ICTWays - ICT Ways for Science Classrooms

Progress Report Public Part

Project information

Project acronym:		ICTWays
Project title:		ICT Ways for Science Classrooms
Project number:		528103-LLP-1-2012-1-PT-COMENIUS-CNW
Sub-programme or KA:		COMENIUS
Project website:		http://ictways.eu
Reporting period:	From	01/12/2012
	To	30/05/2014
Report version:		1.0
Date of preparation:		30/06/2014
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This project has been funded with support from the European Commission.

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Executive Summary

In the recent years there has been an increase in the use of Information and Communication Technologies (ICT) in Education, with different strategies, policies and methodologies. It is now necessary to analyse and reflect on the current results and the context of use and produce guidelines pointing towards the improvement of teaching and learning with ICT.

The ICTWays network has, as main objective, to draw a roadmap of the implementation/use of Information and Communication Technologies in Primary, Secondary and Vocational Schools in order to assess their use and thus design guidelines in order to find best practices of ICT use in teaching-learning processes in science classrooms. This will be achieved through the involvement of practitioners, teachers, researchers and decision makers gathered on a Community of Practice supported by virtual and social tools.

By doing so, this network's objectives meet the Digital Agenda 2015, whose focus is to "promote the use of next generation networks for educational communities by providing services and educational content of interest, enhancing the infrastructure and technological equipment in existing public schools "and the Technological Plan for Education that identifies the need for training and certification of teachers for school modernization in Europe.

The first half of the network period has been dedicated to prepare the methodology and tools that will allow reaching the objectives. The virtual Community of Practice[1] has been developed and tested and has started to be used by teachers. The network has organized two conferences and specific ICT training for teachers, reaching about 350 individuals in total.

In parallel, partners have organized more than 40 local workshops where they help teachers understand and feel more comfortable with the use of ICT in the classroom. About 600 teachers have been reached this way.

In the second half of the network period, the consortium will keep this rhythm and will take advantage from the synergy between the f2f events and the virtual community to foster the use of ICT in science classrooms.

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[1] http://ictways.eu/community

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1. Project Objectives

In the scientific literature there is a huge debate about the potential of Information and Communication Technologies (ICT) and its application in Education but it is fairly accepted that ICT can help extending or renewing the traditional ways of knowledge sharing. ICT tools allow access to multiple opportunities for interaction, mediation and expression, facilitated by flows of information and communication. This is happening quickly in the world, but in many cases, educational institutions struggle to implement these changes due to lack of resources, teacher unpreparedness, excessive administrative focus and rigid curricular approaches.

Therefore we still see in many primary and secondary schools that ICT policies recommended by government and educational experts are not being fully implemented yet. Looking at the amount and diversity of resources (laptops, tablets, digital whiteboards, internet access, etc.) that have been installed in European schools and to the results of studies of its use, we can conclude that there are still large discrepancies. More research is necessary to ascertain the process of implementing ICT in European schools. By identifying the gaps of ICT use in schools and assessing the suitability of the ICT skills of teachers, it will be possible to propose recommendations for a more effective use of ICT in the teaching and learning process but also to create new training that meets these knowledge gaps.

In particular, this concern relates to science teaching and learning because it is clear the difficulty that basic and secondary education students have with Mathematics and other Science topics. And this is a widespread problem as stated by several international and national comparative studies like PISA or TIMMS. This is not due to lesser skills of these youngsters but it is probably due to misconceptions and lack of motivating strategies that integrate correctly the technology. We cannot forget that this generation of students is the "net-generation" or "digital natives". They quickly absorb information in shorter chunks, through images and video rather than text, and they are able to "multitask". They expect instant responses and feedback. They are in permanent (online) connection with friends (local or remote) and they expect to be active in their learning.

This generation expects that science learning to be more than simple fact or formula throwing by the teachers. They want to be able to integrate their learning in their social-communication-technology environment. Learning depends upon actions such as experimenting, comprehending, visualizing, abstracting and demonstrating, by means of which the learner succeeds in constructing his own knowledge.

Teachers must realize the possibilities and advantages of different new approaches to teaching science. They must be comfortable and motivated to use new tools so that they can

participate with their students in experiments. They must understand and be able to show the close relation between everyday life and science. Connecting research to primary and secondary school education can foster the development of new forms of teaching science and motivate students for a learning path into science and technology.

Fig. 1. ICTWays conference in Istanbul, Turkey, May 2014

The ICTWays network has, as main objective, to draw a roadmap of the implementation/use of Information and Communication Technologies in Primary, Secondary and Vocational Schools in order to assess their use and thus design guidelines in order to find best practices of ICT use in teaching-learning processes in the Sciences domain. This will be achieved through the involvement of practitioners, teachers, researchers and decision makers gathered on a Community of Practice supported by virtual and social tools.

By doing so, this network's objectives meet the Digital Agenda 2015, whose focus is to "promote the use of next generation networks for educational communities by providing services and educational content of interest, enhancing the infrastructure and technological equipment in existing public schools "and the Technological Plan for Education that identifies the need for training and certification of teachers for school modernization in Europe.

2. Project Approach

The network goal is precisely to analyse the effective use of ICT in the science teaching-learning context and assess if (and why) it is or not happening. By doing so, it will be possible to tackle current issues on science and mathematics teaching and learning like the declining interest of students in that area, the lack of application of active pedagogical methodologies like problem-based learning or inquiry learning, the lack of motivating materials, using current technologies, to support students practice in or outside the classrooms.

The research team will contribute in one part with their theoretical knowledge and experience in using ICT in teaching-learning process as teachers, and secondly by their experiences and collaborations in the area of Education and ICT use, organizing events under the theme, and training and coordinating teachers in their practice in ICT areas in basic and secondary schools, creating new and innovated courses or various curricular units on the theme of ICT.

The ICTWays network methodology is mostly based on the design and development of the tools that support an Online Community of Practice and develop it into a full grown European Association. Therefore tasks relate, on one side, on the development of the Community (research, design and develop) and, on the other side, to implement face to face events that raise the awareness and train the teachers for this reality. A strong focus on dissemination events ensures the visibility of the network but also the promotion of the use of ICT in education.

The network methodology is organized in the following work packages:

WP1 – Network Management: This WP integrates network planning and monitoring. It is led by the coordinator with the help of the Steering Committee that includes a representative of each partner.

WP2 – Quality Assurance and Monitoring: This WP is dedicated to the process of quality assurance of the approach and results of the network. It includes a continuous process of internal and external monitoring and evaluation.

WP3 – Specification, Design and Development: This WP handled the specification and design of the Community of Practice. It was implemented through collaborative work with the teams formed for each specific task.

WP4 – Community of Practice: This WP corresponds to the implementation of the Community with all the online tools. Currently it is the main focus of activities.

WP5 – Network Dissemination: This WP aims to spread out information on the network and its results, in particular for the target audience (students, teachers, students' families).

WP6 – Annual Conference, ICT Training for Teachers and Workshops: This WP aims to organize special events, which by nature are technical but also dissemination oriented.

WP7 – Exploitation: This WP consists of the determination of processes of multiplication and generalization of the results achieved in the network. This will be achieved by creating academic and training programmes but, above all, by creating a European Association.

The major milestones are connected with the development WPs:

Milestone 1 – Specification of the Community of Practice (end of WP3)

Milestone 2 – Established Community of Practice (end of WP4)

Milestone 3 – Formal European Association (end of WP7)

3. Project Outcomes & Results

As stated before, this network has, as main objective, to draw a roadmap of the implementation/use of Information and Communication Technologies in Primary and Secondary Schools in order to assess their use and thus design guidelines in order to find best practices of ICT use in teaching-learning processes. In particular, the study and design will focus on the application of ICT in sciences teaching and learning.

The network analysed the current practice in the application of active methodologies in the scope of the consortium but also in other entities and projects. It also analysed interactive technologies, from digital whiteboards and mobile devices to low cost 3D systems and its application in this domain. This information is already available at the repository of products and reports available at the network web site[2] (Fig. 2).

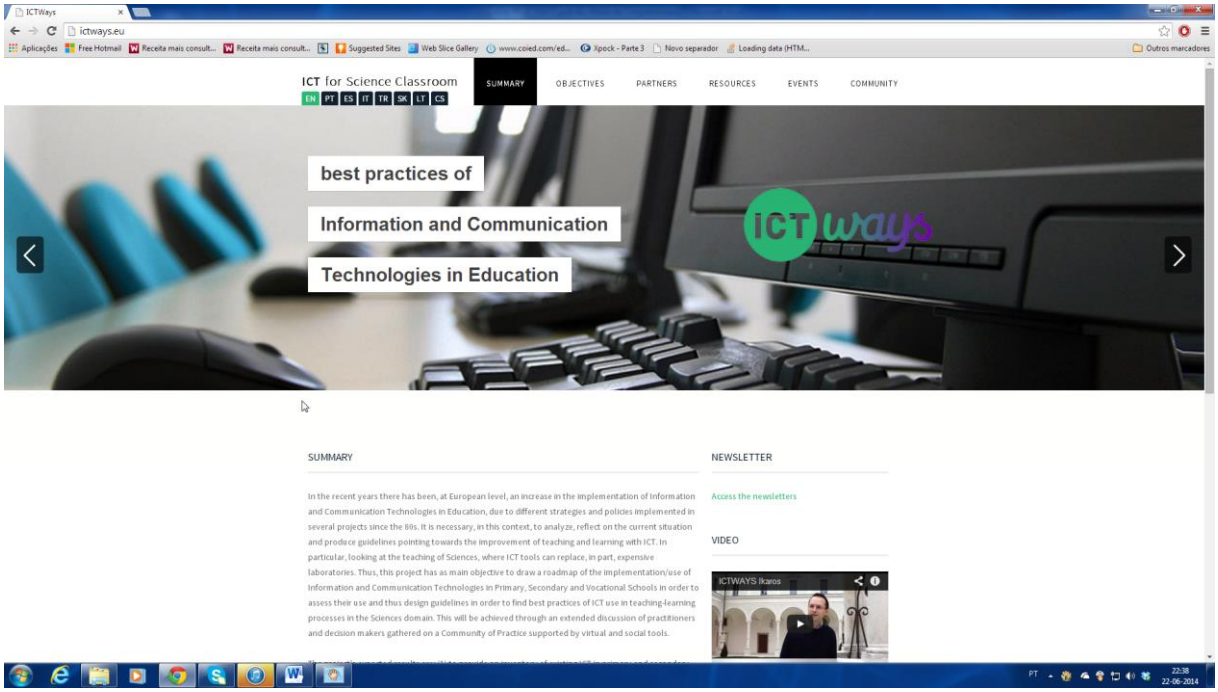

Fig. 2. ICTWays main website

So, the network's expected results are:

(1) to provide an inventory of existing ICT in primary and secondary schools in Europe and the existing gaps in software and hardware, specifically for teaching and learning sciences

[2] http://ictways.eu

(2) to show the current impact of the introduction of ICT in the classroom, in that domain

(3) to analyse training procedures for teachers in ICT use and to assess the motivation of students and teachers to use ICT in the classroom

(4) to recommend best practices for using ICT in the classroom for science teaching, including guidelines for specific hardware and software that the consortium sees as particularly relevant

(5) to create an online Community of Practice to increase collaborative work between teachers, researchers and other stakeholders. The platform (Fig. 3) is available at http://ictways.eu/community

(6) to create ICT training modules so that teachers can get the adequate experience and confidence in the use of ICT in teaching

(7) to extend this set of modules for teachers into a proposal of a post-graduation or similar academic degree related with ICT use in schools classroom

(8) to create special events to disseminate the network results, including local workshops where teachers can get hands-on practice with the tools. The network has already organized 40 of these events with over 600 teachers involved. At the same time the network organized two yearly conferences and ICT Training for teachers events with over 300 participants in total.

(9) to create an European Association that sustains the community of practice after the end of the network funding from the EC.

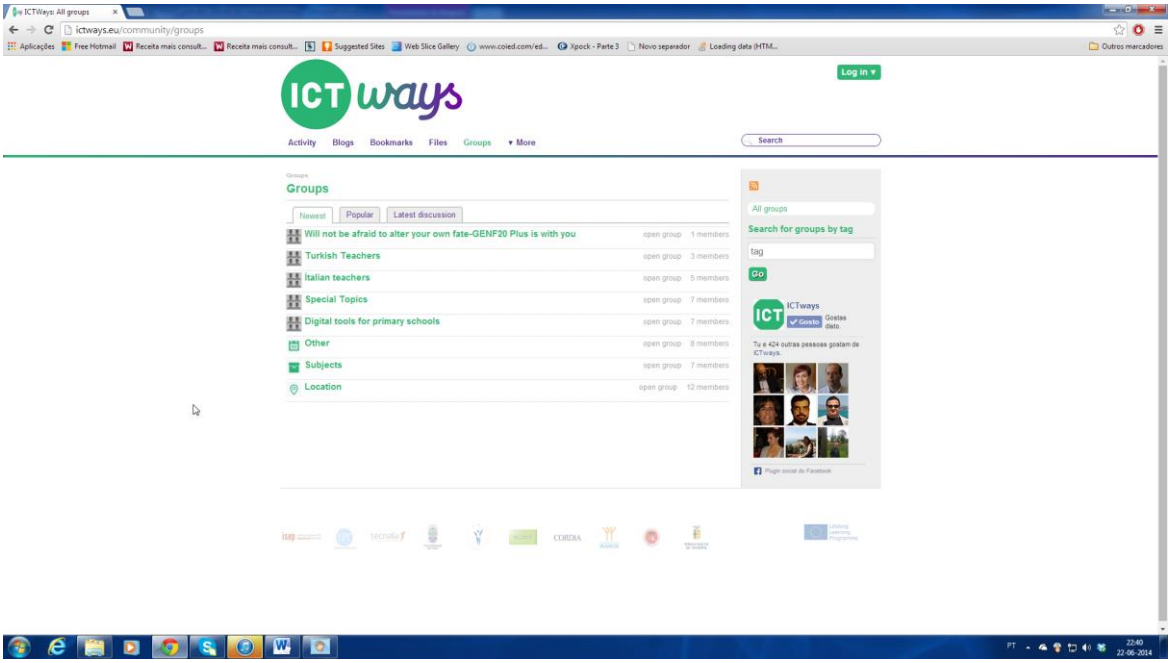

Fig. 3. ICTWays Community of Practice

4. Partnerships

The ICTWAYS consortium is composed by a nucleus of 10 partners with different partnership nature and experience. This consortium was established respecting some basic criteria:

- The presence of partners from countries where science teaching and learning has faced difficulties (namely, due to lack of funding) and therefore require alternative solutions;
- The definition of a nucleus of partners who have worked together before, to guarantee the stability of processes, communication and the attainment of results;
- The inclusion of partners directly involved in the use of ICT at various levels of education;
- An adequate number of initial partners that creates a strong kernel for the development and application of the network results and provides the basis for growth;
- A large coverage of European countries and cultures, for increased diversity of views and different approaches to the subject;
- All the partners had previous experience in European and National projects. That ensured they understood the difficulties and needs of such a network in terms of collaboration, work performance, monitoring and dissemination. All the partners have a pivotal role in their region and were able to assume dissemination based on their geographical location.
- The presence of experts in the use of Learning Technologies and ICT in Education.

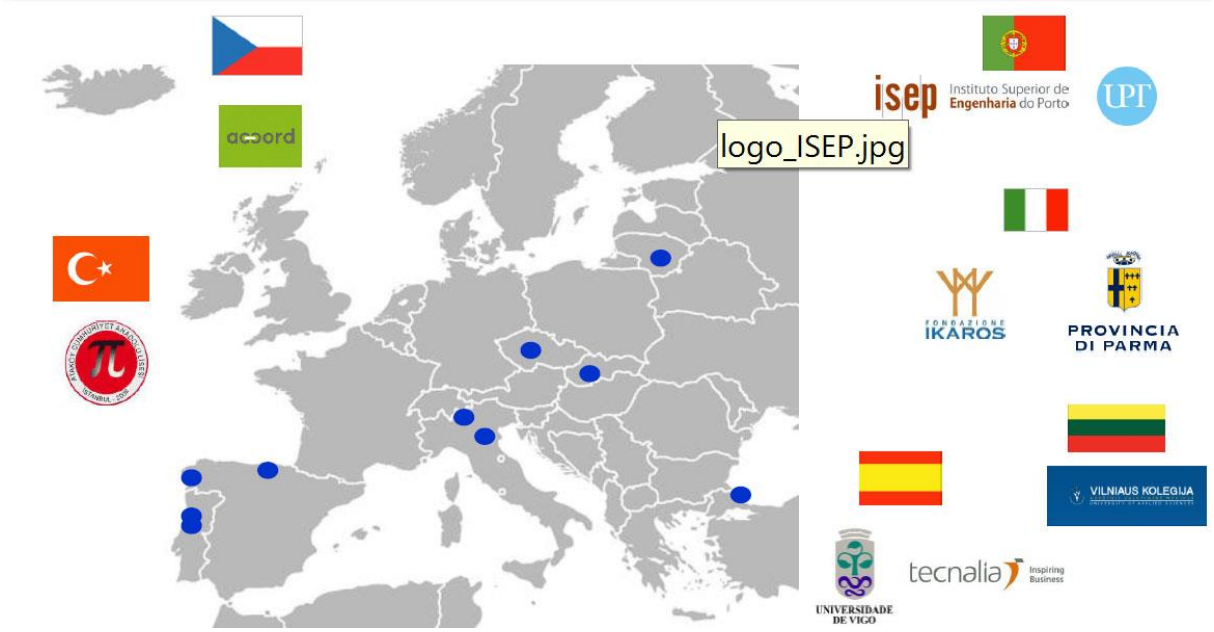

Fig. 4. ICTWays Consortium

Some partners are Higher Education Institutions with involvement in research and educational application of ICT and innovative pedagogical methodologies in different levels (basic, secondary and higher education). ISEP has lead projects on ICT in schools for different education levels and has extended experience in Learning Technologies for Higher Education. UPT, UVIGO and VIKO and ACAL are HEI with extensive experience in the contact with primary and secondary schools namely training teachers. PARMA is a public government entity that supervises a great number of basic and secondary schools. TECNALIA, ACCORD, CORDIA are private institutions with extended experience and relation with schools and the use of ICT in that context. IKAROS is a vocational school with a very interesting initiative of tablet-based learning for all students. ACAL is a secondary school with a specific pedagogical approach.

But in the near future is that this initial nucleus that created the conditions and the basis for the development of the network can grow. Several entities, from schools to Universities, have already shown their interest in joining the network so that their teachers (or future teachers) can benefit from the events and from the ICTWays community of practice. At the same time, a large number of teachers have shown their interest and motivation in becoming part of this community. As an example, in the Istanbul conference (Fig. 4), there was a large number of teachers coming from different schools.

Fig. 5. Poster for the ICTWays Istanbul Conference

We therefore expect that the ICTWays consortium will soon be much larger than the original nucleus.

5. Plans for the Future

The network has two target groups:

1. Immediately, as main target groups, the stakeholders in education and training, that already used ICT in education and particularly, ICT in schools. That is teachers and trainers (see Figure 5).

Fig. 6. Local Workshop for teachers in Porto, Portugal

These are the stakeholders that have been addressed to form the Community. They benefit directly from the network activities and results and will be later able to extend their acquired competences through lifelong learning. Teachers and trainers are interested in taking advantage of the more concrete network results, like the repository of resources, the training actions, the workshops and the discussions and expertise of the Community of Practice. The ICTWays conferences and events are a major personal development asset for everyone.

2. Then, the students and trainees (thinking of vocational schools) that might benefit from that use. They benefit from some specific local workshops, the training actions and the support structure.

Fig. 7. Local Workshop for teachers in Bilbao, Spain

In the near future, the network will continue to organize these events. The third ICTways conference and ICT Training for teachers will take place in Bergamo, Italy in April, 2015. About 40 local workshops will be organized in the second half of the network period. We expect to directly reach about 1.500[3] individuals from the different countries involved. This is a very reasonable number because all the partners have a very strong relationship with other European Research and Education networks so they will establish these links. These individuals will be mostly involved through the online (free) social portal and will participate in the Community activities. But they will also be involved through the face-to-face events (local workshops, conference). Other tasks defined in the Exploitation work package also define possible ways of supporting future cooperation: through common academic degrees, through common tutoring of training modules and through mobility of staff.

[3] Up from the originally plannned 1.000 in view of the results of the first half.

After the network funding period is finished the consortium will look for other forms of supporting the activities. A formal Association will be established to organize and promote the community of practice, the conferences, the trainings and the workshops. The expectation is that in three years about 5.000 individuals can be connected to the network (then Association), reached through the Association activities and dissemination actions.

6. Contribution to EU policies

The European Added Value of the network is very high as it addresses common European challenges: developing digital literacy, improving science and mathematics education, develop new and innovative ways of using ICT in education and, in particular, finding new ways, though ICT in schools, to motivate students and improve the efficiency of the training system. The network's objectives meet the Digital Agenda 2015, whose focus is to "promote the use of next generation networks for educational communities by providing services and educational content of interest, enhancing the infrastructure and technological equipment in existing public schools "and the Technological Plan for Education that identifies the need for training and certification of teachers for school modernization in Europe.

The idea of a Social Collaborative Community transcends the national identity and introduces a transnational scope to the community. Getting the target groups to meet their peers in other countries reinforces the European spirit, strengthening the economic and social cohesion of the Community.

The developed tools are reusable in several linguistic and cultural environments and were be produced in accordance to the specification for cultural differences but with a European perspective. Therefore, the success of the network can lead to quick replication and a strong European impact in addressing the identified challenges. Furthermore, the network's geographical coverage of Europe brings the multiculturalism and multilinguistics aspects of Europe into play.

For the academic and school partners it is also the opportunity to develop new forms of cooperation and to intensify physical mobility between staff and students.