Students' Perceptions of the Differences Between ICT and Programming Courses

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ABSTRACT
The curricula for Computer Science Education (CSE) of many countries comprise both Programming and Information and Communication Technology (ICT); however these two areas have substantial differences, inter alia the attitudes and beliefs of the students regarding the intended learning content. In this study, variables related to students' attitude were chosen and applied to programming and ICT courses respectively. Responses from the total of 126 Greek students, (71 on ICT and 55 on Programming) were used. Based on these responses we identified the differences of students' perceptions among ICT and Programming courses.

Categories and Subject Descriptors
K.3.2 [**Computer and Information Science Education**]: Computer Science Education, Curriculum.

General Terms
Measurement, Experimentation, Human Factors.

Keywords
ICT courses, Programming courses, Informatics, Secondary education, Students' Beliefs.

1. INTRODUCTION
The comparison of Computer Science Education (CSE) in different countries uncovers substantial disparities regarding the conception as well as the practice [4]. Some of these disparities are forced by the big differences in the Educational Systems, while others are caused by differences of traditions, national heritage or public opinion. In several countries, CSE has been included in the curriculum as a distinct discipline in secondary education, while it was taught across curriculum in others [4]. Generally CSE focuses on basic concepts about the constructional principles of computers and networks (hardware) and the principles of programming, (formal languages, programming and software development), whereas Information and Communication Technology (ICT) is focused on how to use computers and how to apply software In many countries [4] CSE includes both ICT and programming courses, however, students' sometimes face these courses differently.

As successful CS teaching largely depends on students' perception and beliefs, we aim to identify students' differences among programming and ICT courses. In this light, variables related to students' attitude were chosen and applied to programming and ICT courses respectively. Then a between group experiment was conducted among students participating ICT course and students participating programming course in the context of Greek educational system. The purpose of this empirical investigation was to measure students' beliefs and to identify potential differences among ICT and Programming courses. As students' beliefs and attitude are highly correlated with their performance and students' perceptions have an impact on what they have already learned and what they choose to do next [5]. Our work is expected to contribute to the understanding of students' performance and intentions to pursue programming and ICT courses in their future studies.

2. STUDENTS' PERCEPTIONS AND RESEARCH HYPOTHESES
All students' perceptions and intentions are considered as important determinants of the learning success. Reluctance towards adoption of CS content implies that research is needed to understand, more comprehensively, how students could be motivated. Several models and theories have been applied to address issues of students' attitude, perceptions and to identify the cause and the effect of different factors on the adoption of science education. For instance, (1) Performance Expectancy (PE), (2) Social Influence (SI), (3) Satisfaction (STF), (4) Self-Efficacy (SEF), (5) Perceive Behavioral Control (PBC) and Behavioral Intention (BI) are some of the most commonly used factors [1] affecting students' intention to attend a respective course. In the view of the above we aim to measure these factors for ICT and Programming courses and to identify potential difference in students' perceptions for these two courses. Thus, the study aims to clarify: *How students' perceptions are differentiated among ICT and Programming Courses?*

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3. METHODOLOGY AND RESULTS

The empirical study was conducted in the context of secondary education in Greece. The relevant curriculum ICT courses (named Informatics) are mandatory during Gymnasium (lower secondary) years and aim to develop students' skills in the use of ICT (operating systems, word processing, spreadsheets, image processing etc). The first group in our experiment (ICT Group) consisted of students attending the 3rd class of Gymnasium. They have experience on ICT courses and they are asked for their perceptions regarding the ICT curriculum in the under investigation factors. The second group in our experiment (Programming Group) consisted of students attending the 3rd class of Lyceum (high secondary). They have experience on the programming course and they are asked for their perceptions regarding the programming curriculum in the under investigation factors.

The research methodology included a survey composed by questions on background information of the sample and on the six principal factors. The survey was open during the last three weeks of November 2011 at four public Gymnasiums and four public Lyceums in the northwestern Greece. The final sample of respondents comprised of 126 Students. From the total of students, 71 (56.35%) were 14 years and attended 3rd of Gymnasium (taught ICT course) and 55 (43.65%) were 17 years and attended the 3rd of Lyceum, in addition, 89 were males (70.6%) and 37 (29.4%) females.

The questionnaire handed out to the students was divided into two parts. The first included questions on the demographics of the sample (age and gender) and the second part included measures of the six factors. In Giannakos et al., [3] you can find more information about these measures. In all cases, 7-point Likert scales were used to measure the variables.

Using the Fornell and Larcker [2] proposed procedures: (1) composite reliability of each construct, (2) item reliability of the measure, and (3) the average variance extracted. We assess the convergent validity of the measures of the study. Afterwards, the differences of students' perceptions among ICT and Programming courses in each of the crucial factors it was examined using Mann–Whitney U-test (see Figure 1).

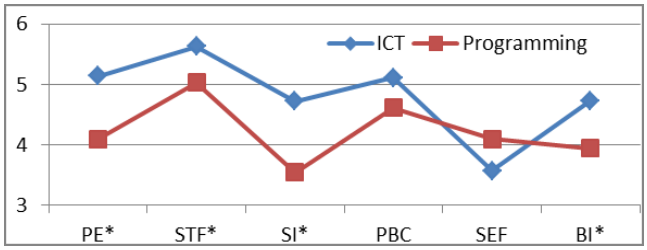

Figure 1. Average amount of each factor at each course

4. CONCLUSION AND DISCUSSION

At the time of the survey, the students had enough exposure to each course, as the lessons starts at the middle of September. Both respondents' groups expressed high satisfaction in ICT and Programming course respectively. Additionally, they expressed slightly lower perceived behavioral control and performance expectancy. High levels of these factors indicate positive views concerning usability, control and usefulness regarding both courses. Also, respondents expressed their positive intentions to attend ICT courses in the future. However, students' belief in social influence from their friends and relatives in ICT is also ranges in high levels on the other hand their conviction to complete a task with ICT is not in such a high level.

Observing Figure 1, we notice that the scores of the ICT students are generally higher compared to the Programming students, except self-efficacy (SEF). This is the only factor indicating higher level at programming courses, although this difference is unfortunately not significant. Besides that we could summarize that ICT courses are more popular than programming courses. The most significant difference among the two courses is indicated in students' satisfaction (STF), this may be possibly based to the wide enrolment with ICT in the last few years. In addition PE, SI and BI, are also indicating significance difference among the two courses, this may be possible explained to the familiarity of ICT in students' daily life and the connection of ICT with entertaining processes. In addition, with informal learning, students are in control of what, how, and when they learned. This possible explanation can shed a light into the high levels of ICT in many of our research factors. On the other hand, SEF and PBC does not indicate a significant difference. Hence, it seems that these factors ranged in the same levels in both courses.

Overall, our study contributes to the literature in several ways. First, this study empirically measures students' perceptions and intentions for CSE. Additionally, this study identifies differences among ICT and Programming courses. The current study is one of the few so far, where a CSE empirical assessment is employed among students who attend ICT and Programming courses.

Previous studies have shown that students' perceptions of what they have already learned affect their performance and what they choose to do next [5]. In view of the above students' performance and intentions to pursue programming and ICT courses is highly affected by their beliefs. As such, our findings have important implications for understanding how students perceive their learning and achievement in CSE. In addition, the results of the study allow us to argue that the enhancement of ICT in a Programming courses may benefit students' beliefs and change their attitude for programming.

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