Exploiting Professional Software in Secondary-Level Vocational Education*

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During the design phase of a Greek nation-wide program aiming to incorporate the usage of professional /educational software into secondary level vocational education, the task of training the teachers was identified as the most critical to the success of the program. Factors that contributed to the importance (and difficulty) of the task included the large number of teachers to be trained (about 10,000) and the diversity of their background. We present the goals and the implementation strategy of the overall program and we introduce the design principles underlying the training of the teachers. Then, we focus on "the training of the trainers", describing the syllabus of the graduate-level course the trainers had to undertake.

Keywords: Vocational education, Educational usage of software, Teachers' ICT training.

1. Goals and implementation strategy

Progress in Information and Communication Technologies (ICT) has found its way in most professions and has transformed the way most professionals operate. These changes have affected all aspects of everyday operations including marketing, technical, and accounting issues. It is natural to expect that these changes will find their way into secondary vocational education.

The experience from program ODYSSEIA [1], mainly targeting general secondary education, shows that introducing ICT into secondary education is not straightforward. It requires a coordinated action that addresses issues related to the existing infrastructure (appropriately equipped and maintained computer laboratories, fast access to the internet), the availability of software titles suitable for educational purposes, and the training of the teachers in integrating software (and IT technology in general) into their teaching practice.

Realizing the necessity to exploit the use of professional/educational software in the Greek public secondary vocational education system, led to a nation-wide program with the following strategic goals:

- The introduction of ICT in wide scale, covering all public secondary vocational education schools (about 450), all areas of specialization, all teachers (about 10,000) and students. See [2] for a detailed description of the Greek Education System.
- The availability of appropriate computing and networking infrastructure as well as the availability of suitable professional/ educational software that can support the curriculum of secondary vocational education.
- The training of teachers in taking full advantage of ICT in teaching practice.

From the stated goals, it was obvious that a successful implementation strategy had to consist of three coordinated actions dealing with the ***infrastructure,*** the availability of suitable for educational purposes ***software and digital content***, and the ***training of teachers***.

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Infrastructure: Fortunately enough, the infrastructure available in Greek public secondary vocational education schools is sufficient. All these schools have computer labs appropriately equipped, all with internet connection. In addition, a network of trained technicians provides on-line support to the teachers in charge of the labs, supporting in that way the labs' year-long availability for hosting educational activities.

Software and digital content: The Greek Ministry of National Education and Religious Affairs owned only a few software titles (in a limited number of licences) relevant to vocational education. Thus, in order to support the large number of vocations covered by the Greek secondary education system in a nation-wide fashion, an extensive program of software acquisition is currently underway. Based on needs dictated by the curriculum in place and extensive market research, specific software titles are identified for acquisition. These titles will be localized and/or adopted to Greek vocational education curriculum to become appropriate for use in Greek schools [3]. In addition, new software will be developed for important topics of the curriculum currently not covered by existing suitable software.

The acquisition/ development of software alone were not deemed enough. Given that the majority of teachers in the Greek education system are not experienced in exploiting software for educational purposes, the necessity to support them with digital content they can utilize in teaching became obvious. Thus, for each software title to be acquired/ developed, it was decided to develop in parallel digital educational content (mainly scenarios for educational activities that utilize the software).

Training of teachers: The teachers to be trained number about 10,000 with background in diverse fields of sciences and engineering. They have formal education in electrical, mechanical, electronic and civil engineering, architecture, computer science, medicine, accounting, finance, business administration, etc. They are located all over Greece. Very few of the teachers have any training on how to take advantage of the opportunities offered by the usage of ICT in teaching. Given that the teachers, and then their students, would be the main users of the IT infrastructure and of the available software titles and digital content, it become obvious that the training of the teachers is the most important action to the success of the nation wide program. It should be mentioned that, from the teachers' point of view, there is also great demand for training in ICT and new technologies, a fact that increases the chances that the whole program can have a long lasting result.

In the rest of the paper, we focus on the organization of the training of teachers, the most critical and complex component of the nation wide program. We present the design principles behind the teachers' training program. Then, we focus on "the training of the trainers", describing the syllabus of the graduate-level course the trainers of the teachers had to undertake.

2. Design principles for the teachers' training program

The type of the training to be offered to vocational education teachers is underlined by three design principles. Firstly, *the training is not about specific software titles*. Specific software titles will be used in the training, but the focus will be in developing long lasting skills for using software to enhance the learning experience. Secondly, the training will *put the trainees at an active role at the centre of learning*. Our hope is that this, more demanding approach, will be favourably received by teachers. The decision to make the trainee an active participant of the learning process, led to the third principle underlying the teacher's training. The teachers' training will be centred on developing solutions (exploiting software) for problems in the area/field they specialize and teach. In addition, their trainers should understand the educational environment the teachers will be called on to apply the acquired skills. Thus, the *teachers should be trained by their fellow teachers specializing in the same or closely related scientific field*. In the rest of the section, we elaborate on these design principles.

The training is not about specific software titles: Given that a large number of software titles are to be acquired/ developed and used in educational activities supporting parts of the curriculum, it is tempting to turn the training into seminars on the specific software titles. This temptation is strengthened by the fact that the development of digital content (mainly scenarios for educational activities that utilize the software) is proceeding in parallel with the acquisition/ development of software.

At a first glance, it seems plausible to give seminars to teachers on how to use specific software titles. However, there is a great danger with this approach:

> *The "knowledge" might have an expiration date.* There is no guarantee that in the software titles will continue to be used. New software titles might become popular, existing ones might be outdated, licences might expire. Moreover, professional software undergoes constant development and evolves all the time. Even the same software title might look and feel completely different in a few years time. It is obvious that the training must focus on teaching *the skill* of "exploiting software for educational purposes" and not on specific software titles. As much as possible, the training should be software independent. The teacher who used in his training software X to develop educational activities for a specific topic should not have any difficulty in adapting the activities to software Y that is functionally equivalent to software X.

In order to avoid the above danger, it was decided that the emphasis of each seminar should be on a specific topic of the curriculum (e.g., "interior decoration" in the Applied Fine Arts curriculum) rather than on a specific software title (e.g. AutoCAD) that should be used in educational activities. Using specific software is inevitable. When training the teachers on aspects of a specific software title, special care should be taken to the "transferability" of acquired knowledge to functionally equivalent software.

Based on the above considerations, it was decided that for each specific software title in the seminar (usually each seminar focuses on one or two software titles) the syllabus must include:

1 *The software's extend of utilization.* For the specific software title, as well as for software with equivalent functionality, the teacher must be aware of the utilization the software can find in secondary vocational education (the courses in which it can be used, the topics it covers, the minimum required technical knowledge for its proper use).

2 *Technical aspects of the software.* The main focus is on transferable knowledge including concepts and models and, secondarily, in specific technical issues.
   a) The *fundamental concepts* underlying the software's functionality. Usually these concepts reflect methodologies/ design approaches employed by the vocation.
   b) The *mental model* (or *user model*) assumed by the software. The mental model describes *the order* in which the user has to perform some of the main tasks/functions supported by the software. This order usually encodes common practices of the vocation.
   c) The *basic functionality* of the software.
   d) The *advanced functionality* of the software *relevant to the seminar's theme* (a specific topic of the curriculum).

3 *Locating functionally equivalent software.* The focus will be on locating software (including java applets) and relevant recourses available for free use in the internet. The teacher must be able to judge the quality of the free software and its suitability for educational purposes.

4 *Development of scenarios of educational activities utilizing the software.* The teacher must have the ability to recognize educational objectives stated by the curriculum, that can be supported by the usage of software and to design and implement scenarios of educational activities utilizing software in a way that improves the learning process, introducing explorative, collaborative, active learning.

The trainees in an active role at the centre of learning: The majority of past training programs targeting the audience of teachers have been organized so that the central role has been held by the trainer and not the trainees. In most cases, the trainees have been restricted to a passive role, just listening to lectures. Their participation has been kept to a minimum, naturally resulting to a educational experience of questionable or, at the best, minimal added value. When the topic of the training is the educational usage of software, such a type of seminar is unacceptable. The trainees must learn to use the software and this can be only achieved by getting enough "flying time" on it. Moreover, in order to give to the trainees a worthwhile learning experience, they must have the opportunity to be creative and productive. The train-

ing program aiming to vocational education teachers tries to achieve this by focussing on specific topics of the curriculum, calling for the teachers to develop scenarios for educational activities that exploit the relevant software to better support their students' learning experience on the topic. Working in groups, the teachers can discuss and debate the merits of different approaches and help each other on technical issues. More importantly, they develop a sense of ownership for their final deliverable and they feel that their participation greatly contributes to the success of the training program. Our hope is that this group oriented teaching approach will be favourably received by the vocational education teachers.

An additional reason to have the teachers develop solutions (educational activities) during their training is making them non reliant to existing digital content. They should learn to adopt existing content for usage with functionally equivalent software, to create new educational activities, to seek and evaluate free digital content available through the internet.

Training by fellow teachers specializing in the same or closely related scientific field: As it was mentioned above, the teachers' training focuses on developing solutions/ educational activities (exploiting software) for problems in the area/ field they specialize and teach. In addition, it is also important that their trainers understand the educational environment the teachers will be called on to apply the acquired skills. Thus, it naturally followed that the teachers should be trained by their fellow teachers specializing in the same or closely related scientific field. It should be noted that the training in ICT skill development in Greece is usually carried out by computer scientist; this is a training program that does not follow this tradition.

3. Training the trainers

The fact that teachers will be trained by their fellow teachers with similar background, and the large number of teachers to be trained (10,000) lead to a two-level training scheme. A group of about 200 *trainers* was selected to be trained and, then, they will carry out the training of their colleagues. The selection of the trainers took into account their previous experience in ICT usage and the demographics of vocational education (trainers were located at areas with high concentration of teachers of similar area of specialization). Successfully *training the trainers* is of great importance. For that reason a graduate level course of 125 *learning hours* (including contact and study hours as well as hours devoted to developing deliverables) was developed aiming to equip the trainers with the state on the art techniques/ methods/ approaches in the use of ICT and software in education. That course would be followed up by an additional 25-hour course of the same style aiming to introduce the trainers to new software titles and to address issues raised during their activities as trainers.

The training methodology followed during the trainers' training should be identical to that applied during the teachers' training. The trainers (now playing the role of the trainees) should be at the centre of learning, their training should be engaging, leaving open space for creativity. In every training session they should work in groups towards the completion of a deliverable related to the topic-of –the-day. At the end of each day session, the groups would criticize each others deliverables, aiming to identify ways to improve them.

The trainers, following the completion of their training, should be called on to give seminars on specific topics of the school curriculum that exploit specific software titles. Thus, they should not only have the pedagogical foundation on the proper usage of software and ICT in education, but they should also be *proficient on the usage of specific software titles*. In order to achieve that, it was decided to group the trainers in groups based on their specialties and use different software titles in the training of each group. In that sense, the training of each group was *parameterized by different software titles*. Based on the formal education of the trainers, nine groups were formed, i.e. the electrical engineering group, the mechanical engineering group, the electronics group, the civil engineering (construction) group, the computer science group, the applied fine arts group, the finance sector group, the applied health group, and the "geoponics, food and environment" group.

3.1 The syllabus of the trainers' training

The syllabus used in the trainers' training, influenced by the content organization in [4], was designed so that the trainers acquire the pedagogical foundations underlying the usage of software in education as well as technical skills related to utilizing the internet and the proper usage of specific software titles. Depending on the formal education of each group of trainers, specific software was used in all demonstration and development activities.

The syllabus included the following sections (numbers in parentheses indicate the total number of hours devoted to the section and the number of hours the moderator was present in the training room):

Pedagogical foundations for exploiting ICT in education (35/23). The directed *instruction* and the *constructivism approaches* are studied through model learning sessions applying these approaches. Software used in teaching is categorized based on the type of its usage. Guidelines and techniques for developing educational activities employing the use of software are examined. During this part of the curriculum, the trainers participate in short "lectures" designed to demonstrate aspects of the teaching approaches and experiment in designing lectures themselves. The reader interested in the pedagogical foundation of ICT integration in education is referred to [4] and the references therein.

Utilizing resources from the internet (35/20). The trainers study the topics of distance learning, applet technology, free/ open source software, critical evaluation of material obtained from the internet, publishing on the internet.

Utilization of software in teaching (35/22). The trainers study the topics of categorization of educational software, evaluation of software suitability for educational purposes, exploitation of general-purpose software (e.g., spreadsheets) in teaching, design and implementation of educational activities that employ professional/ educational software, design of complete training programs (in contrast to designing isolated educational activities).

Adult Education (10/10). Given that the trainers will be giving seminars to fellow teachers, pedagogical issues related to the way adults learn are examined. In addition, experiences from previous teachers' training programs are discussed, focusing on (positive and negative) lessons learned form these past programs.

4. Conclusion

At the time of writing of this paper, the training of the trainers has been completed. Although it is not formally evaluated yet, the indications are that it was well received by the majority of the trainers. The large scale, nation-wide training of the teachers is about to commence in a few months time and will last for at least a year. At that time, we will be able to fully evaluate the teachers' training program based on the participants' opinion. However, we are well aware that the real test is whether there will be a change in the teachers' attitude towards the usage of software in teaching and in whether this change will find its way into the classroom.

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