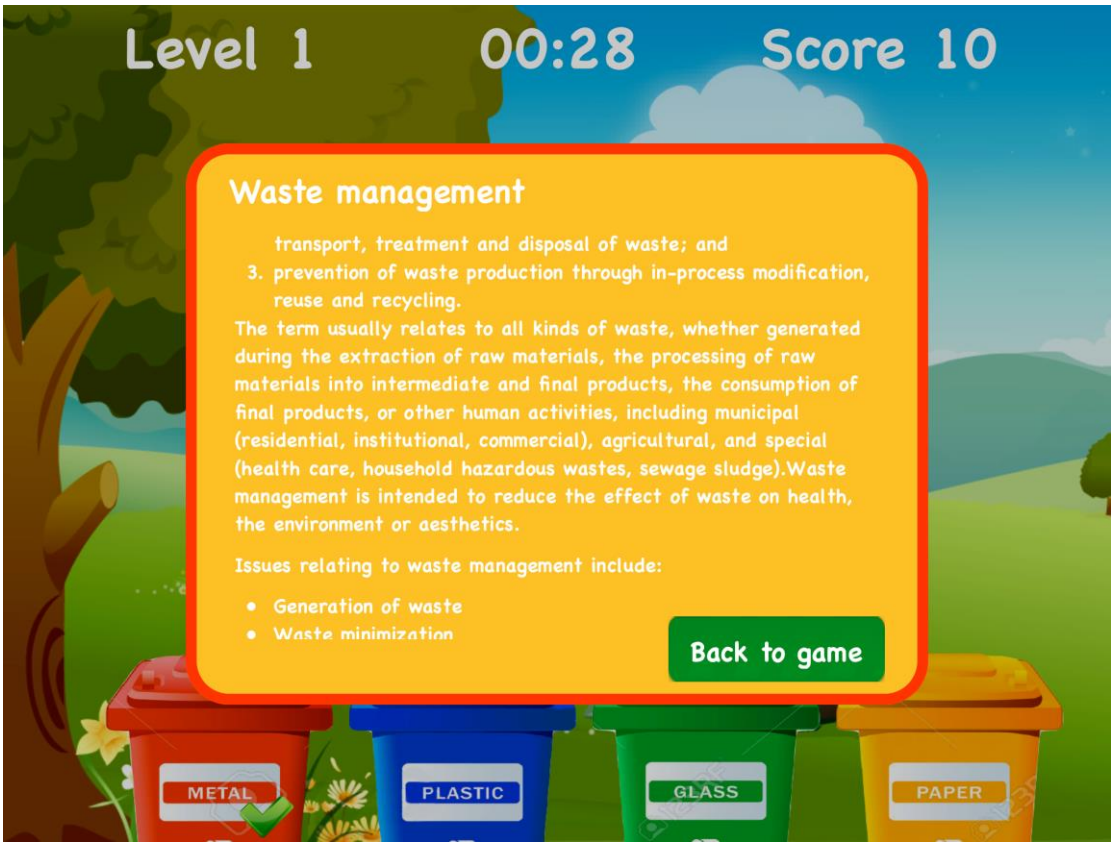

Figure 3. User can learn more about the question asked by reading the lesson

Evaluation and contributions of the app

This study aims to investigate if the EcoQuiz application can be effectively used to test students' knowledge in the area of nature conservation, waste management and recycling. The experiment was conducted on a sample of 160 undergraduate students of the Faculty of Organizational Sciences, University of Belgrade. Students who attended the Ecology Management course were randomly divided into experimental (80 students) and control groups (80 students). All students, both experimental and control group had a block of lectures presented in the traditional way. At the end of each class students from the experimental group used the EcoQuiz application to check their knowledge related to the lesson from that class. In order to measure the research results, we used the knowledge test that students take at the end of semester. In the knowledge test, students were given questions from lessons that were covered by classes. The test we applied in the experiment was a standard test used for testing students for more than five years.

The students in the experimental group took the final test using the EcoQuiz applications, while the control group students took the final test in the standard form, i.e. on paper. A descriptive comparative statistics of results achieved on the knowledge test is presented in Table1.

	N	**Mean**	**Std. Deviation**
Experimental group	80	9.26	1.088
Control group	80	8.82	1.271

Table 1. Descriptive comparative statistics of results achieved on knowledge test

The distribution of grades in the Experimental and Control groups is shown in Table 2. Grades range from 6 (equivalent to E in ECTS grading scale) to 10 (equivalent to A in ECTS grading scale). We can see that the number of students who achieved high grades is higher in the experimental group. The results of further statistical analysis show that a larger number of students from experimental group that achieved high marks in comparison with the number of students from the control group is statistically significant, $F(1,159)=5.473$ ($p<0.05$).

	10	**9**	**8**	**7**	**6**
Experimental group	49	13	9	8	1
Control group	34	18	12	12	4

Table 2. Distribution of grades in Experimental and Control groups

The described quantitative analysis shows that usage of EcoQuiz within the exam contributed to students' results. This may be explained by the fact that students in the experimental group had answered similar questions during the lessons, but on the other hand, this confirms that this application needs to be included as an integral part of the course. Also, a qualitative analysis is required in order to make better conclusions. Therefore, after the test, students in the experimental group were asked to fill in a questionnaire and evaluate the EcoQuiz application. Table 3 shows the students' responses.

Question	5	4	3	2	1	Mean score	Std. dev
Using EcoQuiz application is simple and clear	70	27.5	1.25	1.25	0	4.66	0.57
User interface is well designed	45	41.25	10	2.5	1.25	4.26	0.84
User interface for quiz of knowledge is well designed	35	45	13.75	5	1.25	4.08	0.90
The application contains appropriate information for every lesson	55	37.5	7.5	0	0	4.48	0.64
Information and dialogues during testing are appropriate	38.75	46.25	12.5	1.25	0	4.24	0.72
Questions totally corespond to the lessons	70	25	2.50	1.25	1.25	4.61	0.72
The application has enhanced my interest in the area studied within the course	13.75	28.75	33.75	13.75	8.75	3.25	1.14
I have understood the course contents better after using the application	42.50	41.25	11.25	3.75	0	4.24	0.80
The games in the application were interesting and related to the lesson	28.75	31.25	12.50	10	16.25	3.47	1.43

Table 3. Questionnaire about CSMP application quality results

(Strongly agree – 5; Agree – 4; Neutral – 3; Do not agree – 2; Strongly disagree - 1)

Mean scores are mainly over 4, so it can be concluded that students are generally satisfied with the CSMP application. However, lower mean values indicate that the application needs to be improved in several aspects:

a) The user interface

b) More various games that relate more closely to the lesson

c) Availability of the application for home learning

d) Integrating the application with LMS platforms

One of the most important questions was related to the role of the EcoQuiz in understanding the course contents. Since the mean score for this question was 4.24, we can conclude that the usage of this application contributes to students' understanding of continuous systems simulation and simulation languages. This can be explained by the openness and ease of use of the EcoQuiz.

Conclusion

The main contribution of this work is the development of a new, efficient, and open source environment for learning about ecology, nature pollution and ways of protection. The EcoQuiz is a free tool that improves students' understanding of the theoretical concepts in the fields of environment protection. The proposed solution uses game based learning technique in order to gain and keep students attention and enhance their interest in the field of study. The main goal of this study and the game is to introduce modern technologies as addition to traditional ways of teaching. This has proved to be very efficient and it was well accepted by students.

We acknowledge some limitations of this study. The EcoQuizz is an iPad application not fully integrated in the e-learning process and limited to a number of devices. Therefore, future researches are directed towards the development of an Android Android application with the same features and integration of the EcoQuizz into a learning management system. A full coordination of all processes in e-learning will lead to

an improved quality of the e-learning system. This integration involves integration with LMS systems, such as Moodle. This way results and point won in the application could be calculated in the final grade or as a bonus points. Also this way application would be available for all students either by mobile device, tablet or web service.

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Sustainable U – Mobile UW https://mobile.wisc.edu/mli-projects/project-sustainable-u/

Apple iTunes https://itunes.apple.com

CHAPTER 5: ENVIRONMENTAL EDUCATION AND SCIENCE

SCIENCE AND SOCIETY: NEW PROPOSALS FOR AN UNCONVENTIONAL SCIENTIFIC COMMUNICATION

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Abstract

During these years emerged the need to create new kinds of communication that can activate a conscious society, providing people with clear information on the geo-environmental scenarios of our country.

A sensitive point in the scientific communication is how to organize the information in a strategic way, referring to targets and messages, in order to better communicate the contents to the audience.

Being Landscape an object of human perceptions, it could become a “medium” to communicate the Earth Sciences to the whole society: it can be considered the result of the interaction of many natural and cultural components, as well as the expression of the geological processes.

The following projects, realised in an experimental way in Italy, are successfully started thanks to a synergy between the Camerino University, the Geological Survey of Italy-ISPRA, the National Council of Geologists and Rai Sport.

The main topics are:

- The geological characterization of the Landscape in movies and fictions, based on the use of the filmic communication in order to make the territory comprehensible to the society. In the episodes of the famous TV series "Il Commissario Montalbano" filmed in Sicily, the natural and cultural landscapes, giving a fascinating scenery to the films, represent a meaning in the representation of history.
- The “GeoloGiro” and the “GiROSAuro” (a cartoon created for the youngest audience) for the popularization of the scientific knowledge, explaining the geological setting of the landscapes crossed by the cycling race “Giro d’Italia”.

The morphology of the territory becomes a key component in the race context: if explained by the geologist, can offer to the public a new point of view of the landscapes, linking scientific information to the agonistic valence of the stage. The Giro d’Italia has welcomed the presence of the geologist, thanks to a dedicated space during the TV live transmission of the race.

Keywords: Audience, Communication, Earth Sciences, Education, Landscape

Introduction

We live in an era defined as postmodern. A plethora of tools and sources offer everyone around the world the possibility of participating in social dynamics, a resulting side effect of which is an extreme superficiality and fragmentation of knowledge.

Yet, more and more, socio-economic developments require a knowledge that keeps pace with the dizzying speed of technological evolution, which by now appears self-directed. At the same time, the concept of sustainability has come to the fore as an indispensable response to the effects of development on our planet.

The disconnect between progress and society and the effects on the planet; side effects of progress that continue at an exponential rate and in an often unpredictable manner.

The only possible solution is a shared awareness, and this can only be reached through knowledge, which is provided by science.

With the following project we aim to bring about new behaviour in students and, thanks to them, in society, and thus to arrive at participation in decision making, a desired outcome in a participatory democracy.

Methodology

Landscape plays a key role in the processes of knowledge: it is the result of endogenous and exogenous activities that build and shape the Earth's surface and at the same time, it can be considered the result of the interaction of many components of natural and cultural processes (Troll, 1950; Forman & Godron, 1986; Naveh & Lieberman, 1994): so it represent an excellent vehicle to communicate Earth Sciences (Lugeri et al., 2012). Geological features of landscape, in particular, need to be understood and recognized as a heritage. Geosciences seek to understand the natural history of our planet as well as its evolution. The divulgation of Geosciences, through a simple but rigorous language, is a starting point to reach a shared knowledge on our Planet: the awareness of being part of an ecosystem, is achieved through the knowledge and the experience of the environment (Amadio, 2003; Lugeri et al., 2012). The strategy for the project is to involve students in active, effective, and long-lasting participation in the world of Geo-Sciences. It is structured on a series of methods that make scientific material first accessible, then intriguing enough to engage students, in order to constitute a solid base towards a professional future. A multi-step and holistic approach is the nucleus of the formative methodology, with connections both with the scientific terms to transmit and with the young recipients of the trial. In other words, the possibility to fully explore in an integral way the components/scientific subject matter that are interrelated (holistic approach), guaranteeing a fluidity that can be defined as multi-stepped, with connections to the subsequent levels of acceptable and achievable complexity. Broadly, the project aims to bring students closer to scientific competence by favouring learning in relative disciplines through self-directed education, thus cultivating autonomy and creativity, recognition of one's own aptitudes, and teamwork. The only demonstrated way to do this is through planning and realisation of an objective. The originality of this project lies in proposing innovative projects to capture "universally and across-the-board" the attention of young people, taking into consideration the heterogeneity of socio-economic situations that characterise the world of the younger generations. We strongly believe, following years of experience first in teaching, then in research and finally in scientific communication, that it is necessary to build a bridge between diverse realities and between diverse communicative codes. But the first bridge that should be built is that between dreams and reality, as this is a first step in a cognitive-behaviour process both for those who teach and for those who learn. The appeal to themes that best embrace the collective imagination, cinema and sport, is therefore profoundly motivated as it facilitates phenomena of identification and engagement. Both fields respond to the need to arouse curiosity and vision, which lead to the planning and realisation of a polyhedral objective thanks to teamwork. The holistic approach mentioned above finds fertile terrain of application, the same which favours plurality of points of view that is the only valid way to knowledge, through recognition of one's own attitudes and capacity of integrating those of others. Modern cartography and GIS are the best tools to represent the significant link between nature and culture: the thematic maps obtained thanks to GIS, provide us with the identification and representation of landscape; at the same time they represent a powerful tool for teaching territorial sciences and communicating the territory to society. The modern scientific technologies of GIS and WebGIS are a means of communication with high educational potential thanks to their versatility and ease of use. Used as demonstration tools, they reinforce the message and allow the users to enhance their knowledge.

Science and fiction

Fiction, due to its nature and its modality of consumption, can act as a medium for scientific communication if utilised in appropriate educational planning (Grasso, 2002; Wolf, 1996). The processes of identification in the collective choice of topics to handle and of language to choose are at the base of the activities guided by comprehension and assimilation of themes to be evoked through story telling. (Lugeri et al., 2015)

For example, knowledge and conservation of landscape (an universal heritage) as ratified by the European Convention on Landscape, is a fundamental component of any narrative and introduces many scientific topics, in particular Earth Sciences, Natural Sciences, vegetation, Biology, ecosystems, landscape ecology, and agriculture.

The term "landscape" encompasses a perceptible expression of the result of the endogenous and exogenous forces that mould the Earth's surface. In this sense, the natural scenery of narrative works, in cinema, can be used to transmit scientific information to a mass audience as well as facilitating integration

in society of, for example, immigrants. It also inserts the theme of sustainable development, of natural resources and raw materials, as the challenge for future and shared well-being and survival.

The Italian television series “Inspector Montalbano”, which has viewers all around the world, is filmed in Sicily where Andrea Camilleri’s novels, on which the series is based, are set. We chose this particular series because of the quality of the writing and the adaptation to the television series, fundamental to the popularity of the series and of its characters, but more importantly because many episodes are located and filmed in UNESCO World Heritage sites such as Noto, Ragusa Ibla, Modica, Scicli, Agrigento, and Siracusa (Fig.1).

The landscapes that make up the background to the series are spectacular and they assume a significance in the representation of the plot. At the same time, if recognized, understood, and decodified in their natural history and their value, they become part of everyone’s cultural heritage. (Lugeri et al., 2015).

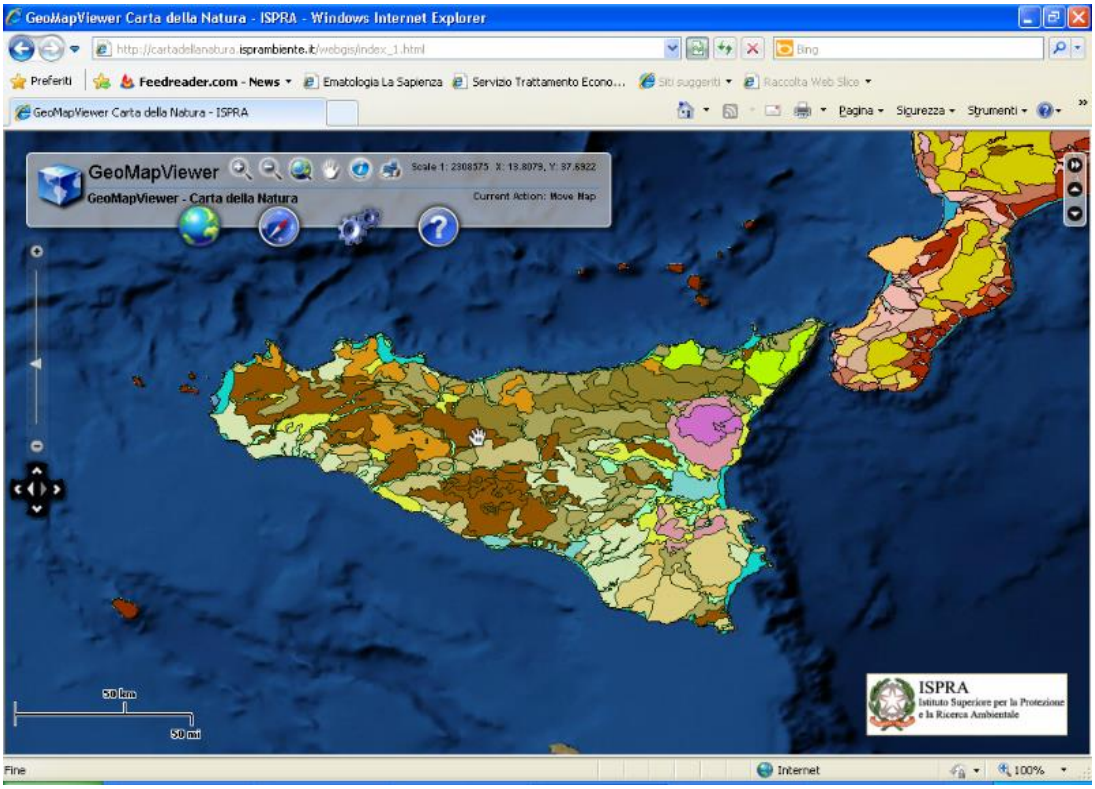

Figure 1. Landscape units map sc. 1:250.000 of the Sicily region - Carta della Natura web GIS.

Science and sport

A further proposal is the pairing of science with sport, in particular with outdoor sports. Skiing and cycling represent possible choices that best lend themselves to our project.

Cycling is an excellent sport, mostly performed in the environment "en plain air", loved and practised by all, and is more and more becoming a means of providing independence and integration for disabled people. Its characteristics means that it is a transport solution with zero environmental impact and thus a fundamental resource for making smart cities possible.

Moreover, as a sport that enjoys a large following at the competitive level, cycling favours the processes of identification and thus has high potential for widely spreading scientific information.

Figure 2. A Dolomitic stage ofThe Giro d'Italia – Ph. RCS La Presse

The "GeoloGiro" is a project for the popularisation of scientific knowledge explaining the geological setting of the landscapes crossed by the cycling race "Giro d'Italia" (Fig. 2), realised thanks to a synergy established between the Camerino University, the National Council of Geologists the Geological Survey of Italy-ISPRA). The morphology of the territory becomes a key component in the race context; uphill, downhill and flat, if explained by the geologist, can offer to the public a new and interesting point of view of the landscapes, linking scientific information to the agonistic value of the stage. Begun in 2012 and in continual development, this project has proved to be very effective, even in tying together science, sport and fair play, reinforcing the assertion of "clean" sport against doping and open to everyone, with particular attention to para-cycling.

Figure 3. The Girosauro, running a Dolomitic stage

The GiROSAuro (Fig. 3) is a cartoon created for the youngest audience, dedicated to the largest public. The cartoon has been presented at the DOSCIENT festival, Rome, December 2014, an international scientific film festival of university and research authority. This is the simple story: a little girl is thinking about a bike trip along the Italian country, through the amazing land settings: her design comes to life and a pink dinosaur offers itself as a guide. It is the GiROSAuro, cycling fan, and pink (Rosa in Italian) like the jersey worn by the winners of the “Giro d' Italia”. The strange character explains to the young rider the secrets of geology, telling her how everything is always changing.

Results

The proposals are unconventional, and aimed to reach a wide audience: in this sense, the analysis of the main results, has to be different from the usual systems. Particularly, the monitoring must be referred to a long period, in order to recognise significant trends.

A synthetic review of the first set of indication, emerged from the performed experiences.

GeoloGiro

Referring to the GeoloGiro, a very encouraging indicator is the continuous presence of the geologist -the same one (F.R. Lugeri), in order to create a link to the public- during the live transmission, along three years; moreover, further spaces and perspectives are in preparation for the next edition. One of the hardest difficulties was to integrate two differnt worlds, as the TV communication and the scientific one are. The presence of a geologist during the cycling stage, has favoured the creation of further links, starrting new kinds of cooperation, i.e. the invitation to participate in other sport popular events (Gran Fondo, Marathon), in order to give a better enhancement to the territories crossed by the races. It is a great result: the message reached the public so that people want to receive a public scientific communication, realised ad hoc for the territory by the specialists, linking sport, nature, culture.

GiROSAuro

This cartoon, realised on our own, has been selected for the final step of the International competition DOSCIENT Festival: a great result, considering the presence of the “Tycoons”.

The Girosauro was requested by the Italian Geological Survey, to be proposed to the young students, during some special lessons dedicated to the Earth Sciences. Moreover, it has been one of the topics object within the event ”Chiamata alle arti e alle scienze” (fig. 4), organised by the “Fondazione Edmund Mach” . Last, but not least, the cartoon has been symbolically acquired by RAI Sport, as a format for the scientific communication linked to sport.

Figure 4: Fondazione E. Mach "Chiamata alle Arti e alle Scienze" / A call for Arts and Sciences

GeoFiction

The first result of this project consists in a format: a proposal of a revisit of the natural scenery of the fiction, immediately after the movie transmission. The recognition process, triggered in the audience by seeing images of the landscape, is enriched with a new awareness brought about by the scientific information provided in an appropriate and understandable way that is connected to the story. The proposal has been presented during the "GeoSciences Week" featuring Cesare Bocci (Fig. 5), the actor who plays the role of deputy to Inspector Montalbano. Bocci has a degree in Geological sciences: this combination suggests a further appeal to the public, as well as an authoritative contribution to the potential of the filmic communication in the popularization of the natural and cultural heritage. Such a double role, suggests the definition of "interpreter", a new way in the mediation between nature and culture in a landscape perspective approach.

Figure 5. TV Series "Il Commissario Montalbano" (Inspector Montalbano)—An image of the trailer. In the box, Cesare Bocci.

Discussion and conclusions

The young generation is the focus of a desirable and necessary dynamics for change; they are a starting place for a new active approach to science and its applications, a catalyst for the process of engagement of the “facies sociale” of adults, leaders and people responsible for the current state of affairs, yet far too often deprived of future prospects and conditioned by the obsession of the “here and now”.

The proposed ideas and experiences must obviously be placed in a broader and coordinated context, which provides integrating between the TV proposal and school education.

Moreover, the divulgation of Geosciences, using a simple as well as rigorous language, is the starting point to promote a culture of prevention against natural and anthropogenic risks (Farabollini et al., 2014).

The prevention, must necessarily be based on cognitive processes, that activate in society conscious knowledge, as well as virtuous practices. It is necessary to start a series of projects and activities aimed at make the science comprehensible, opening up a spectrum of fruitful dialogues between the world of research and the society. New ways in communication, new codes, are just a starting point in launching new bridges, connecting individuals, communities, society.

Acknowledgements

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THE CHEMICAL LANGUAGE OF PLANTS TO COMMUNICATE PLANT SCIENCE

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Abstract

Plant science is usually less attractive than other scientific researches among students of primary and secondary schools. The aim of the study is to raise awareness of young people about the importance and scope of plant science through a topic that is less known by students, but commonly experienced in their everyday life: 'The Chemical Language of Plants'. Plants 'talk' to each other and to the environment by sharing an extraordinary amount of information at the volatile level. The experience of communicate to students the researches on the plant emission of biogenic volatile organic compounds, having different ecological and environmental roles and impact in our ecosystem, is presented. Educational activities were carried out with students of secondary schools within the project 'The Language of Research' (LdR) of Bologna Research Area, National Research Council (CNR; http://www.bo.cnr.it/linguaggiodellaricerca). In order to facilitate scientific involvement, informative and game-based approaches were applied using methodological tools that were designed to get students involved in these plant science issues. After the educational activities, the students had the challenge of become science communicators through the development of different communication products such as video, website, newsletters, poster, and creative objects. This work showed that students were more stimulated in interactive discussions and become more confident with concepts such us ecology, biodiversity, plant-insect interactions, the role of forest on the atmosphere, the water cycle and biogeochemical cycles. The presented activities allowed the students to disseminate scientific knowledge into the public sphere of the school community and to improve their communication skills, while learning about plant science research. The products developed by the students reflected a critical thinking of communicating science, showing the ability to transform and synthesize the information into a meaningful and innovative visualization of scientific concepts. The combination of different forms of science communication, from original tools to video performances and creative websites, resulted effective in communicating a different perspective of the plant language.

Keywords: plant science, communication, volatile organic compounds, language.

Introduction

Understanding plant science and its basic mechanisms is critical in maintaining advances in innovation and technology in many sectors such as food production, health and environment (Fitter 2012). Plant science drives a flourishing economy and fuels our ability to create and enable global sustainability. More efforts are, however, needed to make plant science results marketable, inform the public more adequately, and raise the level of knowledge starting with the education of young students in school. Plant science is usually less attractive and popular than other scientific subjects among students of primary and secondary schools (Stagg et al., 2004; 2009), probably due to the way plant science is taught in schools, to the difficulties in understanding the plant impact on everyday life and, finally, to the shortage of attractive career perspectives. The need to have different approaches for rethinking plant science education has been envisaged; the crucial step would be to individuate a real breakthrough in plant science dissemination and communication, in order to make plant science attractive for the youth. In particular, an interactive science communication could be a way to empower young students as they experience their own curiosity and competence through engaging with plant science. Moreover, experiencing plant science is a critical component in understanding it. Thus, sharing long-term experience, knowledge and expertise in plant science research with schools' students can offer the opportunity to improve attractiveness and interest on plant science. Indeed, this approach, when combined to a participatory and experimental learning

technique, can actively engage students in the scientific process and help understanding plant science and its scientific concepts. It helps the students to directly understand how scientific knowledge on plant science is produced and what working in plant science means for scientists, while helping them to discover what is interesting for themselves. Thus, bringing together scientists and young students could ensure the transmission of ways of thinking and actual expertise that allows the young students to gain a better understanding of plant science, while inducing them to become independent thinkers and potential researchers.

In our study, we present an approach based on the direct contact between young students and scientists taking place at the research facilities, and, thus, create a 'learning environment' that allows school to meet research.

Our objectives were:

- To increase the level of knowledge and awareness of young students on the vital role of plants.
- To favour a renewal of plant science teaching by promoting hands-on activities, active participatory and experimental learning
- To show how todays' scientists are working on plant science-related societal and environmental challenges
- To increase interest in scientific methods and approaches in young generations, and instil at an early level the scientific attitudes to a critical evaluation of the problems.

To address these objectives a specific topic, less known by students but commonly experienced in their everyday life, was presented during the school visits: 'The Chemical Language of Plants'. The focus of the lesson is based on the ability of the plants to communicate through volatiles organic compounds (VOCs). Plants produce a wide variety of VOCs in various tissues above and below ground, that are used not only to defend themselves against biotic or abiotic stressors, but also to communicate with other plants (Tholl et al., 2011 and references therein). Indeed, the emitted VOCs blends are received as chemical signals by organisms at different trophic levels, thus generating a complex communication system between plants and guilds of pollinators, herbivores, and their parasites and predators (Dicke and Baldwin, 2010; Niinemets and Monson 2013). This topic covering different aspects of plants' life and impacts, provides the opportunity to raise student awareness about the vital role of plants and plant science in relation to the major challenges facing human population: food, environment, health, agriculture, and climate change.

Materials and methods

To achieve the proposed objectives we took several actions based on performing frontal-interactive experimental and participatory lectures. The classes together with the professors visited the Institute of Biometeorology and its facilities, and attended lectures on the specific topic of the plant communication system. Educational activities were carried out with students of 11 to - 19 years old within the project 'The Research Language of Research' (LdR) project promoted by the Bologna Research Area, of the National Research Council in Bologna (CNR; http://www.bo.cnr.it/linguaggiodellaricerca). Since 2003 this successful dissemination project that involves every year more than 3000 school students from 11 to 19 years, their teachers, more than 30 scientists and popularization experts. LdR project aims to turn on young people's interest in respect of scientific research, as well as scientific communication, through their involvement in a popularization work. Every year classroom seminars with research scientists are organized on about 30 topics strictly connected with researches and societal challenges, including Plant Science.

We carried out an action-research programme with 11 teachers during the academic years 2012-2013, 2013-2014, 2014-2015. In our study, almost 20 school classes attended the lesson on the Chemical Language of the plants. The lecture was structured to provide not only theoretical knowledge, but also to facilitate the scientific involvement; in fact, the core of the lessons were experimental and participatory activities to involve students with first-hand experiences. In particular, hands-on experimentations, minds-on reflections and dissemination activities (e.g.: discussion games, test, media content) were specifically designed to engage students and to make a more meaningful learning experience.

To make the students understand how the VOCs released from plants (the 'botanical VOCs') perfume their daily life, several activities were carried out to make students address these main questions:

- Where do common smells come from? Students learned through smelling: they experience the smell of different plant species and organs, and then they were asked to describe the origin of the smell while

expressing the emotions they feel (Fig. 1A). This emotional approach relies on the role of the sense of smell and on its impact more on emotions and memory than with the cognitive part of the brain.

- What are the plants emitting? Students smelled individual standards of VOCs and their mixture in different combinations. This allowed the student to realize that the smell released by a plant is a specific combination of numerous VOCs, each of them with its unique smell.
- Which is the VOC emission diversity in plants? Does VOCs emission by plants vary inter-specifically? Students smelled the same plant organ but obtained from different plant species belonging to the same genus or the same family.
- Which abiotic and biotic factors affect or control the release of these compounds? Of particular importance are the roles played by biological (e.g., herbivory, developmental stage, plant metabolism and gross primary productivity), environmental (e.g., atmospheric CO_2 concentration, O_3 levels and other oxidative stress) and climatic (e.g., temperature, precipitation, water stress) variables. Video and other interactive media illustrated the impact of these factors.
- Why do plants emit VOCs? The activities were supported by inquiry-based materials written to encompass core principle, to make students discover that plants detect the VOCs as our nose does, and that these smelling VOCs act as messengers between the plants and the environment. Students started thinking of these smelling volatile molecules as alarms, warnings, and invitations. Videos and other interactive media were shared to make student explore case-studies of these topics.
- How do these emissions affect our environment? Which is the impact of biogenic VOCs on our everyday life? We carried out different but complementary activities: (I) inquiry-based and game-based activities (e.g. using proverbs); (II) experimental demonstration of the formation of aerosol from the VOCs released from plants (Fig. 1B; Andino et al., 2000). These activities were used to discuss the relevant role of the forests on climate and on the water cycle of the ecosystems.

Video recorded during previous field research campaigns, combined to direct visits to the research facilities allowed the students to better understand the cutting-edge research methods, processes and techniques that can be applied for biogenic VOC research at different study levels: from the leaf to the ecosystem level (Rapparini et al., 2008; Penuelas et al., 2013; Greenberg et al., 2014). This activity not only showed the technological innovation on plant science approaches, but also introduced the students to the “ecosystem thinking”. Indeed, ecosystem is considered a relatively young concept (Currie 2011).

Thus, after attending the educational activities, students were asked to become plant science communicators themselves, and create dissemination products on the attended lecture (e.g. videos, websites, newsletters, posters, comic strips and creative objects) by using two idioms, the native and English languages. The best products were awarded during an Annual Conference involving an exhibition of all the dissemination products.

Moreover, the teachers and students of the schools were encouraged to full-fill a feedback form in order to evaluate and enhance the quality of the educational program. This allowed the program efficacy to be evaluated and the educational approaches to be eventually reshaped.

Results and discussion

The applied approach, based on a direct contact between schools and the researchers at the research facilities, was able to stimulate a higher interest than standard plant science classes. By drawing on issues, such as the plant emission of VOCs, the students became more confident with several concepts and they discovered the vital importance of plants in our ecosystem and life.

In particular, the dissemination products (Fig. 2 and 3) developed by the students on this specific topic of plant science, revealed that the students became familiar with some basic and essential concepts of this discipline:

- Plants are a whole system
- Plants are living things
- Plants’ role in food production
- Plants affect the environment
- Plant science is integrated with other disciplines: chemistry, atmospheric physics, agronomy
- Ecosystems

- Spatial and temporal scales of plant science research

The dissemination products reflected a critical thinking of the students in communicating science, showing the ability to develop a personal understanding of plant science concepts, and thus transform as well as synthesize the information into a meaningful and innovative visualization of scientific concepts. The involvement of young students in communication activities allowed them to disseminate scientific knowledge into the public sphere of the school community and to improve their communication skills, while learning about plant science. Indeed, through the activities of communication, students discovered and perceived that certain knowledge or skills are useful to the pursuit of an interest, and are drawn not just to demonstrate but also to master them.

Moreover, the communication products developed by the students, showed that they explored different artistic media and disciplines to communicate plant science, and deepened their own understanding of research: they painted, they wrote, created original newsletters, comics, cartoons, websites, videos, movies, 3D- models, as well as potential smart apps, and even they performed amusing theatrical interpretations. The combination of different forms of science dissemination resulted effective in communicating a different perspective of the plant language and life, using alternative ideas and showing a conceptual change on this issue after the lecture. Communicating plant science is increasingly recognized as a key step for conducting and disseminating research, as seen in our case in the works produced by the students. In particular, the students clearly demonstrated that invoking the arts can be a valuable tool in that process. Indeed, some of the dissemination products (Fig. 3A and B), through an original and creative visualization of scientific concepts, suggest that the combination of art and science is powerful also for students, and the aesthetic-communicative aims of arts can meet the conceptual science. These results highlight that science can inspire arts and arts can become an excellent and powerful way to communicate science.

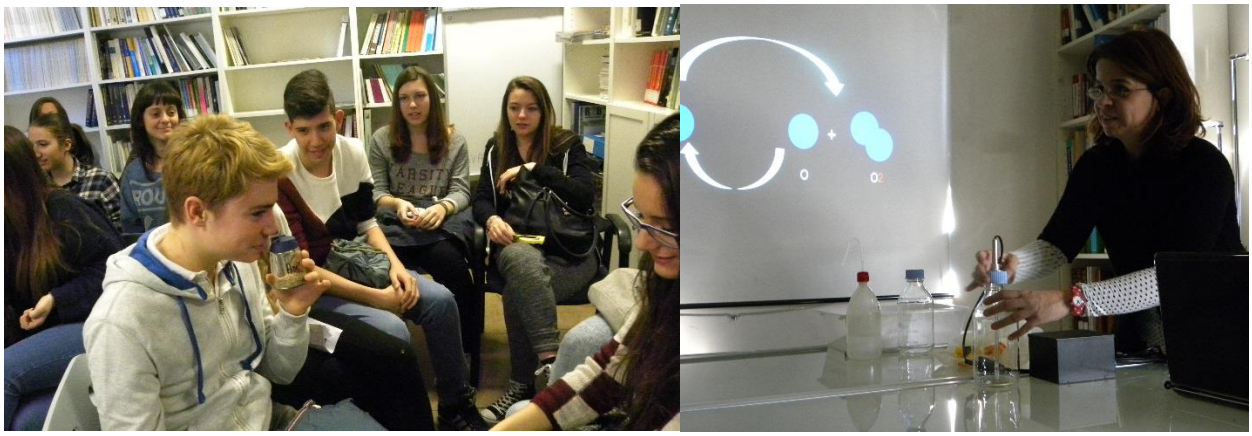

Fig.1. A: Students during smelling activities aimed to explore different aspects related to the release of VOCs from plants; B: experimental demonstration of aerosol formation after ozone and VOCs reactions.

Overall, carrying on the plant science study with students within the LdR project, allowed the development of better connections between the science community and the education system at various levels. Of course, connections with school teachers were developed as well through their involvement within the LdR programme.

A

B

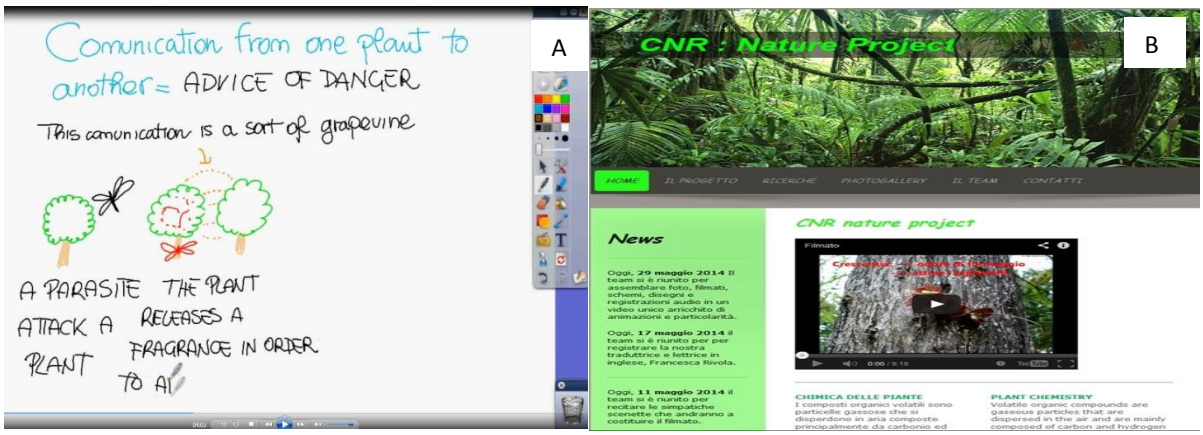

Fig. 2. A: a snapshot of a free-hand drawing video that explains VOC emissions by plants and the VOCs role in plant communication; B: a website that provides a video and different information on the VOCs emission by plants and their role in the environment.

Fig.3. A: the 3D-model visualizes plant organs as a source of perfume (VOCs); B: the 3D-model entitled 'Smell: the sense of refinement' aims at showing the evolutionary impact of plant VOCs on animals' and human being's behavior.

Conclusion

The applied approach resulted effective in providing appropriate learning opportunities to students and motivating them to learn plant science. Future projects will focus on educational activities that can enthuse and inspire young students to appreciate the importance of plants and, thus, continue to pursue studies in this fascinating field and apply the research to a better management of our Earth. Moreover, our study suggests that these effective dissemination activities developed by the students could contribute to social inclusion, bringing students with diverse social, economic, cultural, educational background together and in dialogue with each other.

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INNOVATIVE LEARNING IN NATURAL ENVIRONMENT

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Abstract

The Tartu Environmental Education Centre and the Walk&Learn company have created new pedagocigal materials and environments that actively support development of student ICT compentences when they study changes in the environment through volunteer nature observations in the international student network or collect research data on nature conservation issues. Learning in nature is supported by researchers from the Natural History Museum of the University of Tartu who manage and develop a large database related to biodiversity and living species. The new digital learning environments enable to bring together students from different age, social backround and culture with the scientists, teachers and family members for environmental studies. During the conference we will introduce those digital learning methods and environments, and also discuss their advantages to support the intergenerational learning. The projects to be introduced are DigiPaMu – a native application (Android, Apple) for outdoor learning with rich multimedia content and maps, and Baltic Sea Project (BSP) Reports – the nature observation application for collecting data about the Baltic Sea catchment area. This system has also native applications for Android and Apple devices and is currently used by 10 schools from 9 countries of the Baltic Sea región.

Keywords: ICT in nature education, digital learning methods, pedagogical materials, nature conservation, collaborative learning

A PROPOSAL FOR PRIMARY SCHOOL ENVIORNMENTAL EDUCATION UTILIZING BIOCHAR AS THE CORE IN A PROBLEM BASED LEARNING SCHEME

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Abstract

Traditional approaches to education in Asia and other advanced countries have focused on memorization as the method to educate our youth, however, the future demands more creative cognitive schemes to stimulate students to meet the future challenges that we will face due to environmental challenges that we have brought on by uncontrolled industrialization. This paper introduces a Problem-based Learning (PBL) approach that utilizes sustainable local carbonized organic material—biochar, which not only acts as a soil amendment to improve vegetable production, in addition, acts as an affordable and an effective carbon sequestration method. Carbon Dioxide and methane levels have reached historical and dangerous levels recently, but little is being done to limit them on a global scale. The author believes that an important step in reducing them and other pressing environmental issues is to educate the primary school students through an educational scheme introduces the basics and builds a strong foundation with local volunteers and experts to produce innovative solutions to solve local problems. If replicated locally on a wide scale it can have a greater impact globally. The three main goals of the scheme are to raise the creative capabilities to transform a problem like the excessive overgrowth of bamboo in western Japan into a productive solution, and to revitalize a community's social interconnectivity, and restore the natural environment. After consultation with Japanese elementary school teachers, it was decided that ten one-hour workshops could be realistically integrated into the existing 5th grade Japanese annual elementary school science curriculum. Workshop facilitators range from experts in agriculture and environmental studies to local volunteers who are dedicated to protecting the local environment. Creativity and human relations have become muted in present education and society due in part to technology, so this scheme aims to reconnect them to fulfil our potential.

Keywords: Environmental primary education, Problem based learning, Biochar, Volunteerism

CHAPTER 6: INTERGENERATIONAL LEARNING IN ENVIRONMENTAL EDUCATION

USING APPROACH OF INTERGENERATIONAL COOPERATION AND LEARNING FOR NATURE CONSERVATION AND INNOVATIVE ECO-SOCIAL INTERVETIONS IN AGRICULTURE IN SLOVENIA: A CASE STUDY

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Abstract

Europe and Slovenia are facing today so many problems from different fields: high unemployment, problems related to nature preservation, loss of traditional knowledge, disappearing of cultural landscapes with their natural and cultural heritage, old people are left in the countryside, young people are leaving these areas; but there are solutions for positive changes possible.

We have to take a look in our past and renew practices that once existed (intergenerational cooperation, cooperatives, intergenerational transfer of knowledge and praxis, traditional organic agriculture…) and on this basis enable new opportunities for solving more problems combined in rural areas with attracting people from urban areas.

We will show that people themselves can make positive changes for themselves through cooperation and sharing of available resources. With intergenerational cooperative organic food growing on farms, owned by older farmers who cannot work on the land anymore, we will enable reintroduction of traditional organic agriculture practices with sustainable use of resources, enable protection and restoration of traditional cultural landscapes with their landscape and biodiversity, preserve local heritage and empower participant for employment

Aim is to improve social situation of participants from towns and countryside and on this basis develop new economic segment – social entrepreneurship, together with solving problems of nature and heritage conservation with enabling new sustainable development opportunities.

In this paper we present our research using the method of participatory action research, learning by doing, which will serve us for the establishment of social enterprise start-up, based on our research activities. Those include knowledge transfer from the older generations to younger ones and implementation of this knowledge in today's situation. With the method of participatory action research we have tested our project idea for implementation and establishment of social enterprise in future.

Keywords: intergenerational cooperation and learning, nature conservation, participatory action research, eco-social interventions, social innovation

Introduction

First and most important problem is the social exclusion of people due to their low financial income and differences in these problems between countryside and towns.

Older people in the countryside possess agricultural land; due to their age they are unable to cultivate it. Consequently the land is not cultivated and they cannot get additional income which could improve their economic status.

Unemployed people in towns possess no arable land, but they are willing to work and would like to grow food to improve their economic status. They cannot afford to buy expensive organic food and food represents a significant expense for their family budget.

This situation leads to low self-sufficiency with local food, overgrowing of landscape and disappearance of traditional landscapes with their landscape and biological diversity.

We are losing traditional landscapes and landscape elements that are important for provision of ecosystem services. Organic agriculture depends on these ecosystem services.

Demand for organic products is increasing in Slovenia and domestic farmers cannot grow as much organic food as demanded. Slovenia has problems with low self-sufficiency with agricultural products and at the same time with high unemployment.

How can we reverse this trend? How can we attract people back into rural areas and develop new opportunities for employment on the basis of sustainable use of resources available in these areas?

The solution is our pilot project which connects the unemployed people from the towns with the elderly owners of farms for the purpose of cooperative growing of local organic food for improvement of their social and economic situation.

We will empower unemployed people for local production of organic food on derelict land or overgrown areas for their self-sufficiency with organic food.

Elderly owners of agricultural land will establish new social contacts, and transfer their knowledge of traditional farming practices to younger generations. Young generation will obtain experiences in organic food growing and in possibilities to earn income from it. Aim is to develop cooperation's from self-sufficiency towards empowerment for employment in social enterprise where they will actively participate.

With the establishment of an organized cooperative work in social enterprise we will enable new development opportunities in rural areas and improve economic and social status of participants.

This is a new approach on how to establish frame conditions for sustainable development in rural areas with new concepts for cooperation and partnership including local people and it is in line with the emerging Green Economy concept supported by the EU policies.

Goals are not just solving economic and social problems but through restoration of traditional agriculture practices, which were present in these landscapes and are now abandoned, preserve functioning landscapes.

In this process we will establish social enterprise with eco-social brand for production and marketing of regional organic food products, promote sustainable development of landscapes with introduction of eco-innovations and old farming practices.

With our model we will strengthen the local economy and sustainable rural development.

Present framework conditions in society are very suitable for implementation of this project. Economic and social situation make people more receptive for new ideas.

Methodology

Action research method

"If you want it done right, you may as well do it yourself" (O'Brien, 1998).

Action research is "learning by doing" - a group of people identify a problem, do something to resolve it, see how successful their efforts were, and if not satisfied, try again. It is used in real situations, rather than in contrived, experimental studies, since its primary focus is on solving real problems (O'Brien, 1998). It seeks to understand and improve the world by changing it (Baum et al., 2006). Action research projects are generally situational unique, but there are elements in the methods that can be used by other researchers in different circumstances (O'Brien, 1998).

Participatory action research (PAR)

It is a methodology that promotes researchers to create partnerships with communities in order to promote positive social change. The advantages of PAR are that it is applied collaborative research created through use of a committed community. Furthermore, the topic of research originates from the community itself (Allen et al., 2010).

The reflective process is directly linked to action, influenced by understanding of history, culture, and local context and embedded in social relationships. The process should be empowering and lead to people having increased control over their lives. (Baum et al., 2006).

The PAR movement challenges the system of surveillance and knowledge control established through mainstream research. When communities seek control of research agendas, and seek to be active in research, they are establishing themselves as more powerful agents. (Baum et al., 2006).

It is often the case that those who apply this approach are practitioners who wish to improve understanding of their practice, social change activists trying to mount an action campaign, or, more likely, academics who have been invited into an organization (or other domain) by decision-makers aware of a problem requiring action research, but lacking the requisite methodological knowledge to deal with it (O'Brien, 1998).

Social innovation

Social entrepreneurs have as their central goal, societal impact, with capital wealth creation a secondary consideration. Success for social entrepreneurs is measured in the ability to innovate, facilitate and sustain positive changes and growth for a defined social problem (Allen et al, 2010).

Social innovation is a powerful and valuable tool in the environmental sector. It involves social groups and communities creating, developing and diffusing ideas and solutions to address pressing social needs. More recently, social innovation has been gaining policy attention, providing a means to stimulate new ideas that address complex issues alongside ensuring citizen participation. Due to its participatory and creative nature, it is well positioned to address environmental challenges, which are multifaceted and often require societal or behavioural shifts towards more sustainable options (Science Communication Unit, 2014).

PAR and social innovation

As Allen et al. (2010) said success of social entrepreneurs is measured in the ability to innovate. Before we will establish social enterprise we have to test our innovative project idea.

The concept of social entrepreneurship provides an additional framework for those engaging in applied research and provides a unique focus on innovation and adaptation, which is not necessarily stressed in PAR. Furthermore, social entrepreneurship follows a structured timeline, which includes amongst others, specific milestones indicative of project success. The presence of a timeline may be helpful when attempting to deal with one of the disadvantages of PAR (Allen et al., 2010).

Pilot project - PAR social innovation method

We used PAR to obtain results and experiences which will help us in further development of idea towards social enterprise. Our PAR has timeline, which is growing season.

Our plan was to establish cooperative growing by ourselves to see how implementation of the idea works. We want to identify the problems that arise: the relationship with the owner and how organic farming actually works in practice.

We contacted the owner of a farm that used to have ecological agriculture but due to the owner's lack of time (working) and the fact that farm is too small to have a decent living from organic agriculture as full time job some parts of the land are not cultivated. This uncultivated land was given to our team to work on.

Aim of established cooperation is to learn about:

- how team work is functioning,
- the process of growing plants through all season,
- relations with owner and possible problems that may occur,
- recognize problems in organic agriculture and other problems that may occur during growing season.

During the action process we have made a diary of our work in cooperation for reflection and evaluation of our pilot project.

Results

Establishing a friendship relation with owner is most important. If we don't trust each other the collaboration will not work. Owner recognized our idea and it's potential. We have learned a lot from her about organic agriculture during our cooperation. She also borrows us tolls for field work, so we didn't have to buy any.

In agriculture harvest is dependent of nature. So we have to consider nature properties, especially climate where our pilot project was taking place and weather conditions. In year 2014 we had a lot of rain: it prevented us planting in the optimal time, later we could not work on field in the optimal time for weed control and plants didn't grow or their growth was weak due to too much moisture. Harvest was not optimal as in normal weather condition.

Here comes another fact in consideration – organization of work. We had to take advantage of every opportunity to work on field, because the wet soil obstructed or prevented work. If we did not use this opportunities we had problems with weeds.

Important are practical results which we obtained during cooperation. Owner gave us a lot of advices that helped us by growing. Done by ourselves it has bigger value because we gain experiences. With owners help and her experiences our work was made easier and some problems were avoided. We got an insight into organic farming and first experiences in organic food growing.

Our budget has low income. We made our field work as cheap as possible. We didn't buy seeds and plants, instead we have asked people if they could donate us what they have and we planted our field with no financial income. This showed us that seeds and plants which are available in stores are not better quality that the one which were donated to us.

Current situation in Slovenia is also problematic; there is a lot of mistrust between people. So if we want to convince the people to cooperate in our project we must show them an example and the results.

Discussion and conclusions

Conclusion is that PAR method is, in our case of study, from our point of view, the right approach towards our goal. We have tried it by ourselves as O'Brien (1998) said. We defined the main condition that must be met for successful cooperation between people – this is good relationship between participants, especially trust. We are working in right direction.

The results that we obtained will served us for the next growing season for improvement of our work and helping participants by their work.

Organization of work in the field is the most important; we have to organize it better. A constant presence and responsiveness of work is needed, mainly due to the weather which can obstruct work in the field and also there can come to problems with diseases and pests. Rapid interventions had to be done when problems occurred. At least once a week we must come to work on field to see conditions of crops, to make all necessary arrangements in the field, collects ripe crops and to improve cooperation with owner.

We obtain a lot of information from organic agriculture, deepen our relationship and discuss about her experiences from organic agriculture. This leads to insight in new possibilities for cooperative work on farm.

If you don't have money you can still obtain necessary plants and seeds that you need for the field.

Overall results for evaluation are that the research has fulfilled our expectations. We gain experiences for future work with participants and insight in what has to be improved.

This research is just one step towards our goal. This step is important for organizing work in the future. We have shown what can be achieved and now we can show others. Promotion of results will serve as an example when approaching our potential partners in the cooperation.

First step is done now there are new challenges before us.

Acknowledgements

With the method of PAR we showed that this model is working. We have done it by ourselves, gain experiences, knowledge and reflection of our work. Results are foundation for future work. We are more confident in our idea and we have results for promotion.

Our social innovation is new approach for solving problems in Slovenia. With simple cooperation between generations for common purpose we are able to solve more problems simultaneously in a way that does not require large financial resources. This bottom up approach will enable new opportunities for sustainable rural development on the basis of available resources, create employment for social endangered people and can be implemented all over the world with the purpose for improvement of current situation of people and environment in which they live.

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SERVICE LEARNING AND OTHER COMMUNITY-BASED LEARNING INITIATIVES IN ENVIRONMENTAL EDUCATION; BC NAKLO HIGHER VOCATIONAL COLLEGE CASE STUDY

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Abstract

Community engaged pedagogies (service learning) and community-based learning combine curricular benefits and common good. These forms of experiential learning support community values, sustainability, protection of natural and socio-cultural capital and social responsibility.

The article is focused on service learning and community-based learning model that include internship, out-of-class activities and project experiences practiced by Biotechnical Centre Naklo (BC Naklo) higher vocational college, Slovenia. It is the only institution in Slovenian Gorenjska region that provides educational programs in the field of countryside and landscape management, nature protection and horticulture. This unique institution is simultaneously a school (at secondary and tertiary level), an applied research institute and an educational commercial organic farm. The Centre vision is to be well connected with the local community, to spread a positive attitude towards nature, a concern for production and processing of healthy food and a great care for the natural environment.

The proposed case study focused on students' collaborations in project of intergenerational learning to share good practices of organic farming to elderly population, volunteering in eco villages, internship experiences in protected areas, NGO and SMEs of the green sector. Our aim is to integrate inside education also research and activism to speed up the transitional process toward the strategy of sustainable development. The added values of these collaborations were much higher than just cognitive and effective outcomes of students, since many community benefits were achieved: enhancement of relations with the local community and satisfaction with students' collaboration, improvement of intergenerational help, new community energy and enthusiasm in action to protect natural heritage at local level, improvement of well-being and community values.

Integration of service learning and community-based learning initiatives in education could be a key factor that would support the social responsive multidimensional process of societal change to a more sustainable and equitable societies worldwide.

Keywords: service learning, community- based learning, environmental education

Introduction

Global climatic and environmental challenges require a radical change in thinking, since they are connected to social and economic systems created by humans. Better understanding of the complex interaction of social, economic and environmental factors, would enable more informed decision-making, planning, governance and engagement processes of adaptation to future challenges and creation of more sustainable tomorrow. In particular, we need to rethink the bases of the materialistic approach in economy and lifestyle, but also in education (Giacalone and Thomson, 2006). Today's materialistic and egocentric values are associated with less personal happiness, satisfaction, interpersonal relationships and desire to help others and cooperate in the community (Kasser, 2002). Indeed, it generates a more antisocial, unhealthy and unsustainable lifestyle that hurt us and the Planet. The human society is now in the period of transition thinking toward a more sustainable and responsive society that care for the environment and wanted to preserve biodiversity (Sterrenberg, 2013). We should take into account that it will lead us out of our comfort zone and habits, in particular connected with consumerism, but also nearer to sustainable and pro-environmental outcomes.

The role of the education in this process is very important. Moreover, sustainability should be a core value in education. Environmental education and education for sustainable development (ESD) promote ecological literacy and social changes; therefore transformative learning in higher education should be supported with experiential or practical learning methods (Moore, 2005). New models of interdisciplinary transformative education promote student teamwork and the acquirement of important skills connected with social and environmental responsibility (Cranton, 1994). Current academic systems are often oriented to more competitive models of success; therefore the importance of collaborative models should be emphasized. Social changes and pro-environmental behaviour need to be valuated as important outcomes of modern teaching and learning models.

Service learning is a part of experiential pedagogy in which students render services in their communities for academic credit (Bringle and Hatcher, 1996). The definition is not very clear, since Kendall (1990) reports 147 different terms associated with service learning and other community-based learning (CBL) options. It incorporates many aspects as student volunteering, activism, internship, out-of-class activities, projects and other (Mooney and Edwards, 2001). CBL initiative connects students' theoretical work with their affective domain, values, interest and concern for the local community. When students collaborate with NGO, SMEs and local community as activists, they are able to develop research projects, collect and analyse data, and share their results and conclusions, not just with their professors, but also with their external tutors that can make use of the information. The added values of these collaborations are much higher if outcomes are not just cognitive but also effective.

Biotechnical Centre (BC) Naklo (2014, 2015) is a Slovenian public educational and research institution, ecologically orientated. In the Vision of the Centre is written that the Centre is a truly sustainable institution with a positive attitude towards nature, a concern for production and processing of healthy food and a great care for the natural environment in cooperation with the green economy sector. The Centre property (organic farm) covers 4 hectares of build-up area and extra 22 hectares of ecological agricultural area. It is divided in 3 main units: Secondary school, Higher Vocational College with Research Unit, Enterprise Centre. Biotechnical Centre's Naklo primary goal is education and research for sustainability, biodiversity and nature protection with a great care for our socio-cultural capital. The Centre's major contribution to raising the awareness of local population about the environmental situation and conditions is based on an active approach, natural resources protection, cultural and natural heritage protection actions and projects.

This article is focused on service learning and CBL integrated model for environmental education developed by BC Naklo. The model is based on the implementation of integral developmental models created by Lessem & Schieffer (2010), as well as via their integrated CARE model (Lessem et al., 2014). The integral green economy model by Lessem and Shieffer (2010) is based on four pillars which integrated the world's diversity of nature, community, economics, culture and spirituality, science and technology with the central ethical core. Moreover, CARE (C+A+R+E) model (Lessem et al., 2014) is an holistic approach that covers and connect activities of Catalysation, Activism, Research and Education. The collaboration between Alexander Schieffer and Ronnie Lessem, TRANS4M Center for Integral Development, Geneva, Switzerland, Darja Piciga, founder of the initiative for Integral Green Slovenia (Piciga, 2012) and BC Naklo started in May 2013.

The purpose of the article is to present the below described theoretical models implemented in environmental education based on some CBL good practices that involve students internship, project work and out-of-the-class activities. The potential benefits and implications of shifting higher education (HE) from the current models toward models of transformative learning are discussed. The aim of the used approach is to present a model implementation and connected good practices that could be implemented also in different environments and in consideration of local situations, natural and cultural background of the communities.

Methodology

In the article we purpose a qualitative case study that is used to study complex phenomena within their context (Baxter and Jack, 2008). The case study methodology can be applied not only in the social sciences, but also on interdisciplinary, education, business and environmental studies. There are different interpretations of the notion of "case study" (Yin, 1994; Gillham, 2001; Baxter and Jack, 2008), but in general the case study should have a "case" which is the object of the study that should be complex and contemporary and should be investigated in its natural context with a multitude of methods (Johansson, 2003).

Results

Theoretical models of transformative education, context and adaptation aspects

Rural Development Programme for Slovenia 2014-2020 (Ministry RS of Agriculture, Forestry and Food, 2015) stated that an increasing ability to acquire and exchange knowledge and information is important for the development of Slovenian rural area. Indeed it needs more specialisation in agriculture, forestry and the food processing industry. Communities from rural areas face many difficulties that increase the migration of younger people towards centres, where the education and training offers are better and there is a larger number and variety of jobs. Nevertheless, youth from rural area have a very strong connection to nature, since most of them live on farms, inside or near protected areas and use to spend their free time with outdoor activities in the natural environment (Hauptman and Logonder, 2015).

BC Naklo is located in the rural area of Slovenian "Gorenjska" region and it is well integrated in the territory. "Gorenjska" is an Alpine region with a characteristic diverse mountainous landscape. Seventy percent of the region is a mountainous world, while only 29.8% lies in the depressed/lowland part of central Slovenia. The Centre is the only institution in this area that provides educational programs in the field of countryside and landscape management, nature protection and horticulture. Around 900 high school students and 300 vocational college students are included in educational programs every year. The Centre structure is very particular, since it is adapted to economic, social and natural context. New integral and social economy models for common well-being have supported our attempts to create a holistic structure of the Centre and an innovative learning environment for young people from rural areas that connects education, research and entrepreneurship

The CARE model is represented in a circle (Figure 1) that resembles the holistic approach. Beside education and research, aspects of activism and catalysation are emphasized.

CARE-ing concept has different dimensions:

- Socio-cultural dimension (CARE-ing for personal and professional development of students, employers and local community, since we realize that BC Naklo is a creation of people that believe in its vision);
- Natural dimension (CARE -ing for living organisms and environment that contribute to the ecosystem dynamics and support global ecosphere).

Good practices of CBL as students' internship, volunteering, project work and out-of-class activities integrated with CARE model

To realize the proposed strategy in education and research that is based on experiential learning, service learning and CBL, the Centre has created good connection and collaborations with local authorities, municipality, enterprises and non-governmental organizations (NGOs) in the fields of environmental protection, nature conservation, sustainable development education and research. The educational programs are focused on acquisition of practical knowledge with particular effort on students' internship. These "practical educational collaborations" are integrated with research activities, technology transfer, out-of-the-class activities, activism and volunteering.

Students' internships play a vital role in the higher vocational education, connecting educational institutes and entrepreneurs. Relevant cases of successful collaboration and mutual transfer of know-how between Higher Vocational College of BC Naklo and local enterprises were already presented (Vižintin and Maček Jerala, 2014; Maček Jerala and Vižintin 2014). We noticed that the integration of all these alternative aspects positively influenced the quality of our internship program and raised students' employability. The most relevant good practice was referred to collaboration with the Municipal service for waste, wastewater and environmental management Kranj, which was involved together with BC Naklo students and professionals in revitalization and bioremediation of an abandoned landfill site. Another good practice includes the collaboration with Triglav National Park (TNP), the only Slovenian national park where student collaborate in outdoor activities and guided naturalist tours for visitors.

Indeed we included in practical education also volunteering and activism in collaboration with local NGO that have a very positive impact in student pro- environmental behaviour and social skills (intergenerational help, team work and collaborative skills). Concerning volunteering, we focused on creation of an equitable and inclusive learning environment which would permit educator and student to be addressed and engaged in the issues of diversity, equity, and intercultural understanding inside classroom and beyond. One of our most relevant collaboration started in 2014 with ecological community Sólheimar (2015) Iceland, which was in particular important as a model of reverse integration of the entire society of non-disabled people

regarding disabled people inside it. The focus of this approach is on the statement that non-disabled people should fit to disabled and not inversely. Sólheimar is also considered an environmentally friendly community since beside social development they try also to minimize the impact of the community on the environment. Student from BC Naklo joined the community for 2 month volunteering work and they had a very positive experience that changed their attitude toward sustainable social and environmental aspects (Vižintin, 2014).

Intergenerational help was touched inside collaboration of students in two projects.

The first project called “Elderly people actively explore beneficial organisms ” that wants to establish the conditions for the implementation of horticultural occupational therapy at Nursing Homes for older adults through the installation of raised beds for plant cultivation and human-sized hotels for beneficial organisms and pollinators. The project contributed to the quality of life of residents in nursing homes and also to students’ action education (Čatak and Romih, 2014).

The second project called “Invasive alien species (IAS) in Gorenjska region” involved activism of group of student of BC Naklo working on IAS data collection, which decided to undertake an active role in prevention and eradication of AIS. They wanted to raise awareness and identify solutions to limit the propagation of invasive plants at local scale. Therefore they have taken their own initiative to organize lectures for different stakeholders including youth in schools and older adults in nursing homes, using a self-produced video and didactic games. They involved also local communities in filed actions to eradicate some invasive plant in the zone.

Figure 1. CARE model of BC Naklo (modified from Schieffer and Lessem, 2014).

Discussion and conclusions

Higher education provide students with knowledge and competences to address the serious scientific, innovation and ethical issues of the 21st Century by equipping them with knowledge and attitudes specific to the fields of ecology, sustainability and social science. Sustainability in education could be approached with various methodologies or educational models (Rusinko, 2010). Achieved cognitive and emotional learning outcomes have a significant impact on values, attitudes and behaviours, as supported by researches (Shephard, 2008). Contemporary use of various service learning and CBL approaches encourage students to better understand the complexities of the issues threatening sustainability in a particular social and ecological context. The added values were much higher than just cognitive and effective outcomes of students, since many community benefits were achieved: enhancement of relations

with the local community, improvement of intergenerational help, new community energy and enthusiasm in action to protect natural heritage at local level, improvement of well-being and community values.

For facing climate change and support sustainability, environmental education has a very important role, since it is focused on changing environmental behaviour of students through increasing environmental knowledge. Emotions and beliefs, rather than knowledge, need to be targeted by environmental educators interested in changing students' environmental attitudes (Pooley and O'Connor, 2000).

Central concepts such as critical literacy, personal empowerment, mindfulness, human and nature well-being was successfully addressed. The capacity for ethical reasoning present in human nature is the core of the future survival on this planet. A positive, supportive and productive learning environment including elements of positive psychology and empathetic concern was enlightened in our alternative approach in education (Vižintin and Logonder, 2014). The innovative dimension was focused on creative learning, both cognitively and emotionally, connecting science, ethics and social responsibility. Emotional literacy and self-awareness of the ethical dimension are turning our attention to our inner world of thoughts and feelings; they allow us to manage ourselves well, but also manage the environment (natural and social).

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EXPERIENCES OF INTERGENERATIONAL METEOROLOGICAL AND CLIMATOLOGICAL EDUCATION IN FRIULI VENEZIA GIULIA (ITALY)

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Abstract

The first aim of this work is to present an experience of intergenerational education on meteorology and climatology issues to school population from 6 to 19 years old. The second aim is to present the video-clip "The voice of snow", that represents a mix of science and popular tradition about the snow in the alpine sector of Friuli Venezia Giulia.

The experience with school has involved more than 300 students from the city of Trieste: a group of volunteers ("older" students 17-19 years old) have the role of tutor, and after a supplementary training on meteorology and climatology, have been able to carry out a series of exhibits over meteorological instruments (thermometer, hygrometer, barometer, anemometer, rain gages, etc.) and some specific games, to better understand some meteorological concepts, like density of fluids and greenhouse effects. They make also some exercises of meteorological forecast with meteorological maps, as if they would be a forecasters. All these activities were made in favour of the "younger" students, from the basic and middle schools, with a strong emotion among students of various age.

The video-clip "The voice of snow" is a work projected by OSMER & LaREA ARPA FVG for meteorology and climatology divulgation, on the snow phenomena. The first part is made for increasing the basic knowledge (what's the snow, how it forms, how it's measured and forecasted, how much is the normal snow cover over the various zone of the land) and the effects and the risks (avalanches). The second part include principally a series of interview with old people living in alpine valleys, that speak on popular tradition and show the arts of special technical roofing, an architectural features of the most snowy valleys of the Alps, that characterizes various landscape features in a small country as is Friuli Venezia Giulia (about 8.000 km^2

Keywords: meteo, clima, students, experimentation, video, popular tradition.

Introduction

The experience of student involvement in the dissemination of meteorology began in 2003, with a group of teachers of high and middle schools together with meteorologists. We wondered: how to convey basic knowledge of meteorology and climatology without boring? The following idea came: involve "older" students in the illustration of the weather instruments and experiments in favor of youngers students, and organize an event with lot of schools, and preparing a specific video-clip.

Methodology

First step: meteorologists teach basics of meteorology and climatology to high schools students and propose this project: new theoretical and practical course where students can make experience with different kinds of meteo instruments, technical and historical evolution of measurement methodology, exercises of calibration and plotting. Other students begin to study the weather maps and the key concepts of meteorology and climatology: high and low pressure, cold and warm front, stau and föhn, and with colourful animations propose small lesson. Other groups elaborate a play for understanding a greenhouse

effect with a camping tent, or simulate a hail precipitations with metallic ball over polystyrene pads or the effect of air pressure over air ball, the simulation of the formation of the cloud and a tornado inside a bottle.

This exhibit are shown in a daily event with more of 300 younger students, with joy and enthusiasm with a strong emotional involvement.

Second step: to develop of a series of video-clip regarding meteorology elements and their effects in our region with involvement of university students and the population, especially old people. The first video was about rain, and was already presented two years ago, now it's on work the second video-clip "The voices of snow" . In ten chapters it explains to younger students of basic and middle schools the phenomena of snow, not only with a scientific explanation, also with a historical view and experience of older people about big snowfall precipitation and how the people have made solutions for moving over snow terrain (sledge) how to do roof covering. They did simulations to build the traditional roof tablets coverages of the Friulian Alpine valley, popular poems, songs and dance and other details tradition, as a costumes and masks. These subsection parts of video-clips are recorded in the original and typical languages of our land: Carnic, Friulian, Slovenian and Germany dialect.

Results and conclusions

Results is a important involvement of people: more thousands students during 12 years long project in all the land Friuli Venezia Giulia, hundreds teachers, a very good general involvement of population with mass media publicity and stands during popular events. A very good way for divulgation of meteorology and climatology. We have increasing demand of meteorologists presence during conference, meeting and course.

Figure 1. Illustration of meteo instruments.

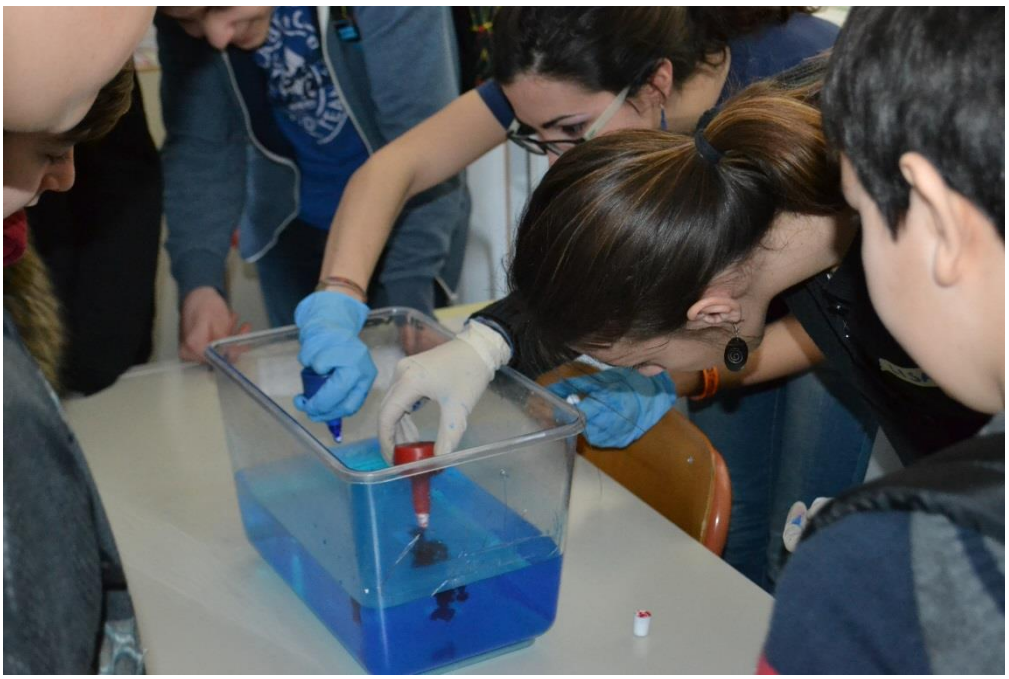

Figure 2. Density of water and seawater.

Figure 3. Simulation of greenhouse effect.

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EXAMINATION OF AGE AND CULTURAL IMPACTS ON TWO COMMUNITY-ENVIRONMENTAL PROJECTS IN NAHARIYA (ISRAEL)

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Abstract

The effect of various age attributes associated with ICT tools regarding community projects are well established in the literature. However, it is less emphasized in terms of their societal backgrounds.

The aim of the research is to examine two environmental community projects that were implemented between 2014 and 2015 in the northern city of Israel, Naariya. While the first project was done by local students, the other one was done by a group of old new immigrants from former USSR countries. The comparative study has shown that despite clear advantages of the young group in sense of accessibility to advanced ICT tools, they tended to adopt in their environmental project much less technical approach compared to the old people in the second group.

Moreover, the young students group tended to identify the use of technologies as less educational in sense of environmental protection compared to the "soft" old traditional means such as social games. The differences between the two groups were explained by the different educational background of them. While the young group is a result the Israeli western education system, the old group is a result of more practical and technical educational system was used in the former USSR countries.

Keywords: technical orientation, human education, community, age pyramid, societal backgrounds

Introduction

Environment adult education (EAE) is generally defined by different scholars and international organizations such as UNESCO (1997) as a permanent process. During this process, individuals gain awareness of their environment and acquire the knowledge, values, skills, experiences, and also the determination that will enable them to act individually and collectively to solve present and future environmental problems.

More often, adult education is linked with civil perspectives that aim to use education in order to create behavioral changes. A plethora of collective pro-environmental actions are taking place worldwide, although environmental problems continue to grow (Walters, 2009; Clover, 2002). However, the influences of different cultural backgrounds on the structure and the implementation of environmental adult education (EAE) programs have not been well investigated.

Using the environmental educational program of the northern Israeli city of Nahariyain two neighborhoods, Ragum and Sprinzak in 2014 as a case study, this article aims to evaluate its results. Moreover, the study examines the socio-demographic and cultural background influences on the educational process over 12 months.

Some previous studies argue that there is a cultural common basis for these actions. Clover (2002; Clover at al., 2013) shows that the volume of these actions situates environmental adult education within a socio-political and eco-epistemological framework. The study explores how new language and metaphors can counteract problematic modern worldviews.

It also emphasizes that adult education for community sustainability can situate local knowledge within a global pedagogy and activism of social survival. Practical and theoretical considerations of environmental popular education within indigenous people's social movements are explained, and the relationship among women, immigrants, young people, and adult learning is explored (Goldman et al., 2006). The aim of environmental adult literacy is to challenge scientific knowledge as the fundamental structure of learning,

and to revalue people's experiential knowledge. A transformative ecological understanding of lifelong learning reconnects humans with nature and fosters social dialogue and action.

This research went one step further and examined the attitude of two groups of immigrants toward environmental education. The first group involved second and third generation immigrants from North Africa who settled in Nahariya, Israel, during the 1950s. The second group comprises older immigrants from the former USSR who came to the city during the 1990s. The two groups are varied not only by their origin countries but also by their age, backgrounds, and their seniority in the Israeli population.

The article first examines the background of the two groups and the study area of Nahariya, and then it describes and evaluates the environmental educational process of each group in 2014, and finally analyzes the changes in their expectations during the process.

Background studies

While there is no doubt about the importance of these activities, their impacts are not always clear. Many researchers believe that although many individual behaviors have changed and a plethora of collective pro-environmental actions are taking place worldwide, environmental problems continue to grow (Clover, 2010). According to Clover (2010), policy makers generally ignore the strengths, knowledge, and power of residents. They also don't pay much attention to large structural and ideological problems at the root of environmental destruction.

Despite efforts by hundreds of organizations worldwide, such as the International Council for Adult Education (ICAE), major political/ policy commitments by politicians to change the destructive ecological course have been weak at best (Clover,2010).

The question that is usually raised concerns the socio-political and eco-epistemology of environmental adult education. Some studies (Clover, 2002; Chen and Martin, 2015) argue that this perspective explores how new language and metaphors can counteract problematic modern worldviews, and analyze the potential of environmental, justice-based learning to combat socio-environmental oppressions.

In some cases, this attitude is linked to environment adult education (EAE). It is based on the assumption that EAE has some clear challenges, which are associated with environmental adult transformation produced by formal and non-formal adult education settings. In this sense, Bush-Gibson and Rinfret (2010) argue that while environmental transformations are necessary to enhance global environmental sustainability, there are difficulties in achieving the necessary attitudinal and behavioral transformations that will eventually lead to global environmental action and stewardship.

One way to explain the success of failure of EAE is to examine the mythology used. Chen and Martin (2015) argue that the effectiveness of EAE is limited due to its small and indirect role in promoting sustainable behavior, while focusing on the impact of social context has been found to be more conceptually relevant. Based on the Transformative Learning Theory, which focuses on promoting social activism through personal transformations, they suggest a four-fold methodology. Their methodology integrates focus on change during knowledge attainment, focusing on revealing behaviors in a real-global context, highlighting internal and external influences on environmental behavior, and includes a problem-solving approach that demands a solution.

Some recent studies have shown that there is an advantage in implementing environment education (EE) programs in high schools. Burns (2015) indicated that this approach brings pedagogical design that draws on the wisdom of ecological systems. It is based on recognizing that ecological systems are our best teachers for creating sustainable and regenerative systems. However, this conclusion is not based on a comparable study with EAE programs. Lange (2010) suggests, regarding the experience in North America, that in this case we need to consider the fact that adult education has many voiced landscapes that unfold with adult education discourse.

Some interesting indications in this issue can be found in the research of Goldman, Yavetz, and Pe'er (2006). They found that graduates of the educational system in Israel who chose to prepare themselves to be teachers were characterized by a low level of environmental literacy, as reflected in their environmental behavior: Students demonstrated limited performance of behaviors that require a high level of commitment, and hence reflect a high level of environmental literacy, and vice versa. The authors discuss the influence of background factors on environmental behavior and its implications for environmental education in teacher training.

Methodology

Study area and target groups

Nahariya is a seaside city located 30 kilometers north of Haifa and 15 kilometers south of the Lebanese border along the Mediterranean coast.

Since 1950, the city has been a target for large numbers of Jewish migrants from different countries. The first massive influx of immigrants arrived during the 1960s, mainly from Morocco and Algeria. The most significant group of immigrants arrived in Nahariya during the 1990s from the former USSR. They brought some new manners and qualifications to the local community. While the immigration group of the 1950s settled in the neighborhood of Ragum, most of the new immigrants from the former USSR settled in the neighborhood of Sprinzak. Unlike the group in Ragum, the group in Sprinzak includes mainly people over 65 years old. Most of them are healthy and in good shape, and willing to take part in social actions that aim to improve their lives.

Both groups live in tall and old buildings that suffer from maintenance problems. Most of them are characterized as low income, which are often supported by the Nahariya municipality welfare department.

Both groups took part during 2014 in an environmental education program of the municipality of Nahariya supported by the Israel Ministry of Environmental Protection. The aim of the research is to examine how the differences between the two groups influenced their attitude toward implementation of these environment education (EE) activities.

The methodology used for this examination included three structured interviews with the participants of the program as well as an observation of the involvement of the participants and their reactions.

Expectations and definition of the environmental education (EE) program

The EE program included several components: a. Knowledge transfer of sustainability background, environment policy, and implementation possibilities by local communities; b. Empowerment activities, which included open round-table discussions and social games; and c. Technical methods of recycling, and energy and water saving techniques.

The first step of the program began with definition of the EE activities by each group. While the group from Ragum chose to focus on component b, empowerment activities, beside component a, the group in Sprinzak preferred to focus on component c., energy and water saving techniques.

The preference of each group was the first significant finding to be investigated and explained. The transfer of knowledge by the first component is almost obvious as a starting point. Some scholars (Hill and Clover, 2003) believe that the aim of environmental adult literacy is to challenge scientific knowledge as the fundamental structure of learning, and to revalue people's experiential knowledge. The difference between the preference for component b and for c needs more discussion. While the first one is more theoretical and focuses on discussions regarding the social-environmental local needs of the neighborhood, the other is more practical oriented.

The explanations were given in the interviews by the participants of Ragum, most of them women between 35 and 45 years old and teenagers who study in the local high school, divided into three sections.

1. "We still don't know what is good for us and need more discussions." Some interviewees remarked that there are some ideas about what the EE needs to include but there is no common clear perspective among the different groups in Ragum.
2. Other interviewees remarked that the situation of the neighborhood is so problematic that there is a need to find a way to solve some basic problems and to promote the local empowerment of the neighborhood. The women interviewees also identify the social problems of Ragum with their gender problems. "The EE should rely on women because we know better than men to take care of the environment, and need more tools and empowerments."
3. Finally, they argue that most women and young people of Ragum have no technical qualifications, so the EE of component c is not relevant. Moreover, they identified "technical qualifications" as a low qualification standard, which provides a poor reward in the salary labor market. "We need to be more ambitious than that."

The explanations given by the older group (over 65 years old) from Sprinzak indicated a different cultural perspective. Their explanations could be also divided into three categories:

1. Most interviewees expressed that they know exactly what is good for the environment and what is good for them. So they don't need any more theoretical explanation. They need only technical means such as efficient light bulbs, insulating materials, or automatic electric switches.
2. Almost all interviewees emigrated from former USSR where they got a comprehensive technical education. Some of them are engineers, "We are very practical people. We don't believe in empty words, just in actions."
3. The third explanation was linked to their age. "Over our life experience, we got a clear vision regarding the environmental crises. As long as we are healthy physically and mentally, we want to go straight to the point of solving the problem and not to waste time."

Impacts of the EE program

Both programs were coordinated by a professional guide of the municipality of Nahariya. The program was implemented separately in the community center of each neighborhood. In Ragum, 36 people participated, 8 of them were women, age 35-45, and most of them are mothers with two children. The others were high school pupils.

In Sprinzak, the participation group is characterized uniformly as 36 older people, men and women, who live in small apartments in the neighborhood.

Both groups heardseveral lectures regarding experiencing an environmental crisis, climate change, and implementing of UN's program "local agenda 21".

At this point, each group got separate annual training. The program of the first group (Ragum) was based on round-table open discussions regarding the ways to improve the poor social and physical situation of Ragum. From the implementation side, the group was involved in the recycling project of the neighborhood, and an annual art workshop that was used to create useful crafts made from recycled materials.

In Sprinzak, the program over the year included technical courses such as installation of energy and water saving equipment. In fact, the Sprinzak group functioned as a reparation team of the neighborhood. Over the year, they went from one apartment to another and offered their technical service free of charge to the old residents of the neighborhood, such as leaky faucets or light bulb changes. They also took care of the public areas of the residential buildings, such painting or gardening.

During the period of the EE activities, the participants of each group were interviewed, using a structured questionnaire.

The first questions related to the theme of environmental awareness. The results showed that the environmental awareness of both groups was improved. However, while most interviewees from Ragum emphasized that they better understood the global problem and its impact on day-to-day behavior, the people of Sprinzak were very doubtful about the given information. "There is no clear scientific evidence for the environment agenda", was a common reaction. Another typical reaction was, "We are too old to take of global problems. We care about our self, our homes, and neighborhood."

Another examined theme linked to the way they integrate contemplative practices into their work and personal lives. The results indicate that the first group brought some changes to their lives. Some said that today they pay much more attention to recycling and energy saving. Others demonstrated their will to be a more social activist.

Regarding the second group, their reaction was more skeptical. "We don't need anyone to tell us what to do and how to save. We know better than anyone else" was the typical reaction. Another common reaction was "We are too old for changes. We have learned in our homeland [Russia] how to save and how to arrange things. All we need is only some technical means."

The third theme defined over the annual EE activities, related to the impacts of the activities on the community development of their neighborhood. In Ragum, the activities led them to create a public council, which tried to represent the community and to advocate their needs and demands in the municipality.

The people of Sprinzak expressed their appreciation for the useful technical tools and methods they got. However, they don't see significant changes in the near future concerning the community of the neighborhood. "We have our old cultural traditions."

Discussion and Conclusion

Sustainability is becoming increasingly relevant in adult education, as the need to address complex cultural and ecological problems intensifies. How sustainability is taught has a profound influence on the kind of learning that takes place and the impact it has in the world (Burns, 2015). In our case, the question of environment education (EE) and sustainability learning was examined among adult groups in two neighborhoods, Ragum and Sprinzak in Nahariya. The results indicated differences in the way each understood the EE program and were influenced by it, as an individual or community.

In general, sustainability pedagogy is offered as a tool for creating transformational sustainability learning that is thematic and concrete, critically questions dominant norms, and incorporates diverse perspectives, is active, participatory, and relational, and is grounded in a specific place. In our case, the difference between implementation in the communities in each place was based on the difference between the two communities and their backgrounds.

In the first neighborhood, the target group was characterized by young women and high school pupils. Most of them were born in this neighborhood. This group is young enough to understand and to accept the sustainability values. They are ready to be changed, and not afraid from the necessary changes.

The group from Sprinzak was characterized by an older group of immigrants from the former USSR. Unlike the first group, these people are more experienced, disciplined, and qualified, and clearly know what they want. That is why the new approach of sustainability was not welcome unless it contributed to their own agenda. Their agenda was based on a practical point of view, very technical, and is against any abstract ideas without technical translation.

The results have shown that in order to maximize the impact of EAE programs, there is a need for a sense of flexibility that takes into consideration cultural and social backgrounds.

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CHAPTER 7: SOCIAL ENGAGEMENT IN ENVIRONMENTAL PROTECTION

SOLIDARITY TOURISM, EDUCATION AND VOLUNTEERING – SOCIALLY RESPONSIBLE PRACTICES IN BULGARIA

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Abstract

Solidarity tourism is a herald of new messages and hopes in the public space, but also new ideas to promote sustainable models for local and regional development and education. It includes forms of tourism where the focus of the journey is contact with people, and also the participation of local people in various stages of tourism projects in terms of people, cultures and nature and a more equitable distribution of resources obtained based on these types of tourism. Solidarity tourism is an ethic for travelling which includes the principles of the Global Code of Ethics for Tourism and environmental education. It is closely connected with the volunteer tourism and often includes best socially responsible practices of environment conservation and education. The survey includes two different best practices in Bulgaria. One of them is the interdisciplinary approach to education in a real environment which is part of the university campaign for civil participation and sustainable development "Place for Future". Specific examples are provided of how sustainable thinking can become a sustainable action through education in a real environment, coupled with the exchange of international experience and the establishment of lasting links between the academic community, civil initiatives and NGOs. The main focus is on the acquisition of knowledge and experience by the students not only theoretical but also the practical aspects of citizenship as the basis for sustainable development. Another best practice is the experience in volunteering of Natura Visitor Center focused on ecology education and youth activities projects. Major conclusions and proposals of this interdisciplinary approach are made which can be implemented in the area of solidarity tourism, education and volunteering.

Keywords: solidarity tourism, environmental education, sustainable development, volunteering

Introduction

In recent decades tourism has been an object of expansion and diversification which has turned it into one of the fastest developing sectors of the world economy. According to the long-term estimate of future trends in tourism of the World Tourism Organization (UNWTO) “Tourism Towards 2030”, the number of international tourists in the world for the period 2010 – 2030 is expected to grow on average by 3.3% annually. This means approximately 43 million more tourists each year, as expectations by the year 2030 are for this number to reach 1.8 billion. Furthermore, the trend of faster growth of the emerging economies in comparison to the developed ones is expected to continue in the future. At a national level, tourism is a leading sector of the Bulgarian economy, and has managed to take first place in the structure of the country’s export. Nevertheless, the contribution to the economies of the host countries is insufficient and rarely profitable to the local communities due to unfair trade deals. Ethics and responsibility towards the local people, as well as the environment, are frequently ignored on account of economic interests of international corporations. According to the United Nations Environment Programme, 80% of the revenue of the typical "all inclusive" holiday is distributed between airlines, hotel chains and other international companies. Very often large hotel complexes in Third World countries are owned by Western companies which is almost always a guarantee that tourists’ spending in the respective country does not remain to help its development, but flows out of it. As a result of this process, the tourist development contributes to the enrichment of foreign investors at the expense of the local population which suffers a partial cultural breakdown, social problems and consumer conflicts. Thus, a necessity arises to emphasise not only on the summer and winter recreational tourism products, but also on specialised types of tourism, which are to contribute to the utilisation of the national natural and cultural-historical treasures, attraction of more solvent tourists and development of year-round tourism, including inner parts of the country. This can be accomplished through the adoption of a new philosophy, associated with ethics in tourism, concern for the

environment and the welfare of local communities. An alternative to the traditional tourist products should be sought in line with the new consumer needs and the introduction of European practices.

Characteristics of solidarity and volunteer tourism

Solidarity tourism is an alternative to the social and economic decline and elevates as a priority the attitude to nature, the traditions and the interests of the local communities. It is a herald of new messages and hopes in the public space, as well as new ideas for the affirmation of sustainable models for local and regional development. Responsible travel places the human and the interaction with humans at the centre of tourism. The participation of the local population in the various stages of a given tourist product, respect for people, culture and nature, as well as a more equitable distribution of the profits of tourist activity are the bases of sustainable solidarity tourism. It provides for up to 95% of the revenue to remain in the local economy, because by means of promotion, it attracts tourists from a certain destination who are genuinely interested in the welfare of the place where they spend their holiday. These characteristics define solidarity tourism as a herald of new messages and hopes in the public space and new ideas for the affirmation of sustainable models for local and regional development. **Tourists,** who undertake a solidarity trip, travel individually or are organised in small or medium-sized groups. Typically, they are inquisitive, possess significant disposable income, have more extensive general knowledge, and during their holiday, they expect to learn more about the visited country and its local population. They prefer to visit and explore mainly mountain and rural areas, less known and non-commercial destinations, characterized by their own appearance, authentic culture and preserved nature. Tourist programmes include various activities and are directed towards building, training and self-development of the participants in a way which does not harm the environment and does not offend the morals of the local population. The main suppliers of services are the owners of family hotels, houses and guest rooms, cottages, monasteries, mountain guides and stablemen, manufacturers of original handicraft products, etc. (Alexova, 2012)

Volunteer tourism observes the same ethical principles, but has a different, more specific focus. Unlike volunteering, which has its traditions, it is a relatively new form of tourism which becomes more and more popular and is associated with those tourists who undertake an organised journey aiming at assisting and relieving poor social groups of the local communities, restoration of the natural environment and exploration of aspects of society or the environment. Generally, the definition of a visitor in volunteer tourism includes every person travelling outside of their constant environment and whose main purpose of visit is different from the carrying out of activities for remuneration within the visited place. A key element of this definition is the lack of pay during the journey which distinguishes them from “working” tourists. They visit tropical jungles, protected areas, popular places including Africa, Central and South America for participation in conservation projects, scientific research, providing medical care, etc., and almost always they pay in some form for their participation in these activities (Wearing, 2001). Volunteer travel includes two elements: tourism and volunteer services. The duration of the travels varies from short-term projects in the time-frame of a few weeks to months, but less than a year. At present a growth in volunteer travel is observed, but it is still difficult to specify how widespread volunteer tourism is. The travels are officially registered as business trips or leisure trips, as the volunteers usually avoid bureaucratic complications and additional explanations to the border authorities. (Wearing, 2001; Tomazos and Butler, 2009)

The high levels and intensity of interaction with other volunteers, researchers, local authorities and inhabitants, albeit for a short time, facilitate the creation of communities. The volunteers often share food, sleep, time for education, and travel to various places within the framework of a project. This gives many opportunities to exchange information about the networks and to create connections with each other which cannot be developed in any other way. Although a sincerely political mission is missing in volunteer travel, through their uniqueness and emphasis upon participation, it is possible to encourage further activity and to reasonably expect the attraction of adherents from distant geographical areas. In this way an exchange of ideas and establishment of networks is facilitated. These new networks, in turn, can encourage the participation in and support for social and conservation movements (Palacios, 2010).

A study conducted with 120 respondents, who had participated at least once in volunteer programmes, shows that: volunteer tourism has the potential to elevate the sense of consciousness, as it includes a significant change in the perceptions of the individual in relation to society, the resolution of social problems and has the potential to change the perceptions of the participants of society on a global and local level. The research shows that the organisations working on projects for volunteer tourism assist the development of global citizenship and more active participation in changing the world (Palacios, 2010).

"Place for Future" – innovative approach for volunteering and education

A typical example for Bulgaria, combining education, volunteering and tourism in the context of the principles, established in the Global Code of Ethics for Tourism, is **the education network "Place for Future"**. The education network “Place for Future” is an initiative of the Sofia civil association “Shastlivetsa” which gives the opportunity for combination of the new and the different with care for the environment and training. The education network allows students from different faculties and universities to get to know new people; to participate in various workshops, outdoor concerts, seminars, discussions, round tables, promotion of active civil initiatives and practices of sustainable development in a university environment; to propose resolutions for the development of their favourite spot, whether it is situated in a natural or in a city environment. The interaction between local communities, active civil initiatives, teachers and students facilitates the application of theoretical knowledge to practice and the acquisition of a new outlook on the surrounding environment and expansion of the horizons. Of key importance for the project is the engagement of the expert potential of representatives of the academic environment and the partner NGOs on the one hand, and the engagement of the students through direct participation in the activities of the project as part of the training on the other. Sharing professional experience through practical exercises assists the mastering of skills for an integral approach, social activity and civil competences. (Krastanova, 2009; Alexova, 2015)

The interdisciplinary character of the collaboration between departments, centres and universities from a wide range of specialties, provides real examples and good practices of sustainable development in an academic environment. The education network turns the university environment into a place of wide public debate and creates opportunities for interaction between the active citizenship and the academic community. The public debate is realised through thematic and conceptually connected events – seminars, discussions, round tables, meetings for the exchange of experience, exhibitions, workshops, screenings and press conferences. The issues of the real civil participation as part of the project for sustainable development of society are integrated in the education of the students. These issues are introduced in specific courses and academic disciplines, development of case studies, course works and theses, the participation in practicum and internships in the non-governmental sector, team work on projects, summer practices and travelling workshops (Alexova, 2015).

“Place for Future” realised several **travelling universities** in the period 2009 – 2015. Since 2013, the travelling universities have had international participation and are concentrated almost entirely in the region of the town of Chiprovtsi and have the aim of turning the university environment into a platform for wide public debate, associated with European, national and local initiatives through the interaction between civil society and the academic community. An international network has been created, including students and teachers from universities and scientific institutes from several European countries, representatives of the non-government sector – national and local civil associations, local institutions and notable citizens of Chipropvtsi: carpet makers, craftsmen and local lore researchers.

The establishment of a permanent link between the academic world, civil initiatives and the non-governmental sector, as well as the exchange of international experience, contributes to:

- Provision of concrete examples of how sustainable thinking can be transformed into sustainable action, by offering practical training to students in the interdisciplinary character of joint work between a wide range of interested parties.
- Transformation of university environment into a place of wide public debate and creation of opportunities between the active citizenship and the academic community, through the realization of a series of thematic and conceptually connected events.
- Integration in the education of the students of the topics of real civil participation as part of the project of sustainable development in our society. These topics are introduced in specific courses and academic disciplines, the elaboration of cases, course works and theses, participation in practicums and in internships in the non-governmental sector, team work on projects, summer practices and travelling seminars.

Socially responsible practices in the protected areas following the example of visitor center “Natura”

An important part in the encouragement of volunteer and education activities have directorates of the national and nature parks through the building of specialized infrastructure, visitor centers and expert

capacity. The development of volunteer tourism in the protected areas allows the inclusion of a wide range of interested parties, zoning and establishment of regimens through application The Management plans, as well as through development of programmes, compatible with the Bulgarian environmental legislation, the international directives and conventions. A number of advantages for the local communities have been proven, associated with conducting education and environmental schooling, the assistance of local business and development of the regions, the revival and development of the local traditions and crafts.

For the purposes of the current research has been studied the example of the Visitor Center "Natura" of "Vrachanski Balkan" Nature Park. The conservation center was opened in 2008 in the building of the former Eski mosque in the town of Vratsa, which had been declared an architectural and artistic monument of culture and which offers information on the nature park, education programmes, work with children and students on conservation topics, tour and mountain guides. For accomplishment of its goals and provision of complex service, the centre features a 3D and digital model of Nature Park "Vrachanski Balkan", an interactive children corner, educational exhibitions on biodiversity and karst-formation, as well as an equipped seminar hall for conducting workshops and trainings. The work with children and students is focused on visits to schools, conducting open lessons and games for children of different ages. The successful joint work with teachers from schools and kindergartens has led to the building of a network in the region (http://balkani.org/activities/species-conservation/tortoise/breeding-center/).

The main activities of the center are associated with afforestations and land improvement, marking tourist routes, cleaning, monitoring of plants and animals, work with children and building of infrastructure. In association with the training of the volunteers and the retention of attention for longer time a manual with games has been compiled for "Vrachanski Balkan". The results of a conducted fieldwork show that 90% of the volunteers in the park are students, 5% university students, and 5% adult university graduates, with medium and high income rates for the standart of the country. In children the ratio is: 15% little preschool children; 30% student to 8th grade and 45% 9-12th grade. Women are about 60%, and men 40%. The main motives of the participants are directed to their contribution to a conservation cause and acquiring new knowledge and skills. The difficulties in organizing and conducting volunteer activities include two groups of problems: shortage of financial resources due to the limited budget of the Directorate of "Vrachanski Balkan" Nature Park and mismatch of the needs of the Directorate and the desire for participation in specific activities of the volunteers. An additional difficulty represents the technology and organization of more specific activities.

Despite existing difficulties, the advantages of working with volunteers in Visitor Center "Natura" are significant. Large-scale participation and promotion of the activities associated with the main priorities of the park is achieved. More than 120 students and teachers from Bulgaria and Germany have taken part in the initiative "Holiday for Sustainable Development" which is conducted on the territory of 6 villages in the vicinity of the nature park and which has had a favourable impact on the local communities. The children take part in cleaning the park annually, organized by the park administration, seed collection, afforestations, placing tourist markings and, though less often – monitoring of plants and animals, participation in festivals, tourist fairs and exhibitions. The Center supports local initiatives and events: Vola Open Air music fest, national bike rally through Vrachanski Balkan, Goat Milk Festival, Balkan Bio Fest, Art Festival Varshets, etc. In this way a consciousness is being formed aimed toward conservation, contribution to the local community and assisting the aims and priorities of the management of the protected area.

Conclusions

Solidarity and volunteer tourism represent an innovative approach for the creation of networks between participants with similar values and interests from all over the world, which includes a different experience and contact with authentic places and people. The sense of consciousness and satisfaction from the empathy to a cause or the problems of a specific social group has led to a tangible change in the perceptions of the individual of society and their surrounding environment. The participation in various activities and themes, the involvement in causes and interactive training programmes expands the horizons and helps volunteers to acquire a different view of the wider world, as well as to rediscover themselves. This approach is a herald of empathy, development of virtues, new messages and hopes in the public space, as well as of new ideas for the affirmation of sustainable models of local and regional development. The promotion of ethical principles, volunteering and the creation of international networks through conducting programmes for volunteer tourism leads to sustainability and balance in the relationship between stakeholders – volunteers, tour operators that offer it, and organizations and local communities. In this way, the tour operators and the organizations follow a clear vision for their aims and activities. The creation of networks

reduces the dependence on short-term and sporadic solutions, as well as the issues associated with a lack of financial and human resources. They stimulate creativity, the application of ethical principles and innovative approaches through which the organizations have the opportunity to attract this type of tourists by responding to their expectations.

Contemporary trends show a smooth and stable development of volunteer programmes in several directions: peace activism; civil rights protection and care for children; wildlife conservation, the plant and animal world, sensitivity toward climate change; solidarity with the suffering – sick and victims of disasters; professional and personal development through participation in scientific research, international exchanges, preservation of cultural values etc. This determines a new vision of our world, a new approach to it and new education, iinterdisciplinary, balanced and organically integrated with our experience, practical, living, environmental and green in the broadest sense of the word. Socially responsible practices, the object of the study, show that part of the principles of solidarity and volunteer tourism, including innovative education approaches, are successfully applied both in academia and in the conservation community. Such practices can be multiplied in other regions with similar problems and development priorities.

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ENVIRONMENTAL EDUCATION IN ACTION: THE CASE STUDY OF WWF "SCHOOL PROGRAM" IN GREECE

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Abstract

The following article refers to the field of Environmental Education (E.E.) and to the ways that have proven to be more effective in creating responsible environmental behavior. As a result active citizens' participation in the environmental decision-making is promoted. Citizens who are aware of environmental issues' processes and related threats to the environment can act beneficially to the environment. Furthermore this article refers to the way in which the environmental education is incorporated in primary schools in European countries. The role of Non Governmental Environmental Organizations (N.G.E.O.) in E.E is also addressed. The current situation regarding E.E. in Greek primary schools is mentioned and finally an alternative program by the N.G.E.O. WWF Hellas is presented. WWF Hellas is a comprehensive public information and training hub in everyday matters, providing simple and effective recommendations for all and encourages involvement in small and large acts of cooperation and solidarity. WWF Hellas invites teachers and students to work with citizens and to encourages them to take action for improving the quality of city life, home and neighborhood environments.

Keywords: environmental education, responsible environmental behavior, primary school system, Non – Governmental Environmental Organizations

Introduction

The issues of environmental instability and worldwide environmental degradation have resulted in a call for greater emphasis on environmental education (EE) in order to create and maintain optimal and sustainable relationships between the public and the environment (Blanchet-Cohen and Reilly, 2013). The most effective way in order to solve the environmental problems is the education of the societies (Arslan, 2012). The active participation in issues involving the environment is required. The fundamental objective behind environmental education is to foster environmental awareness in all segments of society and inculcate positive enduring behavioral changes (Ors, 2012). The purpose of nature education is to help the participants identify nature, its products and the meaning nature can by interacting with it (Uzuna and Kelesa, 2012). From this standpoint, this type of education should be carried out in real conditions in order to enhance interest for nature and relate with it (Uzuna and Kelesa, 2012). Various environmental education programs (field trips, trekking, camping, and adventure activities) help children developing effective relations with their natural environment and support them in improving environmental sensitivity and forming social interconnections (Uzuna and Kelesa, 2012).

Environmental Education (E.E.)

Environmental Education is considered an ongoing process, which is an integral dimension of citizen education, oriented towards knowledge acquisition, development of habits, skills, attitudes and values formation. It plays a significant role in harmonizing the relations between men and nature, providing the reorientation of economic, social and cultural variables when sustainable development is the issue of concern (Ministry of Science and Technology, 2007) (Rodriguesa, 2014). Environmental education imparts knowledge and creates experience to change beliefs, attitudes – and most importantly – behavior (Frantz and Mayer, 2014). Teachers found that learning was most effectively done through manipulation and action (Blanchet-Cohen and Reilly, 2013). Teachers also identified encouraging critical thinking as a way of engaging children in an area that is perhaps more flexible than other subjects such as mathematics (Blanchet-Cohen and Reilly, 2013). The basis of teaching is to connect with the children through their own

experiences (Blanchet-Cohen & Reilly, 2013). Another study (Alp et al., 2008) showed that elementary students' environmental behaviors were independent of their knowledge of environmental issues (Saribas et al., 2014). Affective variables seemed to have greater influence on their behaviors, emotional bonding, for example, and sensitivity toward nature, traits that may have influenced their environmental literacy (Saribas et al., 2014). Communication with respect to the environment needs to be carried out, beginning at the local level and reaching national and international proportions (Ors, 2012). Places like Environmental Education Centers found in every state, and other relevant centers such as wildlife sanctuaries, rehabilitation centers, zoos, mangrove swamps, etc. can become centers for non-formal education schools (Hassana et al., 2009). Thus, this form of education could be considered "learning by doing" which is believed to be highly meaningful and therefore retained longer by the students (Hassana et al., 2009).

Responsible Environmental Behavior (R.E.B.)

Younger generations will be affected by environmental problems arising from present actions, so they need to be provided with accurate environmental knowledge and skills to develop sustainable solutions (Vicente-Molina, 2013). According to research projects, participation in environmental education and the belief that environmental education is able to foster behavioral change are closely related (Zsóka et al., 2013). The greatest challenge for environmental education is to create, educate and activate motivated, conscious and committed students who behave in a consistently pro-environmental manner. The education about the environment aims not only to increase educational knowledge of the individuals but also to translate the positive attitudes about the environment into successful behavioral characteristics (Arslan, 2012). There are studies indicating that when the environmental education is carried out in nature with field works, it is easier for the acquired knowledge to turn into behavior and to have positive environmental attitudes developed (Uzuna and Kelesa, 2012).

The knowledge is a necessary, however not sufficient precondition for developing pro-environmental moral norms and attitudes (Bamberg and Moser, 2007). The main goal of environmental education should thus be to engage students with a complex toolset - containing cognitive, affective and conative elements - which fosters behavioral change (Zsóka et al., 2013). Hearing about environmental issues at school or in everyday life is likely to have an important effect on students' thinking and attitudes (Zsóka et al., 2013). Self-Determination Theory (SDT) posits that people are more likely to engage in a behavior, if they perceive that, the motivation to do it comes from within them rather than from an external, controlling agent (Osbaldiston and Sheldon, 2003). In other words, bribes and guilt do not help creating the type of high quality motivation that will lead people to enforce their responsible environmental behavior for a healthier planet (Osbaldiston and Sheldon, 2003). In contrast, if the request is perceived to be made in a supportive manner that encourages the person to autonomously decide what behaviors are necessary, the person is more likely to develop internalized motivation (Osbaldiston and Sheldon, 2003). In other words, when people feel a sense of ownership of the goals they select, they typically try harder and longer (Osbaldiston and Sheldon, 2003). That is, consistent with self-efficacy theory (Bandura, 1998), once people have success at attaining their goals they will develop stronger intentions to continue to perform them (Osbaldiston and Sheldon, 2003).

People may be motivated to engage in pro-environmental behavior for hedonic reasons (e.g., because it is enjoyable), for profitability reasons (e.g., because it saves money), or for normative reasons (e.g., because they think protecting the environment is the right thing to do) (Steg et al., 2014).

Environmental Education & Primary School System

Environmental education assist youth in developing mental skills, which enables young individuals to identify the environmental concerns, to collect information about the relevant issue, to take the right approach, and to solve the environmental problems (Tayci and Uysal, 2012). Since many members of society are students, we can promote societal awareness by including environmental conservation topics in school textbooks (Karimzadegan and Meiboudi, 2012).

Within European educational systems, formal environmental education is provided either as a compulsory subject, as part of a compulsory subject area, or as an interdisciplinary theme: in some European countries (Belgium, Finland, Greece, France, Spain), environmental education is a compulsory subject; in Serbia, Belgium, Spain, France, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Sweden, the United Kingdom, Poland, the Czech Republic, Slovakia, Bulgaria, Belorussia, Russia, Albania, Croatia, Macedonia, Montenegro, and Bosnia and Herzegovina, environmental content forms part of several

teaching subjects whilst in Austria, Germany, Denmark, and Finland curricula present environmental education via a thematic interdisciplinary approach (Stanišić and Maksić, 2014).

The value and action components require a new approach to teaching, incorporating inquiry methods and field studies, ensuring the integration of knowledge, emotion and action, i.e., “heads, hearts and hands” (Srbinovski, 2010).

Environmental Education through N.G.E.O.

Non-governmental organizations are institutions which operate independently and apart from official institutions, lobby for their political, social, cultural, legal and environmental objectives, invest in persuasion and taking action, admit their members and staff on voluntary base, do not seek business profit but meet their needs through donations and/or membership fees (Çubukçua, 2010). Environmental education is the crux of an NGO’s work. Without knowledge, there can be no action, and without action there can be no change. At the most passive level, NGOs can create awareness by giving talks during school assemblies or lectures supplemented by exhibition panels, poster displays and the distribution of other relevant reading material. At this level, there is minimal two-way interaction. But the increased knowledge does not necessarily lead to appropriate (desired) behavioral or attitudinal change. Workshops, discussions or other in-class sessions would allow for more interaction between the students and NGO representatives. This enables the initiation of detached problem-solving thought processes (Singh and Rahman, 2012).

The students are not taught “what to think” but “how to think”, giving them skills to analyze information, make “sound” judgments and respond with their solutions, ideas or further questions. The interactive method (discussions and experiments) internalizes the behavior. This method is still confined to in-class sessions and the quality of the responses from the students largely depends on their own life experiences, prior exposure to the topic by their teachers or the amount of information that they have picked up from an earlier talk or lecture by an NGO. With adequate awareness, facilitation and positive experiences in the environment, students can be encouraged to design and implement their own research projects (Singh and Rahman, 2012).

When people commit to a course of action that is their own idea (bottom-up), the results are more likely to succeed and continue than when ideas are imposed from the outside in a top-down approach. It has been shown that stakeholders who design their own communication strategy, message and campaign improve the environmental education program, add credibility and strengthen their own skills to do similar work in the future. Once this level of initiative, self-motivation and environmental leadership is achieved, an NGO has come full circle in its contribution to the nurturing of highly aware and concerned citizens of the future (Singh and Rahman, 2012). Without the educational component, NGO’s will not be successful in lobbying for change in public policy and public perception (Singh and Rahman, 2012).

The situation in Greece

i. **Information on how is shaped the school program and what is concluded in this.** The school, in these days, cannot ignore the demands of modern society that wants man to be free, active and a responsible citizen (Botsaris, 2006). As a result the ‘’Flexible Zone’’ has been implemented in schools, in which all the primary and nursery schools are obliged to execute programs and work plans, as stated in (F12.1 / 545/85812 / C1 - GG 1280/2005 sq. B / 31-08-2005) MD (Integrated Administrative Sector - website). The cross-curricular activities of the Flexible Zone aren’t extra courses, but enhancement of related sections of the basic courses. Students are not tested, but they are encouraged to participate in these activities (Botsaris, 2006).

ii. **Environmental Education in school**

By the Law N. 1892/90, Art. 111, § 13, the Environmental Education is a part of the pedagogical process and part of the programs of schools of Secondary Education. Based on the Ministerial Decision YA F.16 / 102 / C / 308 / 4.3.91 (GG 223 vol.B '/ 91) the Environmental Education was extended to primary schools (Botsaris, 2006).

The purpose of environmental education according to the Article is:

- To have students recognize the relationship between man and his natural and social environment.
- To be aware about the problems associated with the environment.
- To become environmentally active, with special programs (Botsaris, 2006).

Case Study: “BETTER LIFE - economically, ecologically, participative’’

The program of WWF Hellas, «Better Life - economy, ecology, participation" started in October 2013 and it is a comprehensive public information and training hub in everyday matters, providing simple and effective recommendations for all and encourages involvement in small and large acts of cooperation and solidarity. This program is developed on four themes: a) consumption, b) nutrition, c) city life, and d) energy. It is aimed at the entire society (citizens, students, teachers, etc.). It has been approved by the Ministry of Education. WWF Hellas created this program in order to propose a new model of life by which citizens would be persuaded to reduce the ecological footprint and the increasing demand for natural resources. The program sets daily activities and it tries to prove that the environment, society and the economy are interdependent parts. It aims to promote a lifestyle different and better, since it would be based on collective action, cooperation, information, environmental education and "special missions". WWF Hellas has as intention to create a reference point for information on issues in order to improve the everyday lives of Greeks and encourage them to take actions at home, the neighborhood and the city. It also seeks partnerships with scientists, institutions and individuals in order to conquer a sustainable and participatory lifestyle. It also attempts to identify policy weaknesses in order to change policy at central or local level. WWF Hellas under the Better Life program works with the Future Library network and creates special training programs for librarians.

In the schools

The aim of this program is to mobilize students, teachers, parents and local residents. The driving force is the school but the action diffused in homes, on the street and neighborhood. WWF Hellas invites teachers and students to work with all citizens and to take action to improve the quality of city life, home and neighborhood. The schools can sign up in the program Better Life and they can deal with one or more topics that have been proposed (Consumption, Diet, Green City, Energy) and at three levels: school, home, neighborhood. When someone from the school signs up, he/she can see the available actions and the schools that participate in the program. The students are inspired by their actions and they join the mission. Also, with the completion of each action, each school has the opportunity to record the experiences of children and to upload relevant material with photos and videos to inspire others. Schools have the opportunity to communicate, to exchange views and to work together. On the website of this program there is educational material on each working topic, which provides ideas and suggestions for action, but also gives guidance on how these activities can become effective. WWF Hellas honors at the end of the year the schools that are implementing the most effective actions on three levels (school / home / neighborhood) awarding Gold, Silver and Bronze Panda. Teachers should ensure that the selection of the action is coming after discussion with the students because only if preceded by discussion, children will focus on the implementation of their ideas rather than be lured by awards. The awards presented by teachers are simply used as an incentive. The goal is learning and social action.

Discussion

The "Better Life" program introduces students to significant daily issues on consumption, nutrition, life in the city and energy resources. It informs them through related articles and pictures and encourages them to act. Responsible citizens able to manage environmental issues, that determine their quality of their life, are created.

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INVOLVING STUDENTS IN REAL RESEARCH STUDIES ABOUT THE DYNAMICS OF AN ANTARCTIC GLACIAL SYSTEM: AN EXAMPLE OF LEARNING UNIT USING OPEN DATA

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Abstract

Students feel particularly engaged in science study if they are requested to face with real scientific case studies (Rocard et al., 2007). On the one hand students can experience the real work of a scientist, gathering, representing and interpreting data in order to gain evidence about phenomena under exam. On the other hand, students become aware of the role they play in giving scientists new data from data sets already existent in web repositories they can easily access as if they were scientists too. The present work aims to promote a learning unit developed during the doctorial period of one of the author at the University of Camerino (Italy). The learning unit is inquiry-based driven and approached using the model of the "5 Es learning cycle" (Bybee, 2006). During the whole activity the teacher plays a role as facilitator fostering and scaffolding every inquiring phase. After a preliminary brainstorming, as engage phase, students are invited to examine some basic features of the clasts included in a drill-core section from Antarctica (ANDRILL AND-1b), whose high definition pictures are fully accessible a the http://coreref.org/projects/and1-1b/viewer/. In the explore phase students use on purpose simplified schemes and are guided by questions in describing number, shape, size, roundness and lithology of each clast sufficiently detectable in the online database. These features are considered essential in understanding how the Antarctic glacial system has worked in the past, during advance and retreat stages (McKay et al., 2009). At a later stage, all these data are inserted in tables or plotted in diagrams. In the explain phase students are asked to interpret trends and patterns they can evidence in the data sets they have collected. Therefore, they are also able to propose a model for the dynamics of the glacial system under exam in the time period considered. Finally, in the elaborate phase, all these evidence are discussed with a scientist who will help students to understand the meaning of their results. The scientist let them also understand if this elaboration does or does not fit with palaeoclimatic models previously described by other scientists. In this way the students rely on their research work and feel self-confident for the role of "true scientists" played so far.

Keywords: IBSE, learning unit, open data, Antarctica, glacial system dynamics

Introduction

It is going out saying that lecturing is worldwide increasingly considered as on obsolete method to teach science subjects involving a mere up-down transmission of contents. On contrast, active learning methods such as cooperative and problem based learning (Herried, 2007) or more in general methods grounded to the constructivism theories (Dewey, 1916), are recognised as more valuable to engage first, then to involve students in gaining new knowledge posing students at the centre of their understanding process (Rocard et al., 2007)

Undoubtedly, the inquiry based learning is thought to be particularly effective in terms of critical thinking skill acquirement and scientific reasoning, since this method leads students to experience, while learning new contents, the same kind of work scientists do (Bybee, 2006). Participating actively in gathering and interpreting original data, students feel protagonists becoming at the same time more self-confident to manage with scientific context, usually considered hard stuff to lead with.

Our work gives students and teachers the opportunity to experience such a kind of activity facing with real data gathered by the international drilling project ANDRILL, that in the austral summers 2006-2007 and 2007-2008 recovered drill cores from below sea-floor sediments in McMurdo Ice Shelf, Antarctica, in proximity of Ross Island. This project had the chief objective to drill back in time to recover a history of paleoenvironmental changes that could guide understanding of how fast, how large, and how frequent were glacial and interglacial changes in the Antarctica region (www.andrill.org). Thanks to an open access web repository (CoreRef) where core pictures of many past drilling projects are stored, students can analyse the same data researchers do, elaborating them in an opportune and guided way in order to gain evidence of the environment succeeded in the drilling site. These aspects are considered of key importance in predicting possible future scenarios of global warming (McKay et al., 2009). In this way, not only are students engaged in approaching science method but also they raise awareness about the role played by polar region as precious archives of Earth's past evidence. In other words, this kind of activity teach students about problem afflicting global climate also giving them a voice in climate change discussion, together with a deeper understanding of the nature of science.

In this work a complete learning unit is described developed and performed with a class during the doctoral period of the first author as a result of declination of disciplinary research studies to an educational context (Macario, PhD Thesis, 2014, unpubl.). All materials, targeted for 14-18 aged students and specifically applicable to STEM curricola, have been designed for Italian users but they are also available in English on demand to the authors.

The context – How glacial systems work

Glacial systems play a determining role as erosive agents, firstly scraping up and plucking rocks from their substrate, then carrying downwards debris that falls on their surface. Glacial erosion polishes and scratches rock and carves distinctive landforms excavating typical U-shaped valley. Since ice is solid, moving ice does not sort sediment so much (Marshak, 2013).

Several different types of clastic sediment, or clasts, can be deposited in glacial environments as *glacial drift*. These clasts deposits can be investigated after ice have left them behind once ice has retreated, providing a number of clues that researchers aim to interpret in order to understand how a glacial system have being worked (Marshak, 2013)

In fact, clasts in different depositional environments commonly exhibit contrasting morphologies as a result of their erosional, transport and depositional histories. Quantitative analysis of clast morphology therefore has the potential to provide information on aspects of debris history prior to and during deposition (Evans and Benn, 2004).

In case sediments have been accumulating layer by layer thanks to calm environments (e.g. without being eroded again), these sediments also give reason of a relative chronological order, so that it is possible to get a picture on what deposited before or after. A fast sinking of the accommodation zone, which is the place where sediments accumulate, enhances greater thickness of deposits.

This work focuses on the investigation about clasts presented in the AND-1b drill core recovered during the austral summer 2006-07. In order to recover this core, 85 m of ice shelf was perforated along, the pipe reaching then the sea floor and digging in its sediments to 1284.87 m below that have been depositing in approximately 13 My (million years). This period spans from Pliocene to Pleistocene, has a good chance to be well reconstructed thanks to the high percentage of recovering exceeding the record of 98%.

Gathering open data on the web-based core imagery CoreRef.

AND-1b drill core, as in other cases, was entirely scanned then its high-resolution images have been stored in an online open data repository, including a 3D visualizer and a punctual description of some specific parameters. This database is freely accessible also for students on http://coreref.org/collection/and.

On the whole, CoreRef provides web-based access to core imagery and data for over 1600 marine, Antarctic, and continental drill holes. Projects can be browsed by drilling program or via a map. Each project has an overview page, which provides a description and related resources, and a core viewer page, which brings the core imagery and data directly into your web browser.

Some clast features can be quite easily measured and described in the pictures, provided that they are visible naked-eye.

Our learning unit proposes students to observe and measure some of these characters, hereafter described, that can be meaningful for paleoenvironmental reconstruction.

First of all, students will count the number of clasts visible in the pictures at different depth intervals. This amount can be considered an index of transportation strength (Benn, 2004) since a greater amount of clasts appears to be due to a greater erosive power of the ice cover, whereas a smaller amount of clasts evidences calmer depositional conditions.

Secondly, students will consider the shape, intended here just as clast roundness, of each clast counted considering the classification proposed by Powers (1953) in a more simplified way (fig. 1). The clast shape is supposed to be related to ice cover dynamics (Benn, 2004). For example, more angular clasts could evidence minor extent of transportation and reworking, whereas more rounded clasts are a good clue of a greater one. The more angular the shape of clasts is, the less intensely it had probably been rolled during transportation.

Thirdly, students will measure clast size referring to given size intervals (Tab. 1). Clast size can be considered an indicator of transport strength. In fact, even though glacial systems are not so selective in clast sorting, the mean size of them tends to increase when the ice mass is larger. The more powerful the ice mass is, the bigger clasts tend to be that can be transported (Hoey, 2004).

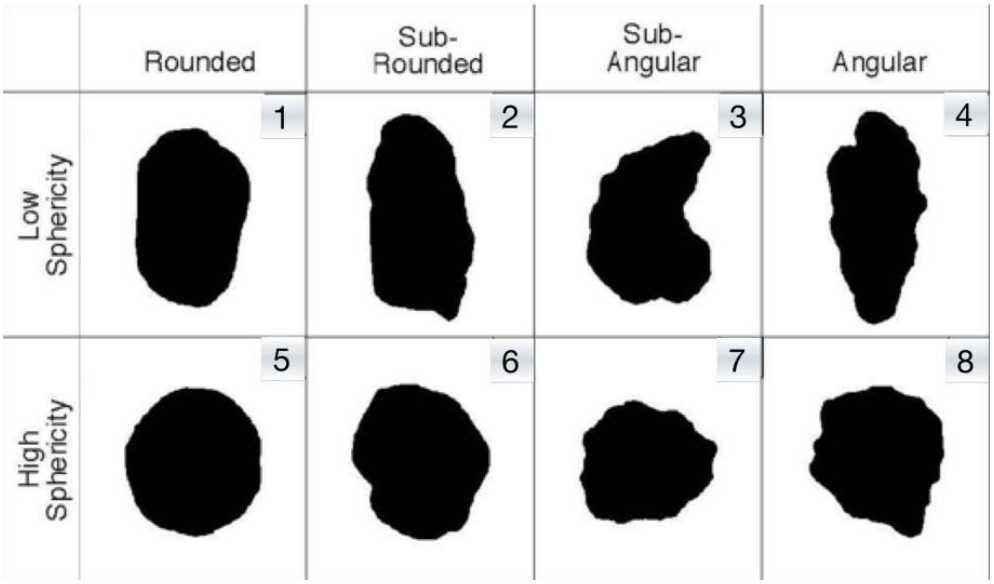

Figure 1. A simplified scheme for clasts shape classification (Powers, 1953, simpl.)

class	maximum clast diameter	notes
small	< 2 mm	barely visible at naked eye
small-medium	2.1 mm - 2.9 cm	granules reaching less than half core diameter
medium-large	3.0 - 5.9 cm	granules to pebbles reaching less than a core diameter
large	> 6 cm	cobbles greater than a core diameter

Table 1. Clast size classes

Finally, another detectable clast character is the lithology, strictly linked to the provenance of the clast namely the rock formation from which it has been plucked by ice. However, only the expert eye of a researcher can be quite sure of this feature, even if the final attribution should be determined examining

the original core section. In our work we suggest just an overall view on what different kinds of clast look like, considering just a rough classification in basic typologies whenever it is possible to detect.

The learning unit

The learning unit was developed with the inquiry based learning approach following the 5Es instructional model or 5Es learning cycle (Bybee, 2006). Moreover, the unit is led through cooperative learning strategies splitting the class in working groups.

The unit aims to lead students to approach a real case study about how a glacial system has been working in Antarctica, gathering and describing data from the online images of the drill core AND-1b. In particular, students are invited to recognize, describe, and interpret some of the clast features as previously described.

Elaborating then interpreting this evidence, students will be able to make hypothesis about the past depositional environments then inferring what could be going to happen to the ice cover during the time (St. John et al., 2012).

Even though all the scanned images of the drill core can be entirely accessed, every student workgroup will only concentrate on a short section of it. Evidence collected by each group will be finally compared in a plenary session and discussed in presence of teachers and researchers, even better if participating in the ANDRILL expedition. A final open forum in presence of audience, like parents or decision makers, could be even more engaging for students.

Time needed to perform the activity is considered 4 class periods (50 min each one) plus some homework.

Engage

The Engage phase can be led easily driven whit the support of videos, starting from a scenario as reported in the following example:

“You and your mates are members of a research group called to find clues about the past history of Earth climate for ANDRILL project. Your group is asked for investigating about a 1 m section of the drill core AND-1b. In particular, you have to accurately describe this portion, gathering more meaningful data as possible.

Your data collection has to be more reliable as possible, because they will be stored, linked and compared with those taken by different workgroups. Finally, the evidences from different groups will be bridged then interpreted, in order to make a “paleoenvironmental reconstruction” that is a resume of all kinds of past depositional environments alternate each other in the drilling site.”

Students are now given printed pictures of sections similar to those they will investigate, in order to become familiar to what they are going to face with. A whole class discussion, better if in presence of a researcher, allows them to share opinions and raise doubts.

Some driving questions help students in focusing on the characteristics they will have to consider: what kind of depositional environment did the section under your exam represent? What are the typical sediments here included? What are their main characteristics?

Students are invited to note down all the aspects they consider valuable or interesting for evidence.

Under the guide of the researcher or the trained teacher, students will be able to figure out the kind of environment they will face with.

Explore

Student groups are provided of all the material at the pc (fig. 2). Every group will concentrate on a section of the core appropriately assigned so that all sections under investigation are consecutive. The teacher or the researcher will scaffold students in every research step, facilitating work, giving advice and monitoring procedural accuracy. In particular, students are asked to gather data regarding to: number of clasts, number of clasts per shape, and number of clasts per size. Finally, if possible, they should gain evidence about

lithology, at least for most evident clasts. Some pop-up windows available in the web images will facilitate students in gaining extra information.

material
Pc or tablet with Internet connection
Lab handout including pictures and

matching cards
notebook and pencil
rock samples of different lithology

Figure 2. Material needed for the explore phase

In order to facilitate clast identification and classification, some matching cards are provided to students similar to that shown in fig. 3. A dychotomous key chart allows students to be more confident in the identification of depositional environments.

Figure 3. Example of matching cards used to recognize the different kind of depositional environment in the core section.

Since gathering data can consume lots of time, it is suggested entering them in a Google Drive shared spreadsheet, as shown in fig. 4 (Smith and Mader, 2015), so that data can be immediately shared between students and researchers.

CLASTS FEATURES

File Edit View Insert Format Data Tools Add-ons Help All changes saved in Drive

	A	B	C	H	I	J	K
1		Depth	number of clasts	small	medium-small	medium-large	large
2							
3	start from	102.69 m					
4	10 cm interval	102,69 m to 102.79 m	11	2	9		
5	20 cm interval	102.79 m to 102.89 m	9		9		
6	30 cm interval	102.89 m to 102.99 m	9		9		
7	40 cm interval	102.99 m to 103.09 m	10		10		
8	50 cm interval	103.09 m to 103.19 m	14		14		
9	60 cm interval	103.19 m to 103.29 m	9		8	1	
10	70 cm interval	103.29 m to 103.39 m	3		3		
11	80 cm interval	103.39 m to 103.49 m	7		7		
12	90 cm interval	103.49 m to 103.59 m	5		5		
13	100 cm interval	103.59 m to 103.69 m	9	1	8		

Figure 4. Screenshot of the Google Drive spreadsheet collecting data about clasts size between 102.69 and 103.69 mbsf.

At the end of the descriptions, students are invited to propose at least two alternative hypothesis giving reason of claims they have inferred by data analysis. In case students struggle with formulation of

hypothesis, they could be driven by questions such as: what kind of paleo-environment might justify for the data you have gathered? What kind of event could explain why this environment took root?

For example, if they cope with a diatomite section, they could infer that on the drilling site there was open marine water, without floating ice above. They could so infer that the drilling site has been shifted far from South Pole, or, on contrast, that ice shelf has retreated.

The App EarthViewer, which visualises the dynamics of continents along the geologic eras, can suggest that the first hypothesis has to be cancelled, because Antarctica has been established on the South Pole since at least 30 Ma (million years ago).

Explain

In the explain phase, some media help students in clearly understanding of ice cover behaviour above the drilling site during the time. Using animated reconstructions they are able to figure out how ice cover works and in which manner its extension depends on the temperature. Moreover, students can appreciate what kind of clasts are linked to the different parts of ice sheet, being able to distinguish sediments typical of open marine conditions, that is without ice cover above the drilling site, from those typical of glaci-marine sediments (ice shelf above drilling site), finally from those typical of ice sheet in direct contact with the sea floor.

The applet (http://www.andrill.org/static/media.html) and the more detailed App for tablet CLAST are particularly significant in this sense (https://itunes.apple.com/it/app/clast/id590350497?mt=8)

Elaborate

After students have collected as many as possible data in the section assigned them, sharing then each other all the results, a possible sequence of events has to be discussed that determined the paleo-environmental succession evidences. Some questions can be meaningful to recognize specific patterns leading to final model of ice dynamics, arising from intervals comparison and trends individuation. What kind of pattern is present in investigated core section? How can we interpret this pattern in the light of ice dynamics?

For example, if groups have evidenced that passing from 191.35 to 190.60 mbsf (=meters below sea floor) the depositional environment changed from diatomite to diatomite with drop-stones (=cobble fallen by icebergs floating above the drilling site), students can argue that the environment mutated from entirely open-marine to one with icebergs that can be a signal of increasing ice advance above the drilling site.

Evaluate

A final whole-class discussion in presence of both teacher and researcher allows students to propose their results. A poster session or presentations are suggested in order to simulate a conference situation. In this way, as a jigsaw, all groups communicate their results to the researchers team sharing their data collection with them.

Conclusion

On behalf of its cooperative basis, more groups can join to this investigation, contributing to provide even more accurate evidence about the same AND-1b core or similar ones. All data will be available indeed for researchers who could benefit of data sets gathered in the way above described.

Many competences will be promoted in students by driving this learning unit to the end. In particular, measuring is a critical skill, including conversions, graphing, and interpretation, while collaborative data collection is a digital-age skill. Moreover, individuating patterns and trends involve metacognition by developing crosscutting concepts, whereas linking them to a paeoenvironmental model involves bridging (cit.). All of these competences finally allow students to raise awareness about the key concept that the past is the key to understand the present and the future, as affirmed by the historical huttonian uniformitarianism principle.

All the materials needed to perform the activity are downloadable for free at the web-links linked in the references.

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Applet - http://www.andrill.org/static/media.html

Earth viewer - https://itunes.apple.com/us/app/earthviewer/id590208430?mt=8

Matching cards – https://www.dropbox.com/s/ujws6bby03q7rra/matching%20cards.docx?dl=0

Lab handout - https://www.dropbox.com/s/3fz82xyo70st1qn/lab%20handout%20involen.docx?dl=0

INTEGRATING CULTURE, ENVIRONMENT, AND OPEN INNOVATION FOR AWARENESS RAISING: A CASE FROM THE FARMA VALLEY, TUSCANY

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Abstract

The Farma Valley is located in Southern Tuscany, half way between Siena and Grosseto. The valley is a very rural setting, dominated by woodlands and home to very small communities, living in three tiny villages: Piloni, Torniella, and Scalvaia. Starting from 2007, in addition to traditional events and activities managed by the local communities, which have always been lively in promoting their legacy, the area has been involved in innovative projects. These range from intriguing promotional activities (e.g. one week of ancient hand ball games in Chicago, Illinois), to participatory environmental monitoring projects (on light pollution and biodiversity), without neglecting initiatives such as photographic exhibitions and live performances. Since 2011 several of these activities have been managed by Attivarti.org, a small but lively non-governmental organization base in the valley. These actions, all designed with a "bottom-up" approach, involving participants of different age ranges and background, had the result of (1) an improved awareness of the local community on the value of tangible and intangible assets of their land, (2) raising interest of prospective visitors and (3) triggering ideas for new educational and professional opportunities in the area.

The paper provides an outline of the most significant projects and an outlook of activities for 2016.

Keywords: Tuscany, capacity building, integration, environment, culture, night sky.

The Farma Valley context

The Farma Valley is located in Southern Tuscany, halfway between Siena and Grosseto. The valley (with an area of approximately 120 km^2) hosts three natural conservation sites designed by the Grosseto Province, and is right next to a fourth consevation area, the Merse Valley, which is managed by the Siena Province. Independently of official conservation areas, this part of Tuscany (Colline Metallifere) has vast extensions of woodland, streams, and agricultural land. Population is very sparse, with one of the lowest densities in Italy. In the Farma Valley, residents are distributed in three communities: Piloni, Torniella, and Scalvaia, which are clustered at the centre of the valley, with a total of less than 500 inhabitants.

The heritage of this area may be summarized as:

- Natural: in addition to fauna and flora assets, the Farma Valley is located in one of the parts of Italy with the lowest levels of light pollution.
- Archaeological: ancient foundries, castles, and other man-made landmarks
- Cultural and social: among other traditions which are known also in other hamlets in the area, the Farma Valley has a peculiarity. In all three of the villages an ancient hand ball game (palla a 21 or palla eh, recognized as one of the ancestors of tennis) is played.

The combination of these elements makes the Farma valley a very peculiar spot. At the same time, its position, not close to the sea and to more famous tourist sites, and the fact of being crossed by a road which became a secondary route with the opening of the Siena-Grosseto state road in 1974, makes the valley currently less renown compared to other Tuscan locations.

Attivarti.org

Attivarti.org was created in May 2011 by Andrea Giacomelli and three other founding members (Francesco Giubbilini, Simona Lombardelli and Stefano Costa). In the previous years, starting in 2007, the team, and other colleagues, had been in fact operating various initiatives without a dedicated legal entity, thus being hosted by other non-governmental organizations (Unione Sportiva Torniella, Associazione Italiana per l'Informazione Geografica Libera, Ortinconca). The need for a dedicated organization emerged in February 2011, having evaluated the planning for that year. The plan was represented by outreach 21 events in five European countries. Managing an effort of such magnitude would not have been practical via a small local organization, or via a national organization with a mission too focused on a specific theme, out of three themes promoted by Attivarti.org. Thus, the founding process for Attivarti.org was initiated, and the presentation of the association was made in Florence in May 2011.

Today, Attivarti.org still counts just four formal members; however, it collaborates with several entities, ranging from non-governmental organizations to research bodies and municipalities. Its current flagship is a participatory mapping initiative called “BuioMetria Partecipativa”, which also brought Attivarti.org to play a formal role in an European research networking project in 2013.

The BuioMetria Partecipativa project

The BuioMetria Partecipativa (BMP) project was started in 2008 by Andrea Giacomelli in collaboration with Francesco Giubbilini, with the aim of encouraging non-professionals to collect data on light pollution as a strategy for environmental awareness raising. The project conjugates this component with a scientific approach, making an extensive combined use of various technologies, and allows the collection of valuable quantitative environmental data, using a low-cost hand-held device, called Sky Quality Meter (SQM). Measurements can be produced borrowing an SQM from the BMP instrument pool, if the users do not own one.

The measurements are loaded to a database on the project web site, and are published in a variety of formats (maps, reports, charts), using open licenceses.

In 2011 the BMP system was extended to collect data from fixed SQM stations for continuous monitoring of light pollution, thus helping to gradually complement the participatory measures with more high-quality time series of light pollution data (http://www.cordilit.org).

At the national level, the project has obtained considerable recognition, in terms of actual participation, media coverage (in the press, on the radio and on TV), and has received in 2009 a national award for innovation and environmental awareness raising.

Internationally, the BMP project represents one of the longest-running experiences of participatory monitoring of night sky quality, and has developed a significant network of relationships, and collaborations, with other institutions engaged globally in light pollution research, awareness raising, and policy support. Since January 2013 Attivarti.org is part of the Loss of the Night Network, funded within the COST programme of the European Union (www.cost-lonne.eu).

The BMP project also interacts with public and private stakeholders to trigger actual improvements in lighting practice, produces presentation material (videos, tutorials, and reports), and holds a significant series of dissemination events around Italy and in other parts of Europe.

The ENVIROFI project and the “Citizens in Tuscany” scenario

Between March 2012 and July 2013 Andrea Giacomelli had a contract as “citizen science coordinator” for the ENVIROFI project. This was one of the eight projects funded in the first phase of the Future Internet Programme of the European Union research initiative. ENVIROFI had as a goal the development of a set of building blocks (termed “enablers” in the Future Internet context) to be used for the creation of internet services. One of the test cases was related to biodiversity. Given a set of schedule adjustments for the main project, the task managers also had a requirement to identify an area for the conduction of the final test of the prototype (an app for the recording of species observations).

Andrea Giacomelli proposed a combination of parts of Southern Tuscany, with the presence of significant biodiversity-related assets, in parallel with the city of Florence, where open data on the location of trees was available, thus facilitating tests with pre-populated data. The Farma Valley acted as the centre of the “Citizens in Tuscany” scenario, also hosting one of the working group meetings, and a public outreach

event in September-October 2012. Within the “citizens in Tuscany” several other dissemintion events were proposed, the main one being a half-day conference in Florence, in January 2013.

The INVOLEN competition

Our group learned about the INVOLEN project and its competition in the Autumn of 2014. The idea sounded interesting, also because the possibility of developing a prototype of map-based system for the Farma Valley was in the minds of the authors since 2008, but never kicked-off due to the lack of a dedicated project, and the INVOLEN competition sounded like an appropriate exercise for this purpose. However, considering the requirements of the competition (which were centred on schools as primary pools for participating teams), we initially saw a major issue in the possibility of actually engaging a school class in the experience: high schools students living in the Farma valley need to reach Grosseto, about 45 km away, and are not all in the same class. Also, there are no high school teachers living in the area. For this reason, the possibility of having a class of students to be motivated in INVOLEN seemed very difficult. We then evaluated how to best adapt the INVOLEN competition “concept” to the social setting of the valley. Having learned that it was possible also for volunteer associations to participate, it was decided to have Attivarti.org acting as the lead, engaging various actors in the three local communities. This process led to identify a couple of motivated youngsters, and a wide group of elders. Identifying volunteers as narrators was not difficult, since sharing memories and insights about the valley is a daily practice in the meeting points of the villages. The challenging aspect for this part of the group was finding the elders who would also be interested in committing more structured tasks, such as providing manual editing of base maps, or recording interviews.

The meetings then took place in parallel, in two locations: one in Torniella (the Wine Bar “La Combriccola”) and one in Piloni (the Casa del Chiodo Farmhouse). Giulia Ceccarini took care of interviewing elders from the Piloni side, and Andrea Giacomelli those from the Torniella side.

Joint meetings were then held, normally at Casa del Chiodo, to summarize the findings as weeks went by.

In parallel to the interviews, the team evaluated technologies. The location-based game platform recommended by the INVOLEN team, given its ease of use and versatility, was ARIS, which currently runs only on Iphones. Give the substantial absence of Iphones in the Farma Valley, ARIS was a non-option. On the other hand, Android-based devices abound; the team thus evaluated the other solutions proposed by the INVOLEN team, i.e. EnigmApp, Huntzz, and Taleblazer. Based on initial tests, the latter looked like the most interesting platform for the Farma Valley needs. However, the development framework exposed some issues. For example, the taleblazer editing interface does not allow batch processing of objects. This is fine for demonstrators or games taking place in small settings, but with the perspective of having tens of points of interest in the valley, and the need to tune their properties in various versions of the game, the idea of having to perform such tasks manually did not seem practical. Another issue which was common to all of the tested plaforms was that none of these allowed the use of multiple languages, while for our needs we would require as a minimum Italian and English.

As the calendar was moving towards the competition deadline, the team took a “non-business decision” (being the INVOLEN competition a volunteered effort, we cannot call it a “business decision”): we would develop our own gaming platform. For this purpose we considered a combination of three building blocks:

- A standard Wordpress installation, equipped with a multi-language plugin and a responsive theme;
- Geolocation extensions for the browser, allowing the application to detect the user's position, when used via a device with a GPS;
- The Leaflet library as a lightweight dynamic mapping tool

Such a framework would easily allow to handle all the key requirements of the location-based games.

Based on these working assumptions, the team developed two games. One is essentially a photography contest, inviting participants to take pictures of points of interest which have been flagged by the elders. The other one consists in a “crash course” in the game of Palla 21. Both games have been developed following an approach which may be defined as “diminished virtuality”, reversing the concept of “augmented reality”. On one side the player of the game will have some form of augmented reality experience, if he/she takes their mobile device on a trail recommended by the elders and visits the points of interest related to nature, archaeology or history. On the other side, the need to execute specific tasks in the “physical world” makes people think less “through the app”, and more with the people who helped to develop its contents. For examples, to check into the game you must obtain a password which is available asking the bartenders

at La Combriccola, or for the palla a 21 game, you will actually be playing in the square of the village, with the score of the location-based game being proportional to the duration of your game.

Conclusions and Outlook for 2016

July 2015 marks the end of the eighth year of activities of the team for which Attivarti.org represent a sort of “facilitation framework” for the promotion and protection of lesser known resources in the fields of culture, environment, and open innovation. The BuioMetria Partecipativa project currently represents the most mature initiative, and experiences like the INVOLEN location-based game competition have helped to re-proposed some of the “traditional” areas of interest for Attivarti.org (I.g. geomatics) with new people. The second part of 2015 is expected to further consolidate the role of the BuioMetria Partecipativa project, and the social dynamics it implies both at the local level (the Farma Valley, as its headquarters) and at the national/European level, with a series of events to be held in Tuscany, Milano, and Europe. Another key development in the Attivarti.org operations is the start of internships for newly graduated students (two of these will take place between July and September 2015). Considering the social promotion and educational aspects jointly with the increased commitment of stakeholders such as owners of tourist facilities, and the fact of having a small but active research network operating in the field or artificial light at night until October 2016, it is impossible to determine what will come in 2016, but the idea is that of further consolidating the developments which have occurred this year, in order to contribute to the development of the Farma Valley, and of any subject which will be interacting with Attivarti.org

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