Greek Computer Science Teachers' Training Needs Assessment

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Abstract—The present study, following the results of a qualitative study that investigated the explicitly expressed, the felt (but not explicitly expressed) and the latent training needs of the computer science teachers of the Heraklion region of Greece, has questioned all computer science teachers in Greece (5865) to confirm or not the qualitative study results. This has resulted in the largest survey that has taken place for Greek computer science teachers training needs and the only one that is competency-based as far as teaching and pedagogical training needs are concerned. The aforementioned properties of the study enable the design of a three modules (Subject knowledge - Teaching methodology - Pedagogy) training program with explicit training goals; a training program that leaves little mismatch between training needed and training provided.

Index Terms—Computer Science Teachers, Training Needs Assessment.

I. INTRODUCTION

The job of Computer Science Teacher is a very demanding one as not only Computer Science and Information Technology is changing rapidly but also it changes the conceptualization of what students must learn in school in terms of ICT/Computer Science. It is interesting that in most of the countries worldwide there is a shift from ICT to Computing in Schools [18], [19]. 'Computing' is the umbrella term for the subject as a whole, which comprises of three elements: computer science, information technology and digital literacy [18].

Therefore, the need for continuous professional development and training is evident. But how a process of professional development and training can be effective? The answer is a well-designed training needs assessment which will inform the development and evaluation of training programs and individual professional development plans.

Educational need, for an individual, is every knowledge,

skill or attitude that is necessary but unavailable for the complete and successful execution of a job or an activity [6]. Training needs assessment for professionals is the most effective way for a successful training program because it helps to detect training needs and organise training activities that aim precisely at meeting those particular, unavailable but necessary needs.

Although there have been some studies investigating the training needs of Greek computer science teachers, those studies recorded only the conscious and explicitly expressed needs of teachers while the context is constantly changing [2], [5], [12], [15].

Furthermore, as far as we know, there are no computer science teachers' training needs assessment studies that are competency based. Competency based training needs assessment is more accurate and explicit and enables design of training activity in a manner that leaves little mismatch between training needed and training provided [1].

For the aforementioned reasons, it was necessary an in-depth training needs assessment that would detect Greek computer science teachers' explicitly expressed training needs, felt but not explicitly expressed training needs and also latent training needs.

- 1) Expressed training needs are needs that the professionals explicitly express when they are asked to do so in training needs assessment. They are also called 'wants'.
- 2) Felt training needs are needs that the professionals know that they have but they do not explicitly express them. This category comprises needs that professionals feel uncomfortable to express.
- 3) Latent training needs are needs that professionals have not realized yet [17].

The aforementioned qualitative study took place in 2014 in the Region of Heraklion investigating in depth the expressed, the felt and also the latent training needs of computer science teachers through individual and group interviews, critical incident analysis and classroom observation [13].

Most of the studies that have assessed Greek computer science teachers' training needs have divided training needs into three categories: Subject knowledge, Teaching Methodology and Pedagogy [2], [5], [7], [12], [15]. As far as subject knowledge is concerned two topics are perceived as training needs in all the aforementioned studies: "Website creation" and "Multimedia development". "Computer networks" were perceived as training need exclusively in the first two studies [12], [15], whereas "Programming" has started to be perceived as a training need in [12] and in all the studies that have followed getting towards Logo-based

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programming environments [2], [5], [7]. As far as Teaching methodology the aforementioned studies suggested topics such as “Didactics of Informatics/Computing” and “Teaching Methodology and Practice”. As far as Pedagogy is concerned Papadakis & Athanasopoulos [15] suggested topics such as “Applied Psychology and Counseling” and “Pedagogy” whereas the topic of “Managing students’ behaviour problems in classroom” has not been perceived as a training need in most of the other studies [2], [7], [12]. Yet, Giannakopoulou [5] recognised as training need “Managing students’ behaviour problems and students-teachers-parents relationship”.

Our qualitative competency based training needs assessment [13], [14], clarified what exactly teachers need as far as the aforementioned topics are concerned. All the competencies and knowledge that were suggested as goals for an effective and complete training program in our aforementioned studies are cited in Section 3 as questions posed to computer science teachers in the study that is presented in this paper.

In this way, with this quantitative Survey, we are aiming at asking all computer science teachers in Greece (total 5865¹) whether our findings in the qualitative study are confirmed by them as training needs.

The Goal of the Study

The goal of the study is to assess the training needs of all computer science teachers in Greece working either in Primary or Secondary education with any kind of employment relationship. In particular, the study aims at detecting and describing competencies and knowledge that computer science teachers need and want to be trained for and acquire. The results of the study can be used to design and organize an effective training program that comprises three (3) sections/modules: (a) Current trends in Informatics (b) Didactics in Informatics and (c) Pedagogy in context.

II. METHOD

We have used the Survey method for educational research [16].

We have constructed an online questionnaire that comprises closed questions while giving the opportunity to fill in on additional training needs. This is the most appropriate method of describing the characteristics of a population providing insight into attitudes, thoughts and opinions, both cost effectively and time efficiently [3], [16], especially in populations with an adequate level of education [4].

We have taken care about the size and format of the questionnaire, clarity of the questions, anonymity of the responses, building awareness of the survey and of the importance of the resulting data. We have been sending the questionnaire along with a presentation letter describing the code/ethics of the process (e.g. anonymity, importance and exploitation of results) to the computer science teachers of 9 out of the 13 regions of Greece, from October 2017 until March 2018, using the e-mailing lists held by the computer science school advisors.

¹ This is the number of computer science teachers that worked in school year 2017-2018 in every employment relationship [10], [11].

Before sending it, a small pilot study took place in order to check the clarity of the questions and the time is needed to fill in.

Fig. 1. Participation of teachers by Region

No surprise that we got also 18 responses from the other 4 regions because computer science teachers from year to year may move among regions (Figure 1). Finally, we got responses from 905 computer science teachers. Utilizing the formula of Krejcie and Morgan [8], and choosing a confidence level of 95% percent we can say that with a margin of 3% error we can generalize the results of the study to the whole population of computer science teachers in Greece unless we find out in another study that computer science teachers of Eastern Macedonia and Thrace, Western Macedonia, Mainland/Central Greece Region and Northern Aegean have different training needs than those of the other 9 regions. Up to now there is no theory to generate such a hypothesis.

For the analysis of the data we have used only descriptive statistics as we don't seek for correlations. We take as positive responses (teachers showing interest) the ones that score 4 or 5 and we assume that more than 50% percentage of responses with score 4 or 5 is an adequate indicator showing that the corresponding subject knowledge or competency is considered a training need for Greek computer science teachers.

III. RESULTS

A. Subject Knowledge

Regarding the question "To what extent would you participate in a Training Program about Informatics/Computing at school that would take place during your free/leisure time and would aim at enriching or updating your knowledge?" Greek computer science teachers' responses are presented in Figure 2a and Figure 2b.

Fig. 2a. Training needs about School Courses

Fig. 2b. Subject Knowledge Training Needs/Topics

Three (3) out of four (4) teachers showed great interest of block-based programming environments and robotics/educational robotics (75%, 72%) while most of the teachers showed great interest in almost all of the topics in Figure 2b (50%-67%). This was not the case for school courses/topics presented in Figure 2a. In particular, the topics that high scored were “Website Creation” (67%), Advanced collaborative tools (66%), Physical Computing (66%), E-learning & LMS (66%), Android Development (65%), Python (63%) and Computer & Network Support (62%).

B. Teaching Competencies

Regarding the question “To what extent would you participate in a Training Program that would take place during your free/leisure time and would aim at you acquiring the competency of designing learning activities (1) based on (a) current developments in subject knowledge, (b) the nature of subject knowledge, (c) students’ learning readiness, (d) students’ learning needs, (e) students’ abilities and interests? (2) that are (a) meaningful for the students, (b) connected with school and everyday life, (c) taking into account pre-existing students’ knowledge?” Greek computer science teachers’ responses are presented in Figure 3.

It is interesting that almost all of the teachers (75%-84%) showed interest in designing learning activities based on the qualities that are cited in Figure 3 whereas less of them (64%-65%) showed interest in designing learning activities based on the “nature of subject knowledge” and “students’ learning readiness” (Figure 3).

Fig. 3. Learning Activities Design Training Needs

Regarding the question “To what extent would you participate in a Training Program that would take place during your free/leisure time and would aim at you selecting and effectively applying the following teaching techniques both onsite and online?” Greek computer science teachers’ responses are presented in Figure 4.

Fig. 4. Teaching Techniques Training Needs

It was not exactly the same interest in learning Teaching techniques: Nearly half of the teachers showed great interest in Teaching through Art, Debate, Conceptual Mapping and “Half-baked” scenarios (41%-50%) and most of the teachers showed great interest in the rest of teaching techniques (56%-67%) with “Group work” as being the most popular teaching technique as training need (71%) (Figure 4).

Regarding the question “To what extent would you participate in a Training Program that would take place during your free/leisure time and would aim at you acquiring the following teaching competencies?” Greek computer science teachers’ responses are presented in Figure 5.

Fig. 5. Teaching Competencies Training Needs

Nearly, three (3) out of four (4) computer science teachers (70%-77%) showed great interest in acquiring all the competencies that are cited in Figure 5.

C. Pedagogical Competencies

Regarding the question "To what extent would you participate in a Training Program that would take place during your free/leisure time and would aim at you acquiring the following pedagogical competencies?" Greek computer science teachers' responses are presented in Figure 6.

Fig. 6. Pedagogical Competencies Training Needs

Most of the teachers (63%-67%) showed great interest in acquiring competencies of 'Drawing up a learning contract', 'Using humor for creating a collaborative climate' and 'Recognizing, Accepting and Controlling your own feelings' and 3 out of 4 teachers showed great interest of acquiring the rest of pedagogical competencies cited in Figure 6. "Managing, effectively, incidents that interfere with learning activity" was the most popular pedagogical training need (75%).

A very limited number of teachers expressed additional training needs, either in Subject Knowledge, Teaching Competencies or Pedagogical Competencies.

IV. DISCUSSION-CONCLUSIONS

As far as subject knowledge is concerned it is obvious some shift of teachers' interest to "Programming"; "Computers, mobile devices, microcontrollers and robots programming" either with text-based (Python) or block-based programming languages. This can be explained by the education policy shift from ICT to Computing [9]. Furthermore, it is interesting to find that "Website creation" is still perceived as computer science teachers' training need perhaps because designing, maintaining and updating school website is, constantly, a computer science teachers' job. Finally, whereas "Network courses" are not perceived as a training need, as in [2], [5], [7] studies, the competence to support and maintain a computer or a network of computers is still a training need as in [12] study.

As far as teaching & pedagogical competencies training needs are concerned, almost three (3) out four (4) teachers showed great interest in acquiring the competencies that are described in [13], [14], studies and are cited in Section 3. It is interesting that when Didactics and Pedagogy are "translated" into competencies in context, they become obvious and important training needs.

This is the largest survey that has taken place for Greek computer science teachers training needs and the only one that is competency based as far as teaching and pedagogical training needs are concerned. The aforementioned properties of the study enable the design of a three modules (Subject Knowledge-Teaching Methodology-Pedagogy) training program with explicit training goals; in a manner that leaves little mismatch between training needed and training provided [1], a training program suitable for computer science teachers in Greece that can be evaluated with reliability and validity [6], [17].

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