EcoLogicaCup: Teaching Ecology on a Web Platform

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Abstract Sciences and scientific methodologies cannot today be limited to the small percentage of students in the schools; all students could know and understand the natural processes and the role they will play in their futures. Nowadays, natural sciences and ecology give rise to much interest in many scientific and not scientific areas because studying ecology we can learn more about our 'natural home', the biosphere. In this paper, an example of an innovative tool to support and integrate teaching sciences in the school is reported. The initiative, named *EcoLogicaCup*, is addressed to students of secondary schools in Italy (from eleven to nineteen years) and aims at arousing interest in students and young people about ecological topics or problems concerning the health of our biosphere. *EcoLogicaCup* is promoted by the Observatory on Marine Mediterranean Ecology of the University of Salento (Italy) in collaboration with the Italian National Society of Ecology (S.It.E.), the Editorial Group '*L'Espresso*' and other partners. *EcoLogicaCup* is the first national on-line competition on ecology in Italy, really a game in which students study, practice and finally play a final competition on ecological subjects. Here, we report some details of this initiative and the results about the previous editions. On national scale, *EcoLogicaCup* achieved excellent results in terms of participating schools and teams and met a remarkable success, on international scale, in terms of website users and visitors.

Keywords: ecology, natural sciences, educational game, teaching, ICT

1. Introduction

Nowadays, the new generation regularly engages in internet as a primary source of knowledge and learning; at the same time, natural sciences and ecology are giving rise to much interest in many scientific and not scientific areas.

In the educational environment, e-learning is becoming a very important tool in the formal learning processes [1]. E-learning is a not traditional system of education because learner and mentor are separated in space [2,3]; it is a way of learning supported by Information and Communication Technologies (ICT) that provide potential tools to strengthen education and fulfill the needs of students [4]. Most of European countries have made significant investments over the last years with a view to ensuring universal access to ICT, with considerable success. European member states themselves are also responsible for implementing ICT measures to improve infrastructure and skill levels as well as for encouraging the integration of ICT into the *curricula* [5]. The use of ICT by teachers can have various benefits such as the increasing of students' motivation to learn through giving the learner more control over the learning experience [e.g. [6,7]]. Moreover, if students themselves are enabled to use ICT in the learning process, a personalised and individualised learning is promoted [5].

The evolution of educational ICT and the changes it has brought about in national policies and practices concerning teaching methods, contents and evaluation processes is certainly clear and highlighted by specialized literature [8,9].

Effectively applied, ICT can play an important role in transforming and supporting teaching [10,11]. The European Schoolnet 'ICT Impact Report' (2006) has found, based on a review of national, European and international studies and surveys, that teachers recognize the value of ICT in education [5]. Particularly with respect to science teaching, the Trends in International Maths and Science Survey (2007) analyzed the use of computers for carrying out scientific procedures and experiments as well as for studying natural phenomena through simulations [12]. In this framework it seems important to develop suitable ICT educational products for school particularly to facilitate the study of the natural environment.

Nowadays, very often we read on the newspapers or listen from mass-media about ecological topics and environmental problems. Even, Pope Francesco (2015) devotes the encyclical '*Laudato Sì*' to ecology and environmental problems appealing to 'every person living on this planet for an inclusive dialogue about how we are shaping the future of our planet' [13]. On the other hand, in Italy, ecology is dealt only marginally in the middle and high schools. In order to give a contribution to restore importance for ecological topics in the schools and to support and integrate teaching sciences through innovative tools, we propose *EcoLogicaCup* aimed at stimulating the interest of young people and students to ecosystems that provide goods and services to our society and ensure the perpetuation of life on the biosphere.

2. What is *EcoLogicaCup*?

EcoLogicaCup is an online educational game included in the non-formal education [14], carried on a national scale, in Italy, in collaboration with several partners for the schools. Moreover, *EcoLogicaCup* is organised as an 'educational system' constantly available for students and other interested people. In *EcoLogicaCup*, students of secondary and high education enjoy ecology and natural sciences; they study ecological topics, proposed on the website, and practice in order to be selected for the final competition. All material and information are freely available on *EcoLogicaCup* website. The main actors of *EcoLogicaCup*, constituting the nodes of this 'educational system', are: researchers in ecology, experts in communication and computer, students and teachers. Researchers and other experts produce ecological contents and online classes on specific ecological topics. Moreover, they provide to the management of the website, platform and facebook page, supervise the connections with schools and organise activities. During *EcoLogicaCup*, students examine in depth ecological matter, practice, play a final competition, while teachers support students as mentors (Figure 1). The experience starts in October of each year correspondingly with the start of the school year in Italy and closes in May with a final awards ceremony.
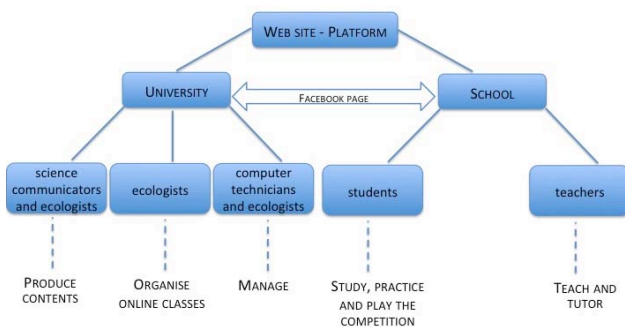

Figure 1. Conceptual map of *EcoLogicaCup*, representing the 'educational system'

2.1. Website and PLATFORM

The website (www.ecologicacup.unisalento.it) includes several sections on general information, news, competition, topics, media and contacts. In the section on the competition are available the game rules and the link to the web platform for registration and practice of teams. On the website, students and teachers can also choose practical experiences on ecological matter of specific interest to carry on in classroom or field; moreover a forum space is available to exchange ideas and information (Figure 2). Several ecological topics, the most conceptually important in ecology and the most actual for environmental problems, are published on the website every year and all contents of the previous editions are currently available, improved and uploaded (see Table 1). The access to the contents is free, so students, teachers and all interested people can read and download. *EcoLogicaCup* website is organized in italian, but we are working for the English translation.

EcoLogicaCup platform (available on the website at the link: registration) hosts questions concerning ecological topics, available for students from the start of the practices to earn score and play a final competition. The questions have different difficulty and score. At the end of each practice, on the web platform, are available and downloadable for all questions: score, answer time, percentage of correct and wrong answers, explanation for the correct answers.
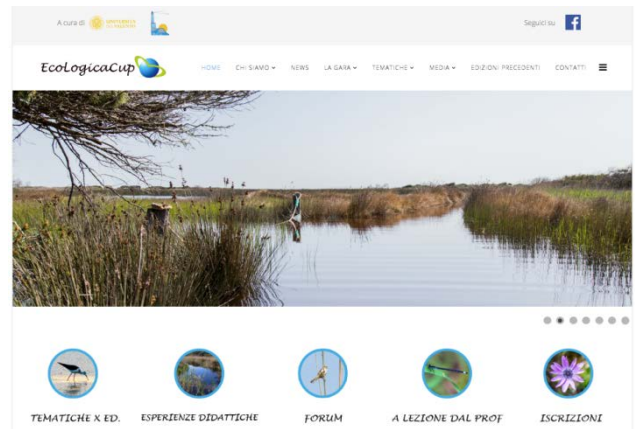

Figure 2. *EcoLogicaCup* website – www.ecologicacup.unisalento.it

Table 1. List of ecological topics available on the website

TOPICS
150th Anniversary of ecology
Biodiversity
Biogeochemical cycles
Climate changes
Cooperate or compete
Ecosystem goods and services
Energy
House, nest and den
Litter
Light and shadow
Marine protected areas
Mathematical models in ecology
Mediterranean lagoons
Size and life
Sustainable development
Use of space
Water cycle

2.2. Rules

In order to give students and teachers a guide for the participation to *EcoLogicaCup*, we prepared some rules including seven main points:

1. each school can enroll more than one team and teacher;

2. each team can include students coming from the same class or different classes from a minimum of 12 to a maximum of 30 students per team;

3. each team can attribute a specific role to each member: captain organizing the work, student specializing in the use of the computer, players working collaboratively during the practices;

4. each team is coordinated by a teacher acting as mentor;

5. the registration has to be made by the teacher/mentor of the team and takes place exclusively by filling out a form available on the platform without any fees for the participation to the competition;

6. for the registration, team name, code school and email address have to be added in order to complete all steps;

7. at the end of the registration, a password is chosen from the team in order to acces to the practices and final competition. All rules are available on the website.

The registration is open for several months from the start of *EcoLogicaCup* every year. All teams participating to *EcoLogicaCup* have to follow three steps constituting the full experience described in the Method: *i)* registration and practices (for all teams and schools), *ii)* preliminaries (for the best three teams of each school), *iii)* final competition (for the best team of each school).

3. Method

3.1. Registration and Practices

Each team can register on the platform from October to March of each year, following the rules already described. After the registration, each team enters the platform using the password, gets the access to questions added periodically and starts to practice answering questions. From January to March, questions are published every week; during this period each team can select a group of available questions, give answer in the shortest possible time, having a maximum fixed time, and earn score. In this step, each team can earn the highest score giving the correct answer to all published questions in the shortest possible time. The score of each question is comprised between 1 and 5 depending on the question difficulty (1: minimum difficulty, 5: maximum difficulty). At the end of this first phase, the best three teams of each school have passed the selection for the second step; moreover, the team with the highest score receive a prize during the awards ceremony.

3.2. Preliminaries

From April to May, the best three teams of each school continue the experience trying to pass the second selection for the final competition. They answer questions, set weekly on the platform, as in the first step. At the end of this step there are two rankings: for the best team of each school, that will represent the own school in the final competition, and for the best school with the highest score resulting from the three teams. This school receive a prize in the final ceremony.

3.3. Final Competition

The final competition is performed simultaneously by students of all teams in a due date, in May before the schools closure in Italy. At this point, each school is represented by the team selected during the previous steps. At a fixed time the competition starts, teams enter the platform using the password and get the access to a first group of questions to solve in a fixed time; after a very short break, teams get the access to a second group of questions to solve in the same way in order to conclude the competition. At the end, all answers have automatically verified by the system and the final ranking is published on the website. The best three teams (representing three schools) are the winners of *EcoLogicaCup* and receive a prize during the final awards ceremony.

During all steps, students can work collaboratively, use calculators and books, but do not disclose with people who are not members of their team and do not ask mentors for help.

4. Results

We promoted *EcoLogicaCup* through website, facebook page and email. Results obtained during the previous editions are here analysed from two points of view: i) in terms of teams and schools participating to the game on national scale and ii) in terms of users visiting the website on international scale.
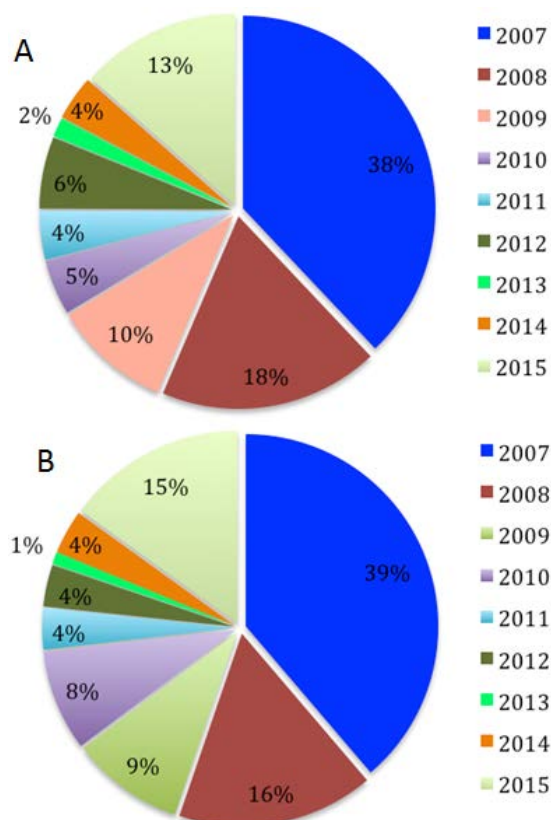

Figure 3. Percentage of participating teams (A) and schools (B) during all editions of *EcoLogicaCup*. Each year refers to the school year in Italy (ex: 2007 is the school year 2007-2008)

On national scale, 927 teams registered and participated to *EcoLogicaCup* and 485 schools enjoyed the game from the first to the last edition. The highest percentage of participating teams, equal to 38%, was registered in 2007 during the first edition. The second and last editions showed 18% and 13% of participating teams, respectively; while we observed percentages of teams comprised between 2% and 10% during the other editions (Figure 3A). Similarly, the schools participating to *EcoLogicaCup* showed a pattern with percentages of registered schools higher in 2007, 2008 and 2015 than in the other editions (Figure 3B). On temporal scale, we observed that some schools participated to more than one edition, representing the users' loyalty for *EcoLogicaCup*. On spatial scale, registered schools were distributed in 12 regions throughout all Italy with the highest percentage of participating schools (32%) in our region, Puglia. In two regions, we observed a percentage of registered schools equal or higher than 10%; while, in the other regions, the percentages of registered schools resulted less than 10% (Figure 4).

Figure 4. Map showing the percentage of registered schools *per* region in Italy during all editions of *EcoLogicaCup*

On international scale, Google analytics data (available from June 2011) showed 179.894 users, from June 2011 to May 2016, among wich 80% new users and 20% returning users. On average 3.108±155 users were registered monthly; the temporal pattern was similar for all editions. We registered two picks with the highets number of users in October-November, just after the start of the game, and in May during which the final competition is played. However, it is interesting observe that users visited *EcoLogicaCup* website throughout all year also after the school closing, from June to September, when the mean number of users was equal to 2.074±184 (Figure 5).
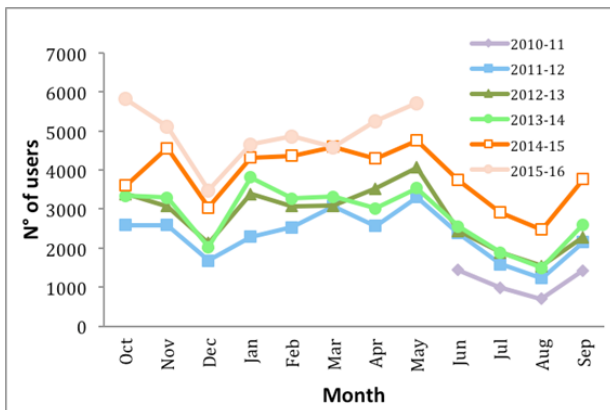

Figure 5. Number of users of *EcoLogicaCup* website *per* month from 2010-11 to 2015-16 school year
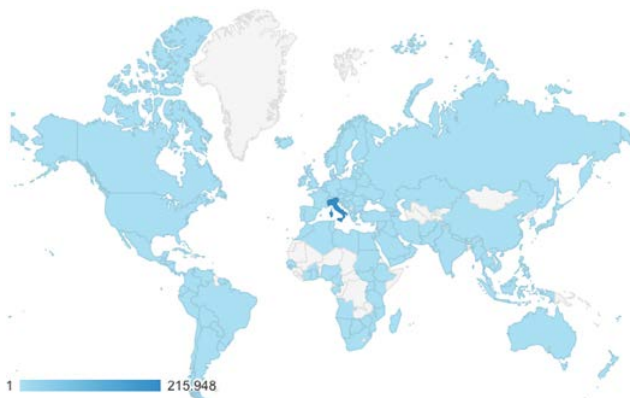

Figure 6. Map showing the areas around the world connected to the *EcoLogicaCup* platform in the period between June 2011 and May 2016

During all editions, 224.525 online sessions and 432.223 views of pages were regirested in many countries around the world. Overall 156 countries visited *EcoLogicaCup* website, among which Italy showed the highest number of online sessions (215.948) equal to 96,18% of all sessions and the highest number of new users (172.211) equal to 95,70% of all new users; 13 countries showed a number of online sessions comprised between 2.000 and 100; 10 or more users were observed in 57 countries, while at least 1 user was registered in the other countries (Figure 6, Table 2).

Table 2. Number and percentage of sessions and new users of the countries visiting *EcoLogicaCup* website from June 2011 to May 2016. Countries with a number of sessions higher than 100 are listed from the highest to the lowest number of sessions

COUNTRY	SESSIONS (%)	NEW USERS (%)
Italy	215.948 (96,18)	172.211 (95,70)
Switzerland	1.966 (0,88)	1.769 (0,98)
United States	938 (0,42)	895 (0,50)
United Kingdom	532 (0,24)	474 (0,26)
France	505 (0,22)	466 (0,21)
Germany	463 (0,21)	466 (0,21)
Spain	425 (0,19)	421 (0,24)
Brazil	167 (0,07)	364 (0,20)
Belgium	159 (0,07)	157 (0,09)
Netherlands	147 (0,07)	139 (0,08)
Albania	138 (0,06)	125 (0,07)
Croatia	138 (0,06)	106 (0,06)
Australia	131 (0,06)	120 (0,07)
Argentina	106 (0,05)	86 (0,05)
Others	< 100	-

5. Discussion and Conclusions

Overall, the results obtained on national scale were satisfying in terms of schools and teams participating to the experience. In Italy, *EcoLogicaCup* is one of the attempts carried out from ecologists to make an effort for the development of the environmental education; their collaboration aims also at highlighting the relevance of ecology in the middle and high schools and strengthening the linkage bewteen school and university for a better training of young people before entering the world of work. Taking into consideration several aspects, we could hypothesize that the differences observed in terms of participating schools to *EcoLogicaCup*, from the first to last edition, could be also related to the different time spent by the researchers for the promotion and management of the game. The best result, observed in our region (Puglia), in terms of registered teams and schools, was probably related to the promotion of *EcoLogicaCup* also by face to face meetings with students and teachers in local schools. The lowest percentage of teams and schools participating to *EcoLogicaCup*, observed in 2013, could be related to the contemporary serious game on ecology ranned from the same research group in Italy and Europe within a Comenius-Lifelong Learning project for students older than 14 years (see [10,11]). This serious game involved more than 400 students from 35 schools among which 28% was in Italy. *EcoLogicaCup*, in fact, is carried out by a group of researchers in ecology, in Italy, spending part of their time for the environmental education and dissemination on local and national scale in collaboration

with the National Society of Ecology (S.It.E) and schools' teachers.

On international scale, the obtained results showed that ecology and natural sciences arouse curiosity and interest in many people independently of the school and the obligation to study this matter. The results, in terms of website users, underline that *EcoLogicaCup* approaches students to ecological topics and environmental problems and arouses interest on ecology in many people visiting the website throughout all year. At this regard, the website probably represents an archive of ecological issues useful for students, teachers and other interested people. The feedback, obtained from teachers and students during each year, highlights that *EcoLogicaCup* is a relevant tool in the schools both for teachers and students to support the study of natural sciences and ecology. Reference [5] reports that the use of ICT by teachers is recommended especially if the students themselves are enabled to use ICT in the learning process. Here, students can use the website to study in deep ecological contents and the web platform to work in collaboration with other students.

Our main perspective is to support, through *EcoLogicaCup*, an increasing number of teachers in sciences lectures contributing to the development of the non-formal education for students. We are working for the implementation of the website also translating all content. Moreover, we are setting up a form for students and teachers to get suggestions on strenghts and weaknesses of the experience in order to reinforce *EcoLogicaCup*.

Acknowledgement

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