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Preparing Teachers for the Use of Digital Technologies in Their Teaching Practice

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Abstract

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Greece these last 15 years has developed and implemented a large-scale system for the integration of digital technologies in education and more specifically in the teaching practice. "Large-scale" means that the whole program concerns all Greek education system. A very important part of this nationwide project is the training of teachers program that involves practically all Greek teachers - so far more than 120,000 teachers have been involved and soon they will be involved all of them (approximately 150.000). In this paper we present a summary of this plan. The monitoring of this project at national level, almost from its very beginning, gave to us the opportunity of collecting a large volume of raw information and data of both quantitative and qualitative nature

Key words: *ICT and Education, Teacher's training, digital literacy.*

Introduction

What Greece is trying to do?

Greece these last 20 years has developed and implemented a program for the integration of digital technologies in education and more specifically in the teaching practice. The training of teachers is an important part of this program. This training is relatively long (more than 80 hours of instruction over a period of three months for teachers and 380 hours for their trainers) and versatile, as it includes lectures, homework, evaluation activities, school practice, use of web 2.0 platforms and a variety of other activities. The training of trainers is an important part of the whole project as well.

This training has a very practical dimension: teachers must of course have special skills in handling software and more generally contemporary digital environments. They also should have theoretical knowledge about topics such as pedagogy, didactics, learning theories and teaching

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methodologies. However, the most important part of their training is, in a way, “non-visible”, or more precisely, it is perhaps very difficult to be described analytically. This part corresponds to a very specific kind of digital literacy. Teachers should be aware of the most common practices used in modern digital social networks, but not of course only as mere experienced users, but as critical 'readers' of those practices as well. Even more, this critical view of the practices should lead them to a creative use of social media. Moreover, their trainers have an even more complex goal, namely to show to other teachers the specific features of this new digital ecology and to devise new ways of teaching the creative and innovative use of these features.

The educational use of digital social networks, of web 2.0 and more generally of digital environments, should be oriented towards the consideration of digital environments and more generally of digital resources, as a kind of wealth, or as a kind of tool (in the broadest sense of the word) that can enrich the learning experiences of students. Common practices, however, often identify the teaching and learning experience with digitization: for example, educational authorities seem to consider the digitalized books in the form of xxx.pdf file, as a major opportunity to access to information and creating new knowledge (e.g. new information). So they try to digitalize all books used in primary and secondary education because they consider that this an enormous progress (which is true to some extend) - but in a way "they stop there". Unfortunately, teachers often adopt similar points of view. In this case, the use of digital technologies or digital resources, in most cases is more a ritual that teachers have to respect, than a true challenge to reorganize their teaching (Jung, 2005).

In this framework we try to identify all these elements that support the real, profound process of the transformation of a teacher to a critical user of digital technologies.
In this paper we present a summary of a specific part of this plan, namely the section related to teacher’s training. The monitoring of this project at national level, almost from its very beginning, gave us the opportunity of collecting a large volume of raw information and data of both quantitative and qualitative nature.

In the next section we present the general conditions for the integration of ICT in education, a general description of the whole training project and then the questions of our research. Next

follows a description of the empirical part of our research: the data gathered, their analysis and the findings. The paper ends with our conclusions.

Conditions for the integration of ICT in education

Successful integration of ICT in education does not depend solely on the digitization of available resources (books etc.), nor on the existence of a physical and technological infrastructure (such as computer laboratories, networks, etc.), not even the combination of them. This is a finding that has often been ascertained (for example: Soloway, 1995; Oppenheimer, 2004; Cuban, 2003). If we consider that an exploitation of ICT in Education must be considered successful when it somehow improves the expected results of the learning process, then it is obvious that the infrastructure and the digitization of resources are not sufficient. The teacher is absent from this tableau, but the teacher is an essential factor for a successful integration of ICT in education (Yucel et. al, 2010; Tarman, Baytak & Duman, 2015). In fact, there are other factors that we are discussing below.

There are many ways of implementation and many "levels" of what we call, in a general way, the pedagogical and didactic utilization of ICT in education. In some countries, the integration of ICT into teaching takes place in a decentralized way and each region decides autonomously how to organize this integration. In Greece, it was decided to apply a single, central model for the whole country. This does not mean that actions are not allowed and implemented in place to integrate digital technologies into education: all Greek teachers can use digital technologies in their lessons. However, here we are referring to a nationwide program implemented by the Ministry of Education across the country for all schools.

The scale of implementation, i.e. the size of the project, is very large, at least for Greece of 11,000,000 inhabitants. This large scale imposes a very long, careful and constantly updated study, a detailed plan for this objective. So, all known factors that play an important role for the success of this project must be taken into account.

Below is a list these factors to be taken into account in order for a program for the integration of ICTs. Education is effective. For each factor, the relevant actions and actions of Greece are also

mentioned. It should be stressed that all planed actions and activities did not follow a completely linear course, nor a time sequence, as the list that follows seems to imply. It is just here that factors and actions are presented in a systematic way.

Factor 1: the agencies and institutions responsible for designing, implementing the project and managing it in general have to be clearly determinate. In Greece, the leader was the Ministry of Education (http://www.minedu.gov.gr), through the Institute of Educational Policy (an Institute of the Ministry) and the Computer Technology Institute Diophantus (http://www.cti.gr), two institutions of the Public Sector dealing with education and technology. It is obvious that thousands of people from different disciplines, such as specialized scientists, technicians, teachers and trainers, administrators and others, have participated in this multiannual program, through the key institutions we have mentioned, as well as many local ones.

Factor 2: An important element associated with logistics has to do with the cost of hardware, but also with its maintenance, infrastructure support and updating. Also important are forecasts of developments (technological, economic, social practices) to come. For example, the work of introducing ICT in education began at the time of "web 1.0", before the open source movement and open software development, before smartphones, tablets and the beginning of interactive boards, before facebook and twitter. Technological developments, to the extent that they are incorporated into social practices and the culture of everyday life, raise questions about the technology that education must adopt and have been a major problem in the development of this program for Greece. Technical infrastructure to be installed in schools is a crucial factor - though not enough, as we have already mentioned.

Factor 3: organization and preparation of teacher education. It is obviously necessary to describe with some degree of accuracy the learning outcome of this training in the broadest way in order to determine the desired profile of teachers and trainers who will attend the relevant program, the characteristics they need to have for handling ICT in classroom - but also out of it. From the description of the profile and the desired learning outcomes, the teacher training need to be gradually organized - we refer about this in detail in the following sections. As in the case of infrastructure, it is virtually impossible to predict the future. In the example of Greece, many

actions were designed before the introduction of the so-called web 2.0, before social media, YouTube, etc. – as we explained. Moreover, elements in education that are now considered important, such as the use of Robotics or the emphasis on STEM, did not have the same "value" they have today. Teacher education and training must therefore be based on more general principles. It is also important, in the same context, to train the staff (pedagogical, teaching and administrative) who should support the whole effort when the program starts to apply.

Factor 4: Creating appropriate teaching and support material. It is generally accepted that the integration of ICT in teaching practice creates new conditions in the classroom. The very organization of the course is different from the one in a typical teacher-centered lesson. It is therefore necessary to create educational material and generally supporting material for the classroom. Thus, for example, school books and curricula should be adapted to the new type of lesson.

At the same time, additional material, in conventional or digital form, must be prepared: text files, software files, images, videos, links, worksheets, etc. It is necessary to set up and operate parallel structures such as repositories, school networks and support for platforms for the creation of communities (students and teachers), to support distance learning courses (modern or asynchronous), etc. Greece, for this purpose, has set up and maintains the Pan-Hellenic school network (http://sch.gr, which supports approximately 1,300.00 students, 160,000 educators and educational staff and about 16,500 school units). At the same time, a number of repositories, content and service portals and national accumulators such as the digital school (http://dschool.edu.gr/), Photodendro (http://photodentro.edu.gr/aggregator/) and Aesop (Http://aesop.iep.edu.gr/) or e-me (http://4all.e-me.edu.gr) include several tens of thousands of supporting material files: audio files, photographic and cinematic material, specific software, video tutorials, teaching scenarios, etc. In addition, hundreds of sites and portals, initiatives by the teachers themselves, offer plenty of digital or digitized material for instructional purposes. An enormous network of linked digital files has been created. In this context, it is of course necessary to create, collect, adapt and use appropriate educational software or software that can be used for educational purposes.

Factor 5: Integration of ICT in education, brings dramatic changes to the structure of the lesson. One issue is whether these changes are consistent with the current institutional framework, the laws and the legal framework on education. In Greece, the adaptation of this framework was necessary - and is still being implemented, as the previous legal framework could not have foreseen these changes. In a way it may be necessary for the legal framework to anticipate and regulate actions that did not exist before the digital age, such as the school's website, the school's digital newspaper, etc.

Factor 6: Creating and installing related administrative structures as well as an electronic system for managing the various actions of the school, as well as training actions. More generally, a somehow a digital ecosystem should be promoted, in which pedagogic and didactic use of digital technologies will be realized. In the same context, a plan should be planned and implemented gradually, for the transition period between the start and the (relative) "finishing" of the process of incorporating digital technologies in education.

Training teachers: history and importance

The project of systematically train teachers in ICT has a rather long history in Greece. Actually began more than 20 years ago, with a series of pilot projects and the organization of the Greek educational software production (production of software from scratch).

During the early years (years 1998-2004) numerous educational programs were created from scratch or adapted (more than 150). Software that could not be built in Greece, because its creation was expensive, has been bought and translated into Greek language. Moreover this software was not only translated into Greek language, but adapted to the Greek educational system. At the same period and within this framework, several parallel actions and projects were organized, such as a pilot program for the creation of standardized Computer laboratories into the public schools and a pilot training program for teachers.

In 2005 began the lessons of the program known as the "First Level Training" (FLT). Teachers of all disciplines attended classes for 48 hours of digital "alphabetization". At the end of the courses

there was a certification exam. Until today, more than 100.000 teachers of primary or secondary education are certified by the system, which is a huge number for Greek standards.

In 2007 the very first of University Training Centers (UTC) were created, which had as a goal to train trainers for the program known as Second Level Training (SLT). In other words, UTC are Schools of Trainers for Teachers. The training program for trainers has a long duration: it includes about 380 hours of lessons, during 6-10 months or so. These courses, taking place mostly in computer laboratories, include theoretical courses, laboratory exercises, practice on the field, participation in discussion lists or digital fora environments and use of web 2.0 platforms. Also, the trainees have a good training in the use of modern digital systems and environments, such as interactive whiteboards or environments for distance learning. In short, the trainers follow a relatively complete and extensive training program.

These trainers then, in their turn, train teachers in various subjects. The training seminars last around 100-140 hours in total and intended solely for the various disciplines: teachers of Mathematics, Physics, etc., follow more than 80 hours of theoretical courses and workshops, and many hours of practice on the field, with a content that is specific to their specialty. So far there are about 600 trained trainers (graduates of UTC) and about 20.000-25.000 trained teachers certified teachers of SLT, while the final expected number estimated to be closer to 60.000.
This year however, another model of training is applied, namely a model of smaller, but combined seminars, with the same total training scheme. These new seminars are called B1 and B2 respectively. This model is more flexible than the previous one.

These numbers are very important for Greek education, because the target of the project is a very high percentage of Greek teachers from all levels of education. This training is therefore crucial for the Greek educational system, since it involves directly or indirectly all the teachers in public education and essentially determines largely the success or failure of implementation of ICT in Greek Education.

Blended and face to face teaching

For these courses, mentioned above, a blended teaching / learning system has also been implemented recently. It is well known that distance education and training presents some disadvantages, but also many advantages over typical face-to-face teaching. Besides the usual social and economic reasons, Greece's reasons for adopting distance learning are also related to its geography. More specifically, Greece is a country with a very special morphology. Its continental section in many places is inaccessible or at least with a difficult access. In addition, Greece has about 2,500 islands, with a lace coastline, having a total length of 15,000 kilometers (continental Africa's coastline is about 17,000 kilometers long). These islands include dozens of small or larger islands inhabited. So, a significant part of the Greek citizen cannot have direct access to educational or training services. Thus, the use of distance learning methods was necessary.
Distance education adopts a blended teaching model. In the relevant lessons, a model is used, according to which the lessons are implemented by 20% with the face-to-face classical method and by 80% from a distance. In distance learning, about half of the courses take place on a collaborative learning platform and the other half with asynchronous training, primarily with the help of the well-known platform moodle.

The careful design of the blended lessons and the constant effort to improve them has resulted in an not-so-expected result: blended lessons seem to have as well, if not better, learning outcomes from face-to-face lessons.

Some questions about organizing training

As mentioned above, the training of teachers in Greece to the educational uses of ICT, is organized the last 20 years in a nationwide scale. Through a system containing different levels of training with different objects and varied courses, many thousands of teachers of various specialties, have been trained in the uses of digital technologies in education. These specialties include teachers of primary education, and secondary education as well, teachers of language, mathematics and science.

In our work, we summarize briefly a framework and an analysis of these data through a specific angle, or more precisely by setting a specific question: to what extent the "scientific" knowledge actually "spreads" to trainees? In short, to what extent teachers learn / acquire applied knowledge during trainings? We emphasize the fact that we do not refer to a specific scientific area (from those mentioned above), but we refer to phenomena that appear independently of any particular scientific area (Drent & Meelisen, 2008; Khe & Brush, 2007).

It is obvious that the application of that knowledge acquired by teachers presupposes the conquest of advanced skills in using ICT. Teachers need to acquire skills that are directly related to the modern uses of ICT, for example, participation in social networks and more generally the web 2.0 tools and environments. They must also have knowledge of a specific vocabulary, have theoretical and practical knowledge related to safe navigation on the internet, know how specific software functions etc. We could assume that such knowledge constitute an "alphabetization" (introductory and often contextualized knowledge), while for the deeper, framed knowledge of uses of ICT we use the internationally known term of (digital) "literacy". Our analysis shows that in a general way, teachers responded satisfactorily to the level of alphabetization. We attempt to investigate also the extent to which teachers conquered the digital literacy necessary for the use of ICT in education. In this case, we are trying to see if teachers take into account the new digital "ecosystem", i.e. web 2.0, social networking and their very important role for the young pupils and students.

It is a fact that, in general, most studies show that teachers have a positive attitude towards the use of ICT in education and especially in teaching. But what is less certain is the following: the acceptance of ICT is accompanied by a similar change in attitude towards ICT, particularly in terms of new social practices? Teachers believe that ICT can be used as tools for a complete reorganization of their courses?

Too often teachers follow traditional teaching strategies. Teachers believe that ICT and generally throughout the digital technology as a mere tool in the classroom. The form of this point of view can be varied: teachers can simply uses electronic slides (power point or something equivalent), may suggest problems written with a word processor instead of handwriting, can post results on the Internet instead of hang them on the walls. All this is a typical use of ICT in teaching. But it is

a very inefficient use: in these cases listed above, it is hard to believe that students will improve their learning through the use of ICT. In short, teachers can simply consider ICT as useful tools rather than as tools that can disrupt the very structure of their courses, in a more productive way. From a different point of view, there are software that can completely overturn the (mentally and theoretically) tools available to students and the teacher and thus completely change the structure of the lesson. A typical example of this kind is the so-called Dynamic Geometry environments - such as Geogebra, which allows the construction and management of geometric shapes with the sole criterion of the principles of Euclidean Geometry. In addition, the Interactive Physics environment performs experiments and simulations in a controlled digital environment, where the laws of Newtonian physics apply.

Yet the use of web 2.0 tools can change, can alter the structure of a typical teacher-centered lesson. A trivial example could be History: instead of describing the characteristics of a personality, for example Alexander the Great, students can search for resources and information on the Internet and combine this information with the help of the teacher. Instead of being informed about the occupations of the Mycenaean or Minoan people, they can visually visit the relevant archaeological sites, examine the findings and try to draw conclusions - always with the support of the teacher.

It is obvious and many related researches confirm, that the use of environments of this kind create multiple transformations in the usual teaching scheme: the didactic contract itself changes radically and the didactic transposition (the way scientific knowledge is adapted to the needs of the education and more specifically, the needs teaching) changes as well. The roles and objectives of the teacher change radically and a training for teaching and pedagogical uses of ICT is not only necessary, but absolutely necessary, if we do not want the use of ICT to degenerate into trivial applications, without learning value. To summarize all this, training teachers in modern applications of ICT in teaching and learning, means more than just skills in using educational software and management of educational platforms; rather it means that trainers should be able to reshape their course and to critically take into account modern advances in digital technologies and their impact on students. Trainers also must be able to "transfer" these skills and attitudes to teachers that will educate. So, our question could be summarized as follows: does this happen?

Data and Analysis

The material we have for analysis and study is massive, covering a long period of time and has a varied form. First questionnaires were given to and answered by trainees by the end of each course. Also, we have data from interviews with teachers and from direct observations of several courses. Along with this material, we had access to the material trainers display themselves at various sites - with open access for all. This material either falls within the framework of their training or not - for instance, can be personal blogs.

In this section we refer briefly to some of our findings that emerged from the qualitative analysis of the data. The data analysis has not yet completed, but the first important results are already emerging. First, the time range, the volume (quantity) and the diversity of the data even if they do not guarantee the reliability of our results, certainly are an important factor of this reliability.
Our most important and significant finding is that teachers (trainers and trainees) have a generally positive attitude towards ICT integration in teaching. This positive attitude is very strong among teachers: it seems to be constant in time as teachers respond firmly, when and if they are asked, that they consider ICT relevant to for teaching and learning. Also seem willing to use ICT in all phases of instruction.

However, despite their positive attitude, rather few seem to have integrated into their teaching practices what we called "modern advances in digital technologies and their impact on students." Specifically, while teachers can easily integrate educational tools (such as educational software) to teaching and "transmit" this expertise to other teachers if needed (for example in training or in-service training), on the other hand modern applications like web 2.0 and social networking, seems not to have so much impact in their teaching practice. Teachers can integrate ICT into their teaching: that is certain. It is not certain however that they are convinced of the role of social networks and web 2.0 in education - at least as far as convinced of the other aspects of ICT. It is true however that recently the training program that we describe here was substantially upgraded in that direction - was enriched to a very significant issues about web 2.0 and social networking. The results of this enrichment are not yet visible.

This reluctance of the adoption of a modern digital applications and environments, this "distance" between a social practice that is widespread in Greece as elsewhere and particularly among students on the one hand and a "wait to see" from teachers position on the other hand, could be considered as a kind of "paradox." But probably this reflects a general characteristic of the Greek education system (Demetriadis, 2003; Legontis & Dagdilelis, 2013; Dagdilelis, 2016).

The Greek education system, completely centralized, leaves sometimes little room for initiatives: all relative material and framework (books, programs, didactic material,...) emanate from central institutions, practically the Ministry of Education, and are implemented and used in the same way in all schools. Within this context, generally, teachers are obliged to follow stereotypic teaching models. The use of tools such as web 2.0, and various forms of social networking, however, has a particular dynamic, which is not compatible with the course, as is usually organized. Thus, the Greek teachers of all levels, are very familiar with so-called "frontal" teaching in teacher-centered models. They are very unfamiliar, if at all, to "open" methods of teaching that would give students the opportunity for initiatives - and this is a problem that obviously requires a long and multifaceted intervention.

Conclusion

The initial data analysis seems to indicate that the use of ICT in teaching has been generally accepted by the teachers. However, some of the modern aspects of this use, namely web 2.0 and social networking, do not have the same degree of acceptance among teachers. Although their significance is not disputed, it is clear however that teachers do not seem willing to incorporate these elements into their teaching.

We hypothesized that a possible explanation of this phenomenon is linked to the centralized nature of the Greek educational system, but of course this is a hypothesis that needs further investigation. If this hypothesis is confirmed, then a long term effort for a new orientation of Greek education is necessary. In any case, further analysis of the already available data, along with what we actually collect, will give us - at least we hope - a clearer picture of the matter.

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