# TRAINING SCIENCE TEACHERS OF SECONDARY EDUCATION WITH NETWORKING: FROM WEB2.0 TO EDU2.0

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**ABSTRACT**: In this paper the development of the social networking's framework of the 'Grand Training Program' for Science Teachers of Secondary Education by the Greek PI is presented, as developed by the trainer and trainees in Mytilene. The research is a reflection case study on the training process applied to Science teachers of Secondary schools with synthesis of personal narrative of trainer and the archival material of the Program. The research aimed to those characteristics of teachers' training that made it an integral part of the education and training, simultaneously happening in many schools of Lesbos and others of Greece. The research highlighted the Web2.0 technologies exploited in science teachers' training giving to the school education evolutional extensions to Edu2.0. sub-queries were about 1. Networking supports teachers' learning, 2. Structuring a network for knowledge and information sharing, 3. Connectivity for the professional development of teachers, 4. Delivery of digital educational material and methodology for teaching Sciences. Trainees learned new techniques and methods of science teaching and applied, firstly among themselves, and then everyone in the classrooms, with his/her students, they wrote the evaluation and reflection of their training and teaching activities, published ideas, thoughts, feelings and comments of satisfaction on their Facebook wall for the 200 and more hours spent participating to the unprecedented service training of GTP.

**Key words:** Science teachers' training, secondary science education, information and communications technologies, greek major Teachers' training program

## INTRODUCTION

According the Article 5A of the Greek Constitution, everyone has the right to information, participation in the Information Society, to facilitation of access to electronically handled information, which the production, exchange and dissemination is obligation of the State. Digital literacy is imperative of the Lisbon Strategy for ensuring the key objectives of the Strategy "Europe 2020" lifelong learning, social inclusion and community integration (CEU, 2007; EC, 2009). The professional development of teachers is directly related to the continuous improvement of their educational skills and the development of their personality (EC, 2009). Teachers are mediators between a rapidly evolving world and the pupils who are preparing to enter in this world. The work of education is becoming increasingly demanding: work with more heterogeneous groups of students in relation to the past (heterogeneous in terms of mother tongue, gender, ethnicity, religion, abilities, etc.). Teachers and their trainers must use the opportunities offered by new technologies to meet the personalized learning request and teach students how to learn independently and for their whole life (EC, 2007).

In Greece, the profession of Secondary Science teacher exercised without specific education and training in didactic and pedagogy, usually empirically of the multiannual apprenticeship in the educational institutions. The Curricula of higher Education focus on the scientific knowledge and have not taken into account the introduction of this knowledge to the secondary schools. Thus, teachers, unwittingly, reproduce teaching experiences gained by the educational system that passed, which usually reflect the traditional, teacher-centered perception. In Greece, the teaching experience of the secondary teachers that has been acquired in the exercise of their profession, has not been recorded and evaluated, with consequence not to have been set a general framework for teachers' education and training, also principles for new teaching methodology but is followed the traditional, unattractive to most of the students, with numerous questions on its quality and effectiveness (ECET, 2010). By introducing innovations in teaching practice, teachers improve themselves, acquire confidence, self-esteem, more and more concrete criteria of their choices and practiced in the perception of the deepest dimensions of the events and phenomena of Science which studied in schools (Kokkos, 2008).

A significant number of researches confirm the positive impact of ICT on understanding basic concepts of disciplines such as Language, Mathematics and Science and the development of higher cognitive skills through the creation of new knowledge building conditions of the students themselves (Crock et al., 2010 in Mikropoulos, 2011). Priority of the developmental Programs of the Greek government in 2007-2015 was to strengthen and improve the quality of training of teaching staff in primary and secondary education, with emphasis in innovation and ICTs, by developing distance learning and upgrading the level of postgraduate studies in order both contribute to the production and dissemination of new knowledge in the applied Sciences and ICTs (NSRF 2007-13). The Grant/Mayor Teachers' Training Program (GTP) implemented at pilot phase in 2009-2011 by the Greek

Pedagogical Institute (PI) for teachers of Primary and Secondary Education in five regions of Greece, among them was Mytilene. The program was based on the findings of a survey of the teachers' training needs and focused on the development of flexible training models, such as e-learning, mixed in person and remotely communication, synchronous and asynchronous education etc., by involving new technologies in all school objects. (PI, 2011).

The design, construction and implementation of GTP with its support activities, as applied in the 'Grand Training Program-3rd section of Science Teachers in Mytillene', contributed to the creation of a real and virtual community of practice and learning (web2.0), where digital interaction was transformed into social, into Education 2.0. Because the concept of learning is changing rapidly in recent years, the duties of teachers are becoming more complex, requiring more planning and evaluation of courses, more connections to the everyday life and society. Teachers undertake the role of the facilitator of learning rather than the sole holder of knowledge and information in the classroom. Therefore, it is necessary to plan and organize new, dynamic and not constant learning environments, ranging from virtual to real life conditions, and transform their courses in active, participatory and students-centered learning processes (Volmary et al, 2009).

European cooperation in Education and Training for the period up to 2020 should be established in the context of a strategic framework spanning education and training systems as a whole in a lifelong learning perspective (EC, 2009). Lifelong learning should be regarded as a fundamental principle underpinning the entire framework, which is designed to cover learning in all contexts - whether formal, non-formal or informal - and at all levels: from early childhood education and schools through to higher education, vocational education and training and adult learning. Specifically, the framework should address THE strategic objectives of making lifelong learning and mobility a reality and improving the quality and efficiency of education and training (EC, 2009). Education and training systems cannot stand alone in the fight against skills shortages. Companies can work in parallel of the public sector and invest in the further VET training of their employees, and offer quality apprenticeships and jobs. Finally, what the evidence alludes to is that EU strategies should aim at longer term goals, including to invest in the key competences of basic skills of individuals so as to enable their adaptability and at the same time further encourage creativity, innovation and entrepreneurship; a stronger social dialogue needs to be built to sustain the development and utilization of skills of people within high quality jobs (PDECP, 2015).

EC (2010) believes that, in order to improve the quality of Teacher Education in the European Union, teachers could take part in an effective program of induction during their first three years in post / in the profession, to have access to structured guidance and mentoring by experienced teachers or other relevant professionals throughout their career, to – take part in regular discussions of their training and development needs, in the context of the wider development plan of the institution where they work. All teachers would benefit if they are encouraged and supported throughout their careers to extend and develop their competences via formal, informal and non-formal means, and are able to have their relevant formal and non-formal learning recognized.
"New School", as all day, innovative, sustainable, inclusive, digital, designed in 2010 by the Greek PI, aiming to students and teachers with capabilities to learn autonomously and from different sources, with problem-solving skills, to cooperate and develop interpersonal relationships, to foster accountability, sincerity and confidence, be able to plan their personal future and societal belonging (PI, 2011).

Below, the trainer describes the exploitation of New Technologies and Social Networking Web 2.0 in a target based, sustainable and integrative 'Grand Training Program-3rd section of Science Teachers in Mytilene'. It's a critical approach of the application of a digital learning community formed by 19 Science teachers of all specialties of Secondary Education, who, upon selection by the PI, had been the 3rd training section of GTP in Mytilene.

## METHODS

In this chapter is presented the development of the social networking's framework of the 'Grand Training Program-3rd section of Science Teachers in Mytillene', which developed by the trainer and trainees. The research is a reflection case study on the training process applied to Science teachers of Secondary schools with synthesis of personal narrative of trainer and the archival material of the Program. The research aimed to highlight those characteristics of the training that made it an integral part of the education and training, simultaneously happening in many schools of Lesbos and others of Greece.

The involved teachers, with their trainer, shared, parallel to the standard distributed material of the GTP, specific digital training material consisting of texts, educational software and Internet applications for the courses in Physics, Chemistry, Biology and Geography taught in schools, also the Research Projects and School Activities Projects all connected to the Science curriculum. The research material, constituted by the reflections written by the trainees at the end of every phase of seminars and the delivered material throughout the Program

implementation, was in printed and digital form, contained texts, videos, images, good teaching practices, fragments from scientific articles and books, software, digital applications, etc. on the Science courses and on didactic theory and applications.

The research sub-queries were about how networking supports teachers learning, how to structure a network for knowledge and information sharing, how connectivity can promote professional development of teachers, how to deliver digital educational material and methodology for teaching Sciences.

## RESULTS AND FINDINGS

Following are inserted interstitially, in quotation marks, some fragments of teachers' written reflections organized in the four coded categories of networking exploitation in teachers' training, by the use of web2.0 philosophy and technologies. The research highlighted the Web2.0 technologies exploited in science teachers' training giving to the school education evolutional extensions to Edu2.0. The expanding frontiers of science and the exponential increase in technological innovations will significantly affect the future, if twentieth century experience is anything upon which to construct a conjecture. In his book, The Third Wave futurologist Alvin Toffler (1980 in Wolhuter, 2011) contends that the three milestones in human history are the agricultural revolution of 10 000 years ago, the industrial revolution 300 years ago, (the second wave) and the creation of a high-technology based society (the third wave) currently taking place. Particularly significant areas of technological and scientific progress are agricultural development and transformation, biotechnology, the communication, information and knowledge revolution, and automation with robotics revolution (Wolhuter, 2011).

With the progress of training, teachers applied those learned to their classes and brought feedback to the trainer who channeling it to the response of the GTP. In this way, training of teachers and education of students was developing simultaneously, rotating reflections and feedbacks.

### Networking and Grouping the Teachers in Training

As knowledge is not transferred or accepted passively by the learner, but actively it built up, many factors can help adults to learn, such are practice, experience, examples from everyday life, analysis and links with the theory (Olssen, 1996), the "change in the new knowledge-introducing", the "consciousness of the teaching object" the "creative company", the "upgrading of culture", the "hope for change", as trainees wrote in their reflections. Active participation in the learning process, the exchange of views and dialogue developed through sincere and cooperative teacher-student relationships have proven that different people can learn in similar ways (Kokkos & Lionarakis, 1998).

For the training needs, in person and remotely process, synchronous and asynchronous, it had established a group of trainees' email addresses, a Moodle platform in e-learning.sch.gr for producing Internet-based courses, a BlogSpot for information and exchange views and two Wikispaces websites for the co-formulation of educational materials on issues of local and scientific interest. The two Wikispaces established for the concentration of educational material on the local issues "Aristotle and Lesvos" and "Sappho the Educator". Networking aimed to concentrate and deliver much and variety training material, practicing teachers in a new way of teaching and work together with their students. This applied and practicing innovative training methodology for teachers' personal and professional development can consequently improve the education they provide to their students. The learning environment of the GTP in Mytilene, real and virtual, created to facilitate active and collaborative learning processes of the learners-teachers who were invited to bridge the gaps created in schools, home, in society, between science and everyday life, and help their students to realize that Science by the use of Technology can improve the quality of life (PI, 2009).

The training in the 'Grand Training Program-3rd section of Science Teachers in Mytillene' was constructed in three levels in accordance to Adults Education Projects, those of knowledge with theoretical subjects, of skills development in practice and the attitudes change level with the combination of different methods and practices, as reported by Kapsalis and Papastamatis (2000). Working in groups provided the field for development all the three aforementioned levels. In Adult Education and Distance Learning, trainer encourages the learning effort, to raise the morale of learners by strengthening, motivation and feedback (Kokkos and Lionarakis, 1998). Within the groups of teachers, trainers and trainees' roles constantly alternated as "with these became again schoolchildren", "children need to have an active role in the teaching game ... The teacher has to be a disciple" "Everybody submits personal experience, biomes and soul in the issues which whenever addressed by the team".

The Chinese saying "I hear and I forget, I see and understand, I do and I learn" performs very well the value of experiential learning. Throughout the period of training, teachers learned capitalizing existing knowledge, biomes and experiences, reflecting upon and metacognitive the teaching practice followed so far and the improvements that can make in the future. They made suggestions for improvements of the existing school educational material, such as "not supposed to say the word 'power' in that place of the Buoyancy work sheet because for better introducing of the new notion.". "should be initial knowledge about acids", "wrong place of reference was made to the bases in this position of the worksheet" "the rope in the image should be shown how to transfer the forces" etc.

**Opening Channels to Share Information and Knowledge in Training**

Communication as a basic need and skill in the 21st century education, digital communications and, through it, social networking is gaining ground in recent years, with many teachers now, tied to global online web. Reflection takes place with the presentation of the components of digital networking trainers and trainees, highlighting the internet websites as a key tool to link trainers and trainees to access educational and training material for self-education and inclusion (EC, 2007). The training process for the teacher web communities was designed with the principles of adult education and implemented on the basis of utilization of ICTs and distance education to promote the educational innovation (PI, 2011).

Regarding the process of organization of the GTP, the PI followed the procedure: Trainers of A level designed and produced educational material for each teacher's specialty and trained the trainers of level B who, in their turn, offered training to teachers from schools in five prefectures of the pilot implementation of the Program. The communication of A and B trainers was done directly to the PI, through the dedicated website and emails. Thus, the announcements and instructions from the project manager to the secretaries, trainers and trainees who finally received all the feedback to the retrograde are distributed hierarchically. Teachers, what they learned during their four-month training, they applied slowly to the classes in an organized and consulted manner, designed and implemented teaching interventions in Science courses in schools, they made reflections in persons during the seminars with the trainers' B also through emails and received feedback from the trainer. Then, all trainers' B summarized the experience and conclusions to the PI and took again feedback.

'Grand Training Program-3rd section of Science Teachers in Mytillene', in collaboration with the trainer, beyond the mandatory, developed parallel, some educational activities in a digital learning community which they built up. On the PI page of GTP posted the entire training material created to serve the needs of the Program (http://www.epimorfosi.edu.gr/). For the 'Grand Training Program-3rd section of Science Teachers in Mytillene' Moodle platform was created to promote the asynchronous e-learning by using the Pan-hellenic School Network (sch.gr) software for producing Internet-based courses and to compensate for the lack of a central, which was announced by GTP but not finally built up. A trainee became the coordinator of the platform and created a class named MPE04MYTILINIS3 selecting one of the categories of available (http://e-learning.sch.gr/), closed to the group of trainees. The course design process followed the following steps: a. selected the unity of developing lessons available to the home page of http://e-learning.sch.gr/, b. added a new course to the setting of the eight modules, available to those who have the corresponding key. c. Trainees and trainer had the capability of downloading files and software for Sciences through URL links, d. was created a Forum for exchange of aspects, teaching material of GTP, useful addresses of scientific websites, ICTs hardware, e. emphasis was given to the IMS (Instructional Management Systems) which allows packaging digital content (documents, images, video, music files) to be viewed as a separate site, navigating digital open access books related to Science and teaching.

By building up two wikis, they collect a kind of dynamic library that can be updated and enhanced to provide additional capabilities to the users, making them in shaping the common content (Stea et al, 2011). Wikis are websites that help the co-construction of knowledge by creating and editing a number of related websites, via a web browser such as Internet Explorer and the HTML language. Wikis created to serve the design needs of the Research Projects which introduced in Lyceums as new courses to promote interdisciplinary teaching, group work, and experiential learning (Circular Ministry of Education YA97364 / C2 / 30- 08-2011).

The BlogSpot mpe04mytil.blogspot.com posted on the e-Google blogger website, utilizing ready BlogSpot's creating forms. It operated alongside the Moodle platform to meet the direct communication and understanding needs of trainees, of sharing and annotation of current information of school lives and any educational and informational questioning-answering. Main was the latest posts, and beneath them there were opportunities to comment and characterization of class post belongs (e.g. education, physics, etc.). In the right part of the page archived posts based on the popularity criteria and chronological order. Below, on the left side of the page, there were various gadgets and a lot of links for general information.

The experiential and discovery learning can now be achieved more easily than in the past with the available appropriate educational software and tools, developing internal learning motivation (Komis, 2004; Kartsiotis, 2008). Without detracting from the importance and usefulness of oral teaching, the choice of active strategies and more modern supervisory instructional media brings closer those are spatially and temporally remote (Moldstad, 1985).

**Connectivity for The Teachers' Professional Development**

Teacher education consists of a theoretical and a practical component. Originally, at the normal schools the practical component was very prominent. That was less so when teacher education relocated to teacher training colleges. Finally, at the university, at first, the theoretical moved to the foreground. The prominence of the theoretical has been dimmed in the recent past by a number of factors, and much greater value is attached to the practical. Pre-1990 university teacher education gave student teachers a liberal education, i.e. a teacher equipped to take his/her own decisions, one of the hallmarks of a professional person, rather than a person whose working day consists of carrying-out the dictates of superiors of a hierarchy (Wolhuter, 2011). Technology is probably one factor behind the shift back to the school as site of teacher education.

Many factors have contributed long to restrict the joint work of teachers, such as the traditional syllabus and curriculums, timetables, the suffocating time of teaching hours, split into 45 minutes, the varied and multiple demanding reality of each school community and each class and generally the prevailing mentality in schools. "We need collaboration among team members", "collaboration and interaction with the instructor offer equal membership", "The evolution of a teacher does not stop with the nomination". "We must constantly be developed and cultivated with new teaching methods, new school, teamwork, use PCs and interactive whiteboards, new curriculums".

The prospect of a social educational network through which can be exchanged knowledge, information, experiences, opinions, personal values and attitudes, gives additional credibility to programs targeting to groups because they help to achieve goals of the groups, which are hardly achievable on individual level (Christakis & Fowler, 2009). The members of a social network exceed themselves-for better or for worse-and become part of something much larger. They become connected. Their connectivity drastically affects in the way they perceive the human condition. At the end of the 1st team exercise, the words that trainees were written in their reflection had all the prefix co (in Greeks 'syn'): -resposnible 'synypeuthynoi', set of 'synolo' collaboration 'synergasia', consciousness 'synaisthisi', conscience 'syneidisi', complementary 'sympliromatikotita', codecisions 'synapofaseis', participation 'symmetoxi', joint management 'syndiaheirisi', composition 'synthesis', conformation 'syndiamorfosis', discussion 'syzitisi'. These constituted the contract of the Group of trainees.

Trainees learned new techniques and methods of science teaching and applied, firstly among themselves, and then everyone in the classrooms, with his/her students, they wrote the evaluation and reflection of their training and teaching activities, published ideas, thoughts, feelings and comments of satisfaction on their Facebook wall for the 200 and more hours spent participating to the unprecedented service training of GTP. Through such training procedures, participants improve the sense of them and enhance their social profile because, as technology evolves, develops also social practices and affects the relationships and the self-image (Turkle, 1996). Many studies have shown that the identity of modern people deeply influenced by participation in online communities in virtual worlds. Finishing the program, the trainees stated: "we felt cooperativeness, pleasure, satisfaction" , "we understood by widening the horizon of our cooperation, the team to creates" "we facilitated the common goal, flexibility and yielding in our opinion, the acceptance of group members", "the lack of experience, the combination of various disciplines in one, the overcoming of individualism caused us difficulties", "leaving, we took in our handfuls hope, experience, expectation, creative company, pleasant atmosphere, spontaneity, humor", "a positive experience expecting the application to classrooms".

**Delivery of Digital Educational Material and Methodology for Teaching Sciences**

and ICTs contribute significantly to teaching Sciences in schools by modeling, visualization and simulation of physical phenomena and processes and help to create dynamical learning environments that provide unique opportunities for users to observe phenomena, materials and processes which are often difficult or impossible or even dangerous to observe them actually (Stavridou, 2011). During the seminars, the traditional classroom changed and got new dimensions in cyberspace, became more attractive and efficient for the trainer and the trainees, following the pattern of modern life, with the characteristics of extremely great diversity and complexity, continuous development, due to the networking and sharing, teachers became also students, trainers and trainees.

Complementing this material posted and shared via the Moodle platform of Wikispaces, Blogspots and emails of the studied network in Mytilene, educational materials for direct use in the classroom in the teaching of Science courses. Environments for the creation of multimedia micro-worlds applications, Flash as Interactive Physics, Modellus, IrYdium, Chemistry 2000, language Logo, Java, use Visual Basic for Application, educational games and e-learning applications contributed to natural phenomena and simulation processes to perform virtual experiments through specialized software. Indicatively referred applications (phet.colorado.edu/Faraday) and nordicgroup.us, the videos and applications in the worksheets for the study of the phenomenon of electromagnetic induction made the new knowledge more attractive for the teachers in seminars and for the students in applied lessons.

Impressive outcome of the abovementioned were the micro-teachings, which designed and implemented by trainees at the end of the Program for evaluation and had tried firstly in their classrooms, which were plural and diverse multimodal teaching texts on Science subjects. Trainees exploited, with the better way, the didactic methodology they practiced, the delivered educational material, and the collaborative philosophy of co-construction they cultivated in designing teachings in Science courses in their schools, far away from those they used to do. This period of their life was the most complete of aim-centered training that they had ever received. "You never know what dynamics have each your colleague", "In the beginning (of the training seminars) you say that all the same and the same will be, but in the process often you change your mind ....".

In the reflection about the changes that trainees could make in the way of teaching at the antipode of the traditional one, expressed proposals supporting the philosophy of GTP on teaching Sciences such as the teacher to: "form working groups for his students" "guide students in laminar didactic paths to discovery of new knowledge," "pro-inform for the new teaching model to be followed", "keep in each case and discreetly the class contract", "devise alternative activities". Regarding students need to "come prepared in the educational process", "assume different roles", "set student coordinator of the educational process inside the classroom". "There is a difficulty to introduce the new ... Students are persuaded only when they are active in the new game!"

## CONCLUSION

The described training intervention of the 'Grand Training Program-3rd section of Science Teachers in Mytillene' simultaneously addressed to teachers and students, giving them the possibility of applying and integration teaching and learning innovations directly from the training seminars to the classroom education. Based on the objectives of the 'New School' reform of Greek school education system, emphasizing the development of horizontal skills of trainees and their students, the program runs transversely all school subjects. Teachers participating in virtual and real encounters of synchronous and asynchronous training, without geographic and economic boundaries, with texts, sound and images used Internet and in person teaching tools, in joint information, sharing and editing teaching materials in Science. All together designed and built the new knowledge in schools that daily change rapidly. The products of this co-construction of knowledge on modern teaching of school Science objects are uploaded on the websites up mentioned and can be basis for discussion and new partnerships of teachers to scientific and technological progress and cohesion of school communities, they can be used in any educational processes anywhere in Mytilene, near or far.

## RECOMMENDATIONS

Of course, all the efforts for renewing traditional teachings need a further glance, an overview of assessment and valuation. Many people develop, also, cautious skepticism, as Ntrenogianni (2010) writes that the digital school is not necessarily progressive, but it could be an extremely conservative school. That is why Internet, computer networks, interactive boards, information portals and digital libraries are educational tools, materials and services which, by their nature, can only "illustrate" and "represent" the new knowledge and not to "intervene" transformational into the educational purposes and goals with subsequent conversion into teaching content and curriculum.

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