# COMPUTER SCIENCE STUDENTS' VIEWS ON EDUCATIONAL STUDIES-PEDAGOGY

By

EFROSYNI-ALKISTI PARASKEVOPOULOU-KOLLIA * GEORGIA SOURSOU **

BILL ZOGOPOULOS *** EVANGELIA OREOPOULOU **** PANAGIOTA KONTOU *****

VASILIKI ZOURA ******

* Adjunct Assistant Professor, Department of Computer Science and Biomedical Informatics, University of Thessaly, School of Science, Papasiopoulou, Lamia, Greece.
** Post-graduate Student in Bioinformatics, University of Crete, Faculty of Medicine, Voutes University Campus, Heraklion-Crete, Greece.
***,****,****** Student, Department of Computer Science and Biomedical Informatics, University of Thessaly, Papasiopoulou str., Lamia, Greece.
***** Post-doctoral Researcher and Adjunct Lecturer, Department of Computer Science and Biomedical Informatics, University of Thessaly, Papasiopoulou str., Lamia, Greece.

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***ABSTRACT***

*The present article is based on a small-scale research that took place with the students in the Department of Computer Science and Biomedical Informatics in 2014 and three years later with the students of the same Department and the Department of Computer Science, as well. Students who have enrolled in the Educational science-Pedagogy module, that the Department offers, were asked if the module was beneficial in a Department purely technical (Faculty of Science) and if this theoretical module assisted them in their academic life and generally. Various views are listed reflecting students' perspective of the module Educational science-Pedagogy and come to the conclusion that we present; no module is useless.*

*Keywords: Computer Science, Educational Science-Pedagogy, Greek Educational System, Hard and Soft Science, Students.*

## INTRODUCTION

The term "Pedagogy" refers to the science of educating children, both in terms of upbringing and of academic development. Etymologically, it derives from the greek words "παις" (child) and "άγω" (to lead). Pedagogy is considered as social science and investigates human behaviour's changes, predominantly during childhood and adolescence, via education (which is a social phenomenon) (Xochellis, 2000).

"The term "Education" refers mainly to the deliberate influences of adults on a child which aim to form, stabilise or modify its intellectual and emotional behaviour […] However, it is not only about deliberate actions. It is a vortex of multifaceted interpersonal relationships and social interactions that transcend the boundaries of scheduled and methodical activities" (Xochellis, 2000, pp. 21-22). Pedagogy is, therefore, an anthropological, intellectual, and applied social science that arose from Philosophy and its aim is to research the entire spectrum of problems related to child's education. This science is interested in all aspects of a child's development: physical, intellectual, and moral. One can therefore claim that Pedagogy is a theoretical as well as an applied science.

On the other hand, Computer Science is the field concerned with the analysis, collection, classification, manipulation, storage, retrieval, transfer, dissemination, encoding, and transmission of symbolic representation of information. In other words, it is the science concerned with the theoretical foundation and the nature of information, algorithms and calculation, as well as their technological application in the context of automated computer systems: their specification, design, and implementation (Buchanan, Aycock, Dexter, Dittrich, & Hvizdak, 2011; Comer et al., 1989).

It is claimed that Computer Science, centered around the concepts of information, computation, and automation, brings together in a unified framework the methodological traditions of positive sciences (mathematical approach), physical sciences (empirical approach), and engineering (engineering approach) (Tedre, 2007). There is also the view that research on the natural world which is traditionally seen to be carried out via two discrete methodological approaches ("theoretical": elegant, abstract, based on simplified assumptions and logical rules; and "experimental": focused on noise, randomness, and the errors in real world processes) is complemented, thanks to Computer Science, by a third approach, based on the in silico simulation of natural phenomena. This is an approach that combines the properties and encapsulates the characteristics of the other two approaches (Flake, 1998).

The field experts' job in Computer Science (and also its sister field, Information Technology) is to create, replace, improve, or implement systems. Frequently, also, their job is to propagate their specialised knowledge, skills, and experience by means of teaching. It is therefore essential for many of them to also develop teaching skills and abilities, both generic and also focused on their subject matter, in order to function efficiently and effectively within the micro-society of a classroom or lecture room (Mialaret & Isambert-Jamati, 1997).

The fields of Computer Science and Information Technology are clearly distinct, yet so closely related that it makes sense for the purposes of this article, to treat them as a single group and consider Computer Science and Information Technology professionals as members of the same profession – at least within the context of them also functioning as teaching professionals.

It is important to comprehend the explosive pace of technological progress taking place around us. Computers have become an inextricable part of our lives; and the so called web of social interactions increasingly converges with the web of computer networks that makes up the internet. This is the reason why it is essential for Computer Science/ Information Technology students and professionals to spend some time focusing on the pedagogical aspects of their subject: by default, they ought to be the ones most qualified to teach the subject, as well as to mentor and shape the character of their academic students (see also Lai, 2011; Castells, 2010).

The purpose of this article is to investigate the manner in which science students (and, in particular, students of Computer Science specialising in Biomedical Applications) can incorporate and combine the science of computing and the art of teaching in their academic training. It is based on a small-scale research within the students who undertook the module Educational Science-Pedagogy, so as to find out how this module affected them in their scientific and personal life.

## 1. Historical Background

In this section, the authors present the evolution of computing all the way to its introduction as a teaching subject in schools.

For several millenia upto 1990, people used mechanical tools for calculations. For instance, the abacus has probably existed in Mesopotamia since approximately 3000 BC. The Greeks also developed some very complex analog computing devices. An ancient Greek shipwreck was discovered in 1901 off the coast of the island of Antikythera. In it, an instrument was found, extremely corroded by salt, comprising of a gear mechanism with multiple hands on a dial, this is the now-renowned Antikythera Mechanism (de Solla Price, 1974). In 1641, French mathematician and philosopher Blaise Pascal constructed an adding machine worked on building two mechanical instruments, a Difference Engine and a much more ambitious Analytical Engine (a precursor of modern computers), although none of his implementation for either of these ever functioned in a satisfactory manner.

Between 1900 and 1939 there has been significant progress in computational mathematics. In 1928, German mathematician David Hilbert posed three questions on the consistency and foundations of mathematical formalism in axiomatic systems. In 1931, Kurt Goedel answered two of Hilbert's questions: he proved that any sufficiently sound formal system is either non-consistent or non-complete. Also, that if an axiomatic system is consistent, this consistency cannot be proven within this system. The third question remained open, replacing 'true' with 'provable'. In 1936, Alan Turing provided a solution by constructing a formal computer system and demonstrating that there is a class of problems that even a machine cannot solve. One such problem is the "Halting Problem", also known as "Termination Problem" (Aikat, 2001).

During the 1940s, WW2 spurred the development of the electronic digital computer. In Harvard University, Howard H. Aiken aided by IBM built electromechanical computer Mark 1 in 1944.

The need to decode encrypted military communication also led to the development of a number of computing projects. The British built Colossus, a computational machine aimed at code breaking. In Iowa State University in 1939, John Vincent Atanasoff and Clifford Berry designed and built an electronic computer aimed at solving linear differential equations, although it never worked quite well enough. In 1945, Vannevar Bush published a surprisingly prophetic article in Atlantic monthly, on how information processing would change future societies. The invention of the semiconductor transistor in 1947 by John Bardeen, Walter Brattain, and William Schockle changed the face of computing by facilitating the microchip revolution. In 1946, ENIAC was the first electronic general-purpose computer and was heralded in the press as a 'Giant Brain' (Aikat, 2001).

In 1951, Grace Murray Hopper pioneered the concept of compilers for programming languages at Remington Rand. A few years earlier, in 1947, Hopper discovered the first "computer bug" (purportedly an actual insect that had crawled inside the innards of Harvard Mark II, although this was later claimed to be an urban myth). In a famous essay published on the Mind Journal in 1950, Alan Turing introduced the concept of the Turing Test, one of the first efforts in the field of Artificial Intelligence. He proposed a functional definition of "cognition" or "conscience" by means of a game: the testers must determine, on the basis of written conversation, whether the entity in the room next door answering to their questions is a human or a computer. If a distinction is not possible, one could arguably claim that the computer can "think".

It was during the 1960s that Computer Science started emerging as a separate field of knowledge. The term was, in fact, coined by George Forsythe. The first academic Computer Science Department was founded in 1962 at Purdue University. It was also during that time that the concepts of automata and formal languages started appearing. Big names in this sector, include Noam Chomsky, and Michael Rabin. The 1960s also saw the emergence of the first supercomputers.

During the 1970s, Database Theory developed via the work of Edgar F. Codd on relational databases. The Unix operating system, very important and still very much in use today was developed in Bell Labs by Ken Thompson and Dennis Ritchie. Ritchie along with Brian Kernighan developed the C programming language, also very important and still in use today along with a number of other very powerful languages that eventually evolved from it (C++, Java, C#, etc). The first RISC architecture was designed by John Cocke in 1975 in IBM's Thomas J. Watson labs.

During the 1980s, the first personal computer appeared, which was developed by Steve Wozniak and Steve Jobs, founders of Apple Computers. The first known computer viruses were spread in 1981. And, in 1987, the National Science Foundation inaugurated the NSFnet, a precursor of today's Internet.

From the 1990s onwards, parallel computers started developing to a useable level. Genetic Programming, pioneered by Len Adlemann is starting to deliver promising results. The Human Genome Project is the first successful attempt to record the entire human DNA. Quantum Computing is also making tracks following Peter Shor's integer factorization method that could work efficiently on a (theoretical) quantum computer.

"Information Superhighways" connect more and more computers around the world. Computers are becoming smaller and smaller, and nanotechnology is making its first infant steps (Eckert & Mauchly, 1964).

**2. Within the Greek Education System**

In Greece, education related to computing makes its first appearance in 1985, when Computer Science-Information Technology is introduced as a subject in the third-year curriculum of Technical High Schools (i.e. ages 16-18). Due to the shortage of teaching staff with the appropriate academic qualifications, this subject is initially being taught by teachers of pretty much every other academic background. A few months later, similar subjects appear in the curriculum of General High Schools. It is not until academic year 1992-1993 that Computer Science-Information Technology officially becomes a separate academic discipline, legally requiring relevant technical/academic qualifications for teaching staff (Katsikas, 2014).

Later, in 1996, as part of a major overhaul of the Greek education system, Computer Science-Information Technology becomes a mandatory teaching subject in the curriculum of Secondary Schools (i.e. ages 12-15). As far as primary schools are concerned, an initial attempt for ICT integration appears with the 28 'All day' School's pilot programme, beginning in 1996. The programme dictates that 28 selected Primary Schools are to add in their curriculum activities and lessons, such as Dancing, Sports and, of course, Introduction to ICT (http://www.oepek.gr/ pdfs/tpe_eaep_800sch.pdf).

As regards the same year (1996) the Ministry of Education launches the ambitious project "Odyssey", which is the first well-established effort for ICT integration in schools. This programme, funded by Greek and EU authorities and implemented between 1996 and 2001, aimed at creating a critical mass of teacher communities able to integrate new teaching and learning practices based on ICT. It consists of numerous sub-projects, all thematically named after characters or important events in Homer's "Odyssey" which can be summarised in three major action lines:

- setting up the necessary infrastructure
- developing sophisticated material for learning
- teachers' ICT training and support.

In the framework of the Information Society initiative (Information Society, 2003), the Greek Ministry of Education and the European Commission have also funded a large-scale project called Teachers' Training on ICT in Education (TTICTE). This ambitious initiative is focused on teachers acquiring basic ICT knowledge and skills regarding the application of ICT in (Jimoyiannis & Komis, 2007).

In the same year (2003), a new subject entitled "Informatics" is inserted into the Primary School's curriculum. The new lesson is to be taught for two hours each week in every class and constitutes the only specialty lesson taught across all years, without exception. The associated teachers, are either IT specialists or Primary and Secondary teachers with a postgraduate diploma in ICT. In 2003, the subject is renamed to "New Technologies in Education", a title which remains until 2009 (http://www.oepek.gr/pdfs/tpe_eaep_800sch.pdf). Nowadays this lesson is being taught only one hour in Primary school.

In 2010, a ministry decree is published, called "Designation of 800 12/placed Primary Schools with Common Reformed Educational Programme", containing the decision which defines the lesson "Introduction to IT" as a standalone cognitive subject in the day classes of Primary school. The teachers are now only IT specialists and apart from the fact that the lessons keep the same appointed teaching time, they are now available for pupils of all classes. At the same time, the lesson is renamed for a final time (up untill today) to 'Technolgies of Information and Communications' (http://www.oepek.gr/pdfs/tpe_eaep_800sch.pdf).

On 25 September 2013, the European Commission released its Communication to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions entitled "Opening up Education: Innovative teaching and learning for all through new technologies and open educational resources". This communication sets out a European agenda for stimulating high-quality, innovative ways of learning and teaching through new technologies and digital content. It proposes actions towards more open learning environments to deliver education of higher quality and efficacy. The communication identifies three areas for policy intervention, namely

- Open learning environments
- Open educational resources
- Connectivity and innovation (Katsikas, 2014).

Nowadays, the Ministry of Education launches the programme entitled "New School, 21st century School". This project aspires to set the students at the centre of the changes in the educational system in order to ameliorate the current level of education and the quality of the educational institutes. The Digital School plays a major role in the vision of the New School and is available to each and every teacher. Its creation is a grave priority as well as a great challenge for the Ministry of Education, as it is a requirement for a complete implementation of ICT in all teaching subjects and the school environment as a whole. As such, the use of ICT turns into a catalyst for altering the curriculum, the teaching and learning method and the relations inbetween teachers, students, parents, and school (http://ecourse.uoi.gr/pluginfile.php/98749/mod_resource/content/5/8.%20MEIZON_ICTinEducation.pdf: 26). The Digital School is organised in many basic actions like the creation of a digital class, the creation of e-books and electronic supplementary material on the PanHellenic exams. More stuff includes additional digital material, educationalist update, and digital governing. In addition, as far as the New School is concerned, e-gates are being made to facilitate everyone taking part in the teaching process (http://ecourse.uoi.gr/pluginfile.php/98749/mod_resource/content/5/8.%20MEIZON_ICTinEducation.pdf).

It is obvious -by looking at the years/dates stated above- that the introduction of computing and Computer Science-Information Technology in the Greek educational system has been significantly delayed in comparison to the progress made in these fields at a global level (Wastiau et al., 2013). The Greek system itself is incomplete (or, more accurately, delayed) in understanding progress. Both the syllabus taught and the availability of equipment, as well as the everyday experience of the teachers, are systematically 5-10 years back. There is a range of consequences arising from this. Firstly, a great amount of pupils in Greek schools, that nowadays have access to modern computing equipment (including mobile and tablets), experience an unrealistic situation when they have to face basic informatics courses in an outdated personal computer (Wiebe & Clark, 2001). Moreover, teachers (excluding the Technology-Computer Science teachers) have to cope with the challenge of a new technical subject that are themselves often unable to absorb due to the lack of appropriate academic background. This means that it is already hard enough for one to teach a subject as broad and deep in a technical sense, let alone educate on it from the far more involved pedagogical aspect.

It is worth noting that, as of 2017, there are 27 Departments of Computing / Computer Science / IT in higher education (16 in Universities and 21 in Institutes of Technical Education) (see also http://sep4u.gr/wp-content/uploads/mixanografiko-2017-new-me-baseis-2016-5p.pdf; Alberts et al., 2006), all of which containing in their syllabus a 'Teaching IT' module, but only some of them an 'Educational science-Pedagogy's module.

### 3. Hard vs. Soft Science

From an educational perspective, it is worth considering the classification of computing-related disciplines within the commonly accepted groupings of knowledge subjects, as well as their classification within the broader science framework.

There is one knowledge, but on multiple fields of Science. These differ between them, but also share common elements. One has to underline the distinction towards humanities that are assumed to be less strict compared to positivist scientific fields, such as Physics, Biology, and so forth; these are called hard sciences. However, humanities and social sciences are treated with a lot of suspicion in comparison to hard and physical sciences (see also Sarandapagni, 2011; Smith, 2000). This might be attributed to several reasons including traditional descrimination in favour of natural laws that govern the universe and have universal value. Positivist studies are considered harder and more demanding than studies in humanity (see also Storer, 1967). Science is, indeed, a social activity and such as is governed by the same sort of forces that govern social behaviour generally (Nowotny, Scott, & Gibbons, 2001). Additionaly, the benefits arrising from the findings of hard science is more readily observable and more directly verifiable (see also Douthwaite, De Haan, Manyong, & Keatinge, 2003).

Initially, the term 'Science' is used to refer to the complete organised body of verified and documented knowledge. This early definition is presented on one of Plato's works titled “Theaitetos”, where one of the character states that “science, therefore, is sound thought by means of reason”; in other words, that science is knowledge backed by logical arguments. Many human preconceptions have at times been doubted and refuted through the advent of scientific discoveries. Nowadays, the term Science is somewhat more limited and rigorous in scope: it refers to the system of developing knowledge by means of research based on scientific methodology (methodological formalism), as well as the organisation and classification of such acquired knowledge (Koppman, Cain, & Leahey, 2015).

This has led to the formation of distinct scientific sectors, which typically tend to fall within two big categories, the so-called “hard science” and “soft science”. Broadly speaking, “hard science” (also known as “positive science”) is the study of natural phenomena and formal systems based on observation, experimentation, reasoning and rational logic, whereas “soft science” (also known as “theoretical science” or “humanities”) is the study of human behaviour and society on the basis of observation and logic by means of analysis and rationalisation (Smith, Best, Stubbs, Johnston, & Archibald, 2000).

Positivist-realism is associated with “hard” science, which sets up hypotheses and tests them with repeatable and quantifiable experiments. Practicioners of hard science are trained to believe that the world they experience has an independent reality that they are discovering in their experiments. Constructivsm is associated with “soft” science, which looks at social phenomena that cannot be reduced to their component parts or repeated outside of their complex settings (Phillips, 2014). Soft scientists contend that contrary to the realistic-positivist approach, knowledge-experience is not passively received and “mapped” onto a learner's brain, but is actively “constracted” by the learner, who fits it into his or her existing mental maps or, less commonly, constructs a new model of reality and makes it part of his/her lifeworld (Douthwaite et al., 2003).

The use of such terminology is somewhat problematic and occasionally controversial. The use of the terms “hard” and “soft” generates a negative connotation against “soft”, theoretical subjects and it is somehow related to “atmospheres” or “moods” that characterize different fields of science, and these are in turn related to the organization of knowledge (Storer, 1967). It may suggest that they are somehow less rigorous or less serious, something that is patently inaccurate since soft science subjects are the cornerstone of classical education (Sarangapani, 2011). The same would happen if we were to use the term “Practical” (as opposed to “Theoretical”) in order to refer to “hard” (as opposed to “soft”). Besides, the distinction between theoretical and practical is blurred. Is hard science only existent at a practical level? Do Physics, Chemistry, Maths, and Medicine have no theoretical element? Conversely, is soft science purely theoretical? Does it not have distinct elements of positive reasoning, rational logic, and practical application in a same way that one can see in “hard” subjects such as Mathematics (Laughlin & Pines, 2000)?

This accumulation of questions tends to make us consider on the shifting image of knowledge (beyond the battle 'soft' versus 'hard' science); scientists experience exceptional joy when comprehending something new and, of course, after years of experience they know the way -meaning the scientific path and theory- that they we will choose in order to penetrate the new (see Nowotny, Scott, & Gibbons, 2001).

The picture is clearer in Social Sciences, a group of subjects traditionally thought to belong to the "soft" category: the introduction, in this area, of quantitative methodologies, such as Agent Based Models, simulation, stochastic prediction, etc., has led to the study of socioeconomic phenomena using methods and practices radically different from the traditional methods historically employed by Social Science. This is one only of the fields where computation and Pedagogics go hand-in-hand. And, of course, one must never forget that many scientific achievements and advances have only been made possible because they have been preceded by philosophical intuition (Christidou & Kouvatas, 2013).

In short, the distinction between hard and soft science is somewhat arbitrary and, as human knowledge advances, the boundary between the two becomes increasingly blurred as the various sectors interact and overlap more and more with each other – and this has a profound effect on educational approaches as it leads to the need to reconsider and possibly redefine the aims and objectives of educational systems. Using, as a starting point, the assumption that education should be aiming to produce diverse, well rounded educated personalities, rather than mobile repositories of highly specialised information, one can see the relevance of this arguments when it comes to the interaction between Computer Science-Information Technology and Educational Science-Pedagogy, essentially between a subject area traditionally perceived as hard science, and one traditionally perceived as soft science.

## 4. Describing the used Method and the Sample

This article is a short-range study that took place firstly in Department of Computer Sciences and Biomedical Informatics and secondly in Department of Computer Science, University of Thessaly, Lamia, Greece. A sample of students who successfully attended the Educational Science-Pedagogy module as part of their undergraduate studies were invited to take part in a short survey in order to indicate whether they have found the module useful within the context of their science Degree. The module is optional within the course and its marking does not contribute to the final grading (as regards Department of Computer Sciences and Biomedical Informatics). Its aim is not to just offer a volume of theory; rather, it is meant to provide an understanding of the basic principles of Educational Science-Pedagogy and the way these can help those who intend to teach applied science as part of their future career. The module works mainly by means of the lecturer stimulating open discussion, using plenty of examples, case studies, and question sessions. It also provides students with the opportunity to express, both individually and collectively, their own views on subjects that are related to Educational Science-Pedagogy. The interactive element is very strong throughout the term of the module. Students are also deployed to Primary and Secondary schools, in order to practically teach ICT, Computer Science or Computing (as one may see, term translation has not clarified the course's title issues) and they get feedback from the module lecturers; before entering schools they also do rehearsals between their co-students and the lecturer being present.

In this paper, the authors have used the methodological tool of content analysis. This method is defined as 'the scientific study of content of communication. It is the study of the content with reference to the meanings, contexts, and intentions contained in messages' (Prasad, based on Lal Das and Bhaskaran, in Dedotsi and Paraskevopoulou, 2014, p. 6). It is a method that treats any form of 'text' as an object for research or as a set of messages. The question asked is: "As Faculty of Science students do you believe that you are benefited by the lectures regarding Educational Science-Pedagogy and why?".

## 5. Views (Year 2014)

The Educational Science-Pedagogy module was rather misunderstood in the Department of Computer Science and Biomedical Informatics, as is typically the case with theoretical modules in a Science Department (see also Russell, 2007). That becomes obvious from the fact that the responses that we got were few (6) and, especially, since it is an optional module. Therefore, they have tried to aggregate the views of students who have attended the module, in order to estimate how useful it actually turns out to be to individuals who opt for education as their career path (see also Emerson, Fretz, & Shaw, 2011; Miles & Huberman, 1994).

The response from the majority of students surveyed (whose level ranged from first year up to final before graduation), responded that they benefited from the Educational Science-Pedagogy module, as it provided them with theoretical background for a more suitable way to teach as well as to perceive their own classroom environment. In addition, it helped them take into account the social dimension of a school setting by means of analysing and, ultimately, understanding behaviours.

A student told us that she *"found the module important at the level on educating one on the subject of the educational process"* (s14.4)[1]. She added that it gave her the theoretical and technical background on techniques for guiding students, helping them to develop their personality and improve their social perception.

Some other student regarded the module as an introduction to the pedagogical process, that would help him cope with the challenges of a classroom environment. His view was that *"the module provides an insight to the institutional dimensions of education from the points of view of the child who receives it; of the teacher who provides it; and of the State that regulates it"; he continued saying that "it is a source of knowledge that would be useful to me when I will become parent in the future"* (s14.3); this is a common element to the data we received from students in 2017.

Further on, another student stated that she attended the Educational Science-Pedagogy module purely out of curiosity as to *"what exactly a theoretical module could contribute to the context of a purely scientific course"* (s14.1). She concluded that the presentation of pedagogical theories by means of empirical examples helped her transmit knowledge on science experiments better than she expected during a day of voluntary work. A remark of hers that they found important was that *"the ability to pass on knowledge to an audience is more important than the height of expertise in that field of knowledge – and this is typically a dark area in Hard Science"* (s14.6).

Another student referred to her own teaching experience and stated: *"After having being in contact with numerous children via a programme for teaching simple robot construction and programming to primary school teachers, I realised that each one of these children is a reflection of its parents. Each pupil's starting point is the stimuli and foundations picked up from his/her home environment. There are only a few exceptions to this, only to confirm the rule"* (s14.5). She also pointed out that, apart from the family background, the educator also plays a significant role in a child's social development – therefore, the module has practical advantages despite being supposedly just theoretical. On the other hand, there has been one student who stated that the module content was way too theoretical and more emphasis should be given onto its practical aspects, since there is always a significant gap between theory and practice (s14.2)(see also Morris, 2012).

**6. Views (Year 2017)**

The findings of this small scale research derived from the Faculty of Science, University of Thessaly, Departments of Computer Science and Biomedical Informatics and Computer Science students' responses. The authors decided to ask other students (4 years later than the first ones) since a Faculty was founded (untill then only existed the Department of Computer Science and Biomedical Informatics) and as such we were given the opportunity to offer them the 'Teacher Certification' (Ministry of Education, Decree no.194542/Δ2, Govt. Journal Vol. 3815 issue B/28-11-2016). It is a ten (10) lectures-modules course, which is completed by awarding a specific diploma which highlights that the person is a certified and qualified teacher.

Students, who answered their question, are the first who chose to attend the lectures of Educational Science-Pedagogy offered by the Faculty of Science in order to gain the 'Teacher Certification'. Results' analysis and comparison were based on factors derived from students'

[1] The codes for 2014 students are s14.1-7 and for 2017 student are s17.1-14

own answers, the different personalities of which helped us to draw interesting and complete conclusions, but they had to bare in mind that these results could not be generalized. As De Souza (2016) writes regarding dominant social science theories,*"…researchers […] have expressed reservations about using such theories as ready-made explanations comprising general statements about empirical reality that sometimes take little account of the particular historical and contextual conditions influencing the observable events"* (p. 217). This quote could also enlighten one part of the research: we have to pay attention to every idiom that our students presented and simoultaneously not consider that what they said remains the same for the whole country (see also Denzin, 1983), since they conducted a small-scale research within one specific placement in a specific Faculty (and so it could not be generalised).

Students' replies were complete and informative. The reasons why they chose to attend the lectures of Educational Science-Pedagogy are clearly presented (they tried to gather their answers in Tables). Most seem to agree that these lectures benefit them in their professional life and in their wider social life.

The majority of responses were consistent with the point of view that the lectures offered to them were an important resource to help them become true teachers, people and parents. Most students (9 to 14) focused on the need to acquire pedagogical knowledge, in general; not only to those who wish to pursue the teaching profession, but also to all those who coexist (or will coexist) with children in any context.

*"…one gains more knowledge regarding children and how s/he should handle some situations…"* (s17.3)

*"…it is essential in order to become an educator…"* (s17.6)

*"A valuable factor (gaining pedagogical knowledge) that plays important role and differs in transmitting knowledge and being creative practitioners of our profession"* (s17.10)

*"Gaining knowledge is great, but the transmission of it is even more important than the knowledge itself…"* (s17.9)

*"… one can see that these lectures have benefited me not only as a School of Science student but also as a person…"* (s17.1)

*"We are given the opportunity to get to know a different world, the world of education…"* (s17.11)

*"Through this process we learn how to behave and how we can shape ourselves, our goals…"* (s17.7)

*"It is very important because we learn better about people and we have the opportunity to communicate better with them; especially children in development need support and good treatment…"* (s17.8)

*"…any person intending to teach should have some elementary knowledge of pedagogical science whether or not they are confirmed by pedagogical EPARKEIA competence …"* (s17.4)

Some students answered that the existence of Pedagogical Science lectures in the Faculty's programme is an important opportunity to acquire knowledge about an object that differs a lot from the Faculty of Science, thus widens their horizons. They believe that the combination of the two branches has more benefits than a better professional rehabilitation.

*"…are an opportunity for people who think that in the future they could deal with education"* (s17.2)

*"The prospect of combining the field of science with the pedagogical field has been motivating for me and also the acquisition of experience in the field of teaching"*

*"We are given the opportunity to explore a branch which, when we entered as students, might not have been thought very well"*

*"…pedagogical lectures help us to broaden our knowledge beyond computer science …"*

*"Student has now the choice of viewing whether another piece of IT fits her/him…"* (s17.5)

Some students considered it as an important experience;

*"It's a way of linking School of Science with education in general…"*

*"…the knowledge offered by a School must be spherical…"*

It provides them with knowledge on how to creatively coexist with people –professionally- not only inside, but also outside the school environment.

*"… it is an opportunity to see how a working environment (like school) functions, helping us to be better prepared in the future …"*

*"…all this process of teaching and presenting will help us in the future in professional presentations that we may need to make…"*

Interesting is the aspect that the two sciences combination in a module evolves and widens them both (Computer Science-Information Technology and Educational Science-Pedagogy).

*"…an essential factor in the evolution is the transfer of knowledge to the next generations. Let's not forget that doctors would be nothing without teachers"*

*"This is how we create the informational ideas and needs that unite these two branches, something that the branch of computer science could not find on its own"*

*"…it shows another version of IT…"*

Teachers working within state and its education system should play the role of the connecting link between wider society and each student's close family environment. To achieve this goal, 'in-gestation' educators should be provided with the appropriate knowledge in any scientific field (Palios & Paraskevopoulou-Kollia, 2010).

## Conclusions

Both research studies (2014 and 2017) were aimed at investigating students' beliefs. Note that in 2014, the Faculty was made up of a single Department (Department of Computer Science and Biomedical Informatics), which was not authorised to issue a teaching qualification degree. By 2017, the Faculty has evolved; is now made up of two separate Departments (Department of Computer Science and Biomedical Informatics and Department of Computer Science), and the degrees issued constitute official teaching qualifications. The latter exercise invlolved surveying students from across the Faculty (i.e. both Departments).

Most of the answers that the student gave were positively coloured. This is not just something that confirms the initial hypothesis, but it clearly states that the Educational Science-Pedagogy module in a technical Department is indeed useful (see also Cooperrider & Whitney, 1999; Daniels & Walker, 2001; Duffy & Ney, 2015; Jamal, Taillon, & Dredge, 2011).

A student in a Science Faculty should have a range of sciences in her/his academic life, including a theoritical one, as the later assist someone in having a global point of view rather than endorsing only a technical background. As Dietrich Bonhoeffer pointed: "The 'polymath' had already died out by the close of the eighteenth century, and in the following century intensive education replaced extensive, so that by the end of it the specialist had evolved. The consequence is that today everyone is a mere technician, even the artist" (https://www.goodreads.com/quotes/170137-the-polymath-had-already-died-out-by-the-close-of). Hence, learning the basic principles of the Educational Science-Pedagogy module give examples to someone who wants to teach an applied science in her/his career as regards being an effective transmitter of knowledge and not only a 'mere technician', since in-classroom pedagogy is not a 'generalizable mechanism' (De Souza, 2016, p. 227). This is because it is so important to attract pupils' attention in a classroom (see also Jacobsen, Eggen, & Kauchak, 2008; Brown, 2004).

Simply put, when someone in the field of technology is coping with the challenges of a classroom environment, it is crucial to have a theoretical background, such as those that the Educational Science-Pedagogy module offers; this particular module has practical advantages despite being supposedly just theoretical -develops someone's teaching skills as well as her/his personality and improves her/his social perception, including child's social development. The authors therefore infer that Educational Science-Pedagogy is a subject of relevance for hard science students interested in pursuing a career in education because it aids them take into account the social dimension of a school setting by means of analysing and, ultimately, understanding behaviours (see also Bulotsky-Shearer, Domínguez, Bell, Rouse, & Fantuzzo, 2010; McClelland & Morrison, 2003).

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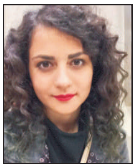
## ABOUT THE AUTHORS

*Efrosyni-Alkisti Paraskevopoulou-Kollia is an Adjunct Assistant Professor in the Department of Computer Science and Biomedical Informatics at University of Thessaly, School of Science, Papasiopoulou, Lamia, Greece.*

*Georgia Soursou is a Post-graduate Student in Bioinformatics at the University of Crete, Faculty of Medicine, Voutes University Campus, Heraklion-Crete, Greece.*

*Bill Zogopoulos is an Undergraduate student in the Department of Computer Science and Biomedical Informatics at University of Thessaly, Papasiopoulou str., Lamia, Greece.*

*Evangelia Oreopoulou is an Undergraduate Student in the Department of Computer Science at University of Thessaly, Papasiopoulou str., Lamia, Greece.*



*Panagiota Kontou is a Postdoctoral Researcher and also an Adjunct Lecturer in the Department of Computer Science and Biomedical Informatics of University of Thessaly, Papasiopoulou str., Lamia, Greece.*

*Vasiliki Zoura is an Undergraduate student in the Department of Computer Science and Biomedical Informatics at University of Thessaly, Papasiopoulou str., Lamia, Greece.*