School on Cloud: Transforming Education***

Kostis C. Koutsopoulos*
National Technical University of Athens, Greece

Panos Papoutsis**
Doukas School, Athens, Greece

Abstract
Nowadays for an appropriate way to deal with teaching and learning there is an axiomatic need to accept an integrated-holistic approach both in terms of the way we regard education and of how we practice it. This leads to a two-prong position: First, that education constitutes a dialectic entity and second that approaches to education presently in use are now absolute. That is, education has recently undergone a paradigm shift from a *Student Ce*ntred *Learning* approach, which in its own way have replaced the traditional *Teacher Centred Instructing* approach, towards an integrating holistic approach, bringing education into the new *Net Centred Knowing* paradigm which is based on cloud computing and represents the goal and objectives of the School on the Cloud project presented in this paper.

Keywords: School on the Cloud, Paradigm, Integration, Cloud computing.

* **Kostis Koutsopoulos**, School of Surveying Engineering, National Technical University of Athens, Greece

** **Panos Papoutsis,** Project Manager School on the Cloud, Doukas School, Athens, Greece

Correspondence: Kostis Koutsopoulos, koutsop@ survey.ntua.gr

Introduction

In epistemology, in the last few years, important differentiations have occurred related to the way we view our disciplines as well as their basic principles. The most important of these differentiations, as they relate to education, are the changes in the way we regard:

Teaching: from a process where teachers are using class time to lecture and dispense information to an approach where teachers facilitate student's learning.

Learning: from consideringg learning as a collection of factual and procedural knowledge to the acceptance that it is a process of acquiring new or modifying and reinforcing existing knowledge, behaviors, skills, values, or preferences and thus involves synthesizing different types of information.

Education: from the assumption that it is a form of learning in which knowledge, skills, values, beliefs and habits are transferred only under the guidance of educators, to the belief that learners should energetically participate in the educational process.

These changes in perception are of particular importance, because they clearly show the need for a new approach to Education, as the discipline of teaching and learning. More specifically, we need to clarify the fundamental principle that determines nowadays the way education is regarded and the methods used in teaching and learning.

Unambiguously and categorically, we would like to declare that at the centre of the pedagogic approach towards teaching and learning should be the concept of *integration*. This leads to the position of this paper that not only the traditional *Teacher Centred Instructing* educational paradigm, as well as the much herald present approaches to education, defined as the *Student Centred Learning* paradigm, are now absolute and we find ourselves in the period of the *Net Centred Knowing* paradigm which is based on Cloud Computing**.**

More specifically, the position presented here is simple in its explanation, but radical when is considered in terms of the excising beliefs and practices in the education community. That is, today's major educational stakeholders require capabilities such as: Students the ability of working and communicating without taking into account space and time; Teachers the mechanisms to receive unlimited support in preparing their teaching portfolio (presentations of lessons, conferences, articles, etc.), teaching practices (methods and teaching techniques, study materials, feedback) and evaluating (methods and techniques of evaluation and management of the results) (Thomas, 2009); Administrators the capability to design, build and test their programs as well as execute them fast and efficient. But these combined and simultaneous capabilities cannot be dealt with unless we accept the fact that they represent different manifestations of "a whole", the dialectic entity of education. Therefore, an integrated approach towards teaching and learning is required, an approach that is not possible without the help of the *networking abilities provided by Cloud Computing*.

The term "networking provided by cloud computing" has two components: The component "networking" refers to the integrated nature of education, which is equally important with the integrated efficiency of "cloud computing", the second component. The implications of

these is that: ***an integrated holistic approach in considering teaching and learning is imperative***. But understanding such an approach to teaching and learning is possible only through an examination of their nature and their evolution, which in turn determines how we perceive education as well as how we practice it.

However, these two dimensions have recently been involved in changes representing what epistemologist Thomas Khun (1962) has termed paradigm shifts and which are not rare events in disciplines like education. As a result, it is necessary to examine the current consideration of education and the approaches of practicing it as well as the way they have reached their present form.

Considering Education

The way we view education has altered in the last century following changes in the way we reconstruct societal values and consider important societal goals. That is, in order to successfully prepare students for the future we cannot continue educating them in ways that address education and market needs of the past (Fullan & Langworthy, 2013). As a result, although the world has been changing in ways that are not always easy to understand, at the same time it is imperative to be able to accurately respond and prepare our students for these changes and needs. In other words, every time a change is happening a new educational approach is needed to educate students for the challenging future (Gialamas et. al., 2013). This implies a stepwise process of changes in teaching, learning, managing and leading in education. Following is a brief presentation of these changes and the resultant responses which were determined by the way we considered education every time.

Monodisciplinary approach

From the beginning of the 20th century and for some years following World War II, education had a value that society systematically downgraded and considered it as just a tool in attaining other pressing societal objectives. This was accompanied by the inefficient way disciplines were operating. More specifically, every particular scientific endeavor was concerned only with its own subject area. As a result, concern for education was treated, like the rest of the disciplines, in a ***monodisciplinary*** manner. In other words, the teaching and learning aspects of education represented the exclusive realm of educators who were the only ones that could offer the methods, techniques and knowledge to handle education, for the simple reason that society and other scientist had little or no interest in them. In this monodisciplinary approach, however, the practitioners of every discipline through their "exclusive" paradigm, have been creating a ***"fragmented"*** approach to societal needs and obligations, including education which was providing a fragmented and mainly a descriptive learning process (the way students can learn). Therefore, it is of no surprise that educators followed the well known and long lasting traditional ***Teacher Centred Instructing*** paradigm, whose main teaching tool has been teachers' instruction (Fig. 1, first row).
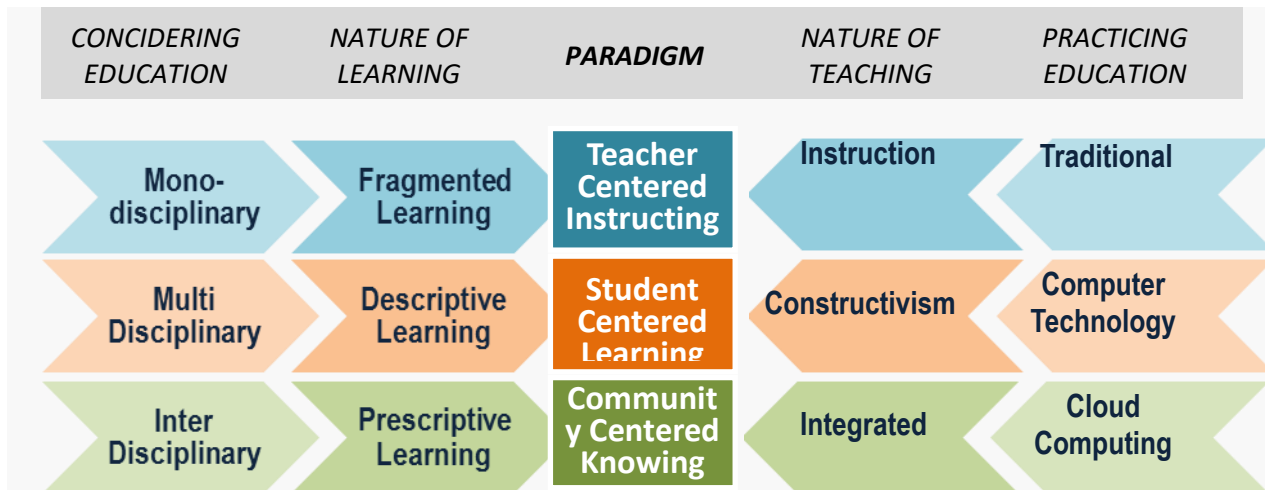
CONCIDERING EDUCATION	NATURE OF LEARNING	PARADIGM	NATURE OF TEACHING	PRACTICING EDUCATION
Mono-disciplinary	Fragmented Learning	Teacher Centered Instructing	Instruction	Traditional
Multi Disciplinary	Descriptive Learning	Student Centered Learning	Constructivism	Computer Technology
Inter Disciplinary	Prescriptive Learning	Community Centered Knowing	Integrated	Cloud Computing

Figure 1: Changes in Education

Multidisciplinary Approach

In the 1970's the significance of education was recognized and the requirements of teaching and learning acquired a place at the centre of societal interests. In addition, however, there was the strong questioning of the monodisciplinary practices by the scientific community, which resulted in the development of an alternative consideration. More specifically, all societal needs and practices were required to be approached from various perspectives and concerns, which led to a ***multidisciplinary*** approach towards education. Under this perspective, education was treated by the society and other interested scientists as if it consisted of the sum of all the distinct parts of a multidimensional cultural, political, social, environmental and economic reality. In other words, because human knowledge necessitates "abstractions" of all aspects of reality, learning was expressed in the form of a set of *separate* relations, interdependences and interactions, providing still a descriptive learning education. But this notion of a descriptive - multidimensional education required a constructivism approach in the classroom, which in turn formed the basis of the education paradigm presently in use, defined as ***Student Centred Learning***. A paradigm that is focusing, in a descriptive way, on both individual learners (their heredity, perspectives, backgrounds, talents, interests, capacities, and needs) and on learning itself (the best available practices that promote the highest levels of motivation, learning, and achievement for all learners) (Fig. 1, second row).

Interdisciplinary Approach

It is the strong belief of the authors that today this multidisciplinary approach cannot be acceptable anymore. It is suggested that an integrated approach is necessary, which has to be simultaneously cultural (i.e. new role of students), pedagogical (i.e. new role of teachers), technical/technological (i.e. use of the internet), administrative (i.e. new role of school administrators), social (i.e. a different disposition of parents towards school) and political (i.e. a different approach of government to school), in dialectic harmony and respecting all aspects of

teaching and learning an integral part of which are the basic education stakeholders (pupils, teachers and school administrators).

In other words, it is argued that a holistic learning approach is required in order to express the multidimensional relationships and interdependencies of all the stakeholders that constitute the specific entities participating in the education process, which is the "whole". As a result, an *interdisciplinary* approach is required, which leads towards the integration of all possible learning actors and approaches in order to overcome the compartmentalization of knowledge. However, such a regard of learning establishes a holistic education which provides *prescriptive* learning (the way students should learn) and leads towards a new paradigm in education, named in this paper *Net Centred Knowing.* That is, we suggest that the "participatory" approach of the student centered education, which emphasizes the active involvement of students in the learning process, now is being substituted by a holistic approach towards knowledge, which is the foundation of the new Net Centred Knowing paradigm (Fig. 1, third row).

Practicing Education

Pedagogical approaches provide the tools for teaching, but "which of them are used?", "what they are used for?" and "how to make best use of them?", depends on the attitudes and mind set of the education stakeholders and the way they regard education. For example, in the inerdisciplinary-holistic consideration of education and in order to describe and comprehend the required approaches to teaching, a corresponding integrated pedagogical approach will be required, which will differ if education is considered in a different way. That is, the pedagogical tools used in determining teaching have necessary undergone an evolutionary process of change, which has been driven fundamentally by the increased necessity of integration.

That is, teaching methods as well as educational curricula have been changing, but the key to understanding these changes is the appreciation of the swift changes of how we regard education: from an old paradigm filled with traditional instruction methods to another anchored in computer technology and finally to a new one where cloud computing with its integration capabilities plays the central or the determining role. Therefore, it is suggested that practicing education has, in the span of a little more than half a century, undergone the following transformations (Fig. 1).

Traditional or Instruction Approach

The traditional approach, which lasted until a few years ago, was very simple: the teacher transmits information to students who passively listen and acquire facts. Pedagogically, in this approach subject matter and teaching methods are focusing on the simple transmission or instruction based curriculum. This leads to a Teacher Centered Instructing teaching process which Goodlad (1984) has described as:

> Not "how" but "what' to learn dominated consistently. Teachers and children were busy covering' what was set forth in the textbooks and workbooks. Children, either as individuals or in groups, were not seeking solutions to problems identified by them as important and meaningful. Instead, they were moderately busy on assignments

predetermined by teachers. In general, the subject matter studied appeared to be remote from daily concerns and interests of the children. (pp. 13-14)

Moreover, this approach is characterized as the one in which (Cuban, 1993):

- Teacher talk exceeds student talk;
- Teachers look upon the textbook to guide curricular and instructional decision making;
- Instruction occurs frequently with the whole class; small group or individual instruction occurs less often;
- Use of class time is largely determined by the teacher;
- Classroom furniture is arranged into rows of desks or chairs facing a chalkboard;

As a result, as Fowler and Mayes (2000) pointed out, there is a "representational" view of learning with its concomitant "transmission of knowledge" by instruction approach, which determines the design and operation of the learning environment. Actually this approach to knowledge is so dominant in the learners' conceptions of learning that memorization is practically the exclusive path to learning. All these characteristics and practices lead towards the well known and long lasting traditional Teacher Centred Instructing paradigm (Fig. 1, first row).

Computer Technology or Constructivism Approach

The increased use of microprocessors altered the traditional teaching approach creating a new one based on ***computer technology***. It was accepted by educators and policy makers alike that education had to be in the information business (or no business at all) and most of the pedagogical tasks in the classroom or outside it had to be accomplished by utilizing some form of computer technology. This resulted in the emergence of a new information education in the context of a world of computers and interactive software.

The use of computer technologies, however, emphasizes the importance of creating engaging learning environments that provide students with meaningful learning experiences from various forms of learning relationships which are the result of interactions between learners and content, learners and learners and learners and teachers (Anderson 2003; Godwin & Kaplan, 2008; McConnell, 2005). In other words this corresponds to a Student-Centered Learning education which involves both learning and the learner and most importantly is directed towards all the programs, policies and teaching in order to support: Students for effective learning; Teachers for being familiar with the instructional techniques that supports such learning; Administrators for developing a school environment that enhances that desirable learning; School counselors for improving both the conditions for learning (parent education, classroom environment, teacher attitude) and with helping each learner develop to his/her fullest potential.

But such an approach to education basically re-envisions education by drawing on social constructivist educational philosophies (Holmes, et al, 2000; Fowler &Mayes, 2000; Cormier, 2008). An approach which emphasize the importance of interrelationships between persons participating in the teaching and learning processes and the kinds of interactions that need to be fostered in planning learning resources to create participatory learning experiences. In other words, it is based on *Constructivism,* and not Constructionism, a theory which is based on

observation and scientific study and determines how students learn and how they construct their own understanding and knowledge of the world, by experiencing things and reflecting on them.

As a result, the constructivist view of learning leads towards teaching practices encouraging students to use participatory techniques such as experiments and real-world problem solving, in order to formulate learning and reflect on, as well as talk about what they are doing and how their learning is improving. In other words, in the constructivist approach, nourished by computer technologies, students by questioning themselves and their strategies, become "experts" on their own learning, providing them with the necessary tools, in the classroom or outside it, to keep learning or *learn how to learn*. Thus establishing the education paradigm presently in use, defined as Student Centred Learning (Fig. 1, second row).

The Integrated or Cloud Computing Approach

Up to now the three basic educational stakeholders (students, teachers and administrators) were considered by the education community as independent and sometimes conflicting pedagogical forces (Koutsopoulos, 2008). However, the thesis of this paper is that such an approach is clearly scientifically shallow, logically unsound and mainly lacking the necessary integration required in the complicated and dialectic present day scientific, societal and educational environment. That is, although the adoption of new computer technology techniques in teaching is imperative; for example, Dede (2008) considers Web 2.0 as a "seismic" change in pedagogy. Nevertheless technology cannot be utilized alone, ignoring the other educational actors (i.e. teachers with no computer skills or lack of understanding from decision makers). The same is true in terms of the role of teachers. Clearly, nowadays teachers have to be involved in getting away from transferring knowledge to understand available information in context (this paper suggests cloud information) or using it to solve problems. But this cannot be achieved without the help of school administrators and/or public officials. A School Principal or the Ministry of Education can certainly design an innovative program, but if parents and teachers are not convinced to co-operate a failure is inevitable.

Basically, all stakeholders in the pedagogical process are teaching and learning factors, which have as common background their educational dimension. But most importantly, they are closely interrelated and not independent, inadvertently complementary and not conflicting and thus they can be integrated into an educational "whole". As a result, according to this paper, they should be considered as components of an integrated teaching approach representing different manifestations of a holistic teaching methodology.

In other words, the goal of the new way we practice education is to alter the approaches we catalyse learning and innovation as well as the ways which complement and enrich the individual's personal learning space. That is, the nature of teaching is a lot more and well beyond a constructivist approach, where learners actively participate in the educational process by simply using various tools . More specifically, the new way of practicing education encompasses beyond ICT tools, all stakeholders in different ways so that it:

- Transforms the role of pedagogy;
- Provides students with a variety of services the control of which is handed to them;
- Empowers learners to regulate their own learning;

- Changes the roles that teachers and educators play;
- Eases the burden of teachers on transferring knowledge;
- Creates new knowledge with skills;
- Provides Leadership and *i*nstitutiona**l** change;
- Provides administrative support for a digital society in teaching and learning.

Cloud computing can fulfill all these capabilities because it represents a fundamental change in the way computing power is generated and distributed. Indeed, as Microsoft (2012) has declared "With Cloud computing in education, you get powerful software and massive computing resources where and when you need them (and we may add in any way you desire), in order to apply new educational approaches ... Cloud services can be used to combine on-demand computing and storage, familiar experience with on-demand scalability and online services for anywhere, anytime access to powerful web-based tools". More specifically, cloud computing according to a report by the School on the Cloud network (Koutsopoulos, 2015): "is a new ICT approach which by possessing five essential characteristics (*On demand service, Network access, Resource pooling, Rapid elasticity and Measured service*) can provide ubiquitous, rapid, convenient and with minimal management effort or service provider interaction, three forms of services (*Infrastructure* service*, Platform* service *and Software* service) that can be deployed in four fundamental types of the Cloud (*Private, Community, Public and Hybrid)"*

That is, it represents a framework which can successfully serve and support an integrated approach to education because:

- Its characteristics have a direct application to the integrated approach, because Net Centred Knowing education cannot be achieved without multitasking, the ability to handle a large number of users and applications, the need for flexibility as well as the ability to meet changing demands.

- It allows the major education stakeholders (students, teachers and administrators) to access stored files, e-mail, database and other applications from anywhere at request (Nicholson, 2009).

- It represents a familiar and appropriate tool for today's education stakeholders (the first generation to grow up within the digital technology era), who are familiar with using computers, videogames, video cams, cell phones, and all the other tools of the digital age.

- It qualifies as an ideal environment for the support of major education stakeholders, because it provides:

  ✓ Students with the ability of working and communicating without taking into account space and time.

  ✓ Teachers the benefit of unlimited support in preparing their teaching portfolio (presentations of lessons, conferences, articles, etc.), teaching practice (methods and teaching techniques, study materials, feedback) and evaluating

(methods and techniques of evaluation and management of the results) (Thomas, 2009).

✓   Administrators with the ability to design, build and test their programs.

From the previous discussion, it should be clear that cloud computing approaches, although similar to the computer technology ones in addressing teaching issues differ in one significant aspect. Namely, they represent the pieces of a holistic and integrating framework by providing an information system domain within which virtually all aspects of education can be practiced. This dialectic concept, by emphasizing a holistic view of education, is broader than data or information; it is open rather than closed; it can accommodate pluralistic teaching styles; and offers no restrictions on subject matter or curriculum. And thus provide the foundation of the new Net Centred Knowing paradigm (Fig. 1, third row).

In summary, it is suggested that in the last few years education, through two parallel changes in the way it is perceived and is applied, has gone through two paradigm shifts. From the Teacher Centred Instruction paradigm characterized by a monodisciplinary/fragmented approach with learning and traditional/instruction teaching methods, to the Student Centred Learning paradigm represented by a multidisciplinary /descriptive approach with learning and computer technology/constructivism teaching methods and finally to the new Net Centred Knowing paradigm expressed by an interdisciplinary /prescriptive learning approach with the teaching methods of integration/cloud computing as shown in Fig. 1.

The case for the new paradigm

This new paradigm based on the two pillars of how learning is considered (interdisciplinary/ prescriptive) and is practiced (integrated/cloud computing), can be defined as the process of answering pedagogical questions, solving teaching problems or addressing learning topics which cannot be dealt with adequately by a simple independent mono or multidiscipline approach. But most importantly, in approaching these educational issues the Net Centred Knowing paradigm draws on various perspectives that express multidimensional relations and interdependencies of the elements that constitute or represent specific entities or parts of the problem, topic, or question under consideration. Because all these are simultaneously ecological, economic, social, technical-technological, political and cultural. In this way organic integrations and not mechanistic sums are achieved, through the construction of a holistic perspective, based on modern day tools and in dialectic harmony with all education stakeholders. As a result, the Net Centred Knowing paradigm which is based on cloud computing is not a simple supplement, but a new and corrective of the presently used Student Centred Learning paradigm.

In addition, the main argument against the new paradigm can easily be rebuked. This argument presented mainly by those working within past paradigms, is that the Net Centred Knowing paradigm rests on a conceptual confusion or as professor Benson (1998) has stated: "integrated studies are a fool's project, propounding equations where all terms are unknown." However, the Net Centred Knowing paradigm as a connection between integration and interdisciplinarity with the use of cloud computing, should be understood as representing the confrontation of education stakeholders with the world, be it a pedagogical problem, an event or

even a teaching or learning question. But out of this phenomenological confrontation rises a situation which is too broad to be handled by a mono or a multidisciplinary approach and traditional or simple computer technology methods, with no regard for the holistic nature of that world. That is, the purpose of Net Centred Knowing paradigm is more than just to address questions that transect discipline boundaries or integrating insights or methods to illuminate teaching and learning issues. It involves an articulate spectrum of principles to help education stakeholders to determine when and how to confront the world by seeking out a holistic approach to interrelations and interdependencies, that can be achieved with the use of cloud computing.

School on the Cloud

From the previous discussion it should be clear that there is a need to thoroughly examine and evaluate the interface between education and cloud computing as well as explore how teaching and learning should respond to new ICT developments, in the form of cloud computing, that are transforming education and will continue to do so in the immediate future. That need and the ideas behind it were shared by many ICT experts and educators, some of which had an opportunity in a meeting for ICT in education in Spain on April 2012, to discuss them. These discussions resulted in an idea for a School on the Cloud proposal which was submitted and approved creating the School on the Cloud: connecting education to the Cloud for digital citizenship network (SoC).

Goals and Objectives

The basic goal of the SoC is to evaluate the state of the art, by examining and assessing a wide range of topics related to Cloud based education such as: tools, methodologies, pedagogical issues and visions. Moreover, the SoC network seeks to achieve its goal and objectives by addressing the following two key questions: How should education respond to cloud-based technologies? What is the impact, now and in the future, on education stakeholders and teachers?

Answering these questions in essence puts the foundations in applying the new Net Centred Knowing education paradigm. The reason is simple: as learning becomes increasingly digital, cloud-based developments become the necessary vehicle for a new integrated way to education (Donert, 2014). An approach that aligns with the way we think, share, learn and collaborate, inside and outside the classroom, which in turn allows education to be holistic as well as bring into teaching and learning the necessary dynamic, interactive and multimedia tools.

However, selecting, implementing and managing cloud-based services, school-wide collaborative tools, educational forms etc. are not easy tasks. Although education and learning responding to present day needs and requirements has to be supported by cloud computing, there remain issues to be resolved related mainly to their interface during the transition from the old to the new paradigm that is taking place right now (Donert &Bonanou, 2014). That is, although there is a rich production of research projects and applications on the present state and the future of education on one hand and on cloud computing on the other, each area has been examined individually with no real concern for their interaction. The literature has yet to provide answers to issues concerning their interface. In other words, there is a need for examining the status of cloud based education, which has to address both these areas as they are combining and interacting.

Moreover, the literature (Meier, 2012; Gutta, 2012; Cruz, 2011; Northgate, 2012) indicates that cloud computing is not a novice technology that promises to deliver many exciting things. It is already a reality and there are many educational implementations of it. However, evaluating the maturity it has reached, its present and anticipated pace of growth as well as its effects are not easily attainable objectives, but they are achievable as long as there is a good grasp of them. Following is such an examination of the effects which are emerging from the impact of cloud computing in education as well as in teaching and learning and which are elaborated in more details in a SoC document (Koutsopoulos, 2015).

What Cloud Computing Brings to Education

Experience and the literature (IBM 2013; Gaytos, 2012; Sultan, 2010; Duggan, T., 2012) shows that there is a range of resources and services available to education using cloud computing, whether they concern infrastructure, services, solutions or the introduction of new processes. That is, cloud computing brings many benefits to education of which the following are considered the most commonly referred and important.

Savings: The cloud promotes in general, and in education in particular, a cost effective use of ITC resources, by reducing all kind of costs;

Flexibility: One of the main benefits of cloud-based teaching and learning is that it can prevent individual investments in equipment, programs etc. The reason is that the centralized infrastructures of cloud computing promote flexibility in various ways;

Effectiveness: Cloud computing by promoting a dynamic exchange and participation between teachers and students, their social network and parents, leads into: first, finding the appropriate to the stage of education information and tools and second, an effective learning and teaching process (Tuncay, 2010).

Sharing: Cloud computing provides the means in every institution to avoid the duplication of resources that exist elsewhere. That is, skills, good practices, applications, teaching content and infrastructures can be pooled and shared.

Real time Access: Cloud computing allows students and teachers to access in real time useful and free information from anywhere in the world in a matter of seconds.

Reduces the Risk of Obsolescence: For all practical purposes cloud computing provides an "anti-obsolescence" insurance against technological changes, because it can cope better and more efficiently with their increasingly rapid development.

What Cloud Computing Brings to Teaching and Learning

There have been significant advances in ICT, in the form of cloud computing, that continue unabated up to now. As a result, there is an increasingly perceived vision that cloud based education should be the single most important path towards a successful education. In other words, it is suggested that the use of cloud computing in the classroom has an impact on the fundamental elements of classroom education (the subjects taught and the teaching and learning

methods in attaining them), as well in the changing role of several influential factors (Koutsopoulos, 2015), as shown below:

Subjects: In terms of the teaching subjects it is suggested that cloud computing is the 4th fundamental subject that students should master (after reading, writing and arithmetic). That is, education is being transformed into an activity of providing an additional subject that is commoditized and delivered along with the traditional 3R subjects.

Learning: Several studies (i.e. European Commission/ Horizon Report Europe: 2014 Schools Edition**,** European Commission/Ala-Mutka et. al., 2010 and Beyond Current Horizons Program/Facer and Sanford, 2010) support the thesis of this paper that recent developments related to dexterities, skills and competences, require changes in our schools. Among these changes the most important are:

- Learning should be focused on Four not the three Basic Object Competences;
- Learning should be tailored to the Needs of Individuals;
- Learning should be based on a Holistic New Vision;
- Learning should be active and Connected to Real Life;
- Learning should be towards Open, Flexible and Networked Relationships;
- Online Learning should be strengthen;
- Distance Learning should be strengthen;
- Hybrid Learning should be strengthen;
- Flipped Learning should be strengthen;
- Non- Formal Learning should be strengthen;
- Network learning should determine the design of a curriculum.

Teaching*:* In the learning and the digital landscape in which education is presently operating, requires comparable teaching methods (Vuorikari et. al 2010). Some of those are:

- Collaborative Teaching
- Collective Teaching
- Personalized Teaching
- Parents Teaching
- Real-time Assessment
- Predictive Analysis in Teaching

The Changing Role of Education Elements: Cloud Computing with the recourses it provides to educational elements, it forces them to adapt to the developing situations, which in turn change their place and role in the education process. Among them the most **adept** to change are:
- *Teachers:* Teachers role must change to be capable of:

  ✓ Guiding students in the new "time-space" that is created;
  ✓ Guiding and advising them in the new methods of learning (i.e. social networks, online discovering, etc.);

    ✓ Acting as referees to avoid bad habits (i.e. filtering unsound knowledge gleaned from the internet or from "friends" on social networks);

    ✓ Basing their teaching on collaboration between students and promoting their more energetic participation in classes.

- *School Administrators***:** The administration of any institution has to adapt and reflect the new ways of teaching and learning. Educational changes have brought about new conditions that need to be imposed and become operational, such as:

    ✓ New forms of curricula;
    ✓ Assessment approaches and networking;
    ✓ New practices that work, can be shared and make visible and learnable their results
    ✓ Both, top-down and bottom-up approaches to make changes happen.
    ✓ Support Innovation in all educational and administrative aspect of an institution
    ✓ Facilitate the monitoring and dissemination of good practices.

- *Transforming of Knowledge***:** With the emergence of new technologies, teaching strategies and pedagogical approaches the way knowledge is transformed has to change.

- *Social Media*: Technological developments have brought about changes in the role social networks must have for education shareholders, who must use them as professional communities of practice, as learning communities and as a platform to share information (Falconer, I., 2013)**.**

- *Open Education Resources***:** Cloud Computing is an efficient conduit for open educational resources (OER), and as such it should be used.

- *Data-Driven Learning and Assessment***:** Cloud Computing has brought about changes on the role of data sources in the education process which must be used for personalizing the learning experience, for ongoing formative assessment of learning and for performance measurement

Conclusions

    Present day students all of which have practically been born in the 21st century, representing the so called Z Generation, are growing and operating in an environment where collaboration and exchanges are spontaneous, learning has become ad hoc and networks are imperative, forming an intrinsic part of their lives. Moreover, surfing the Net looking for new encounters and experiences has become virtually their "first nature". As a result, using yesterday's teaching tools does not correspond to their needs and their very nature. To the contrary these tools can only create confusion and appear, to put it mildly, artificial to present day students. In fact, what the work of SoC demonstrates is that they actually deprive students of the

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tools they need most to master the skills and dexterities that they will be required both in today's and tomorrow's world, and which in the world of education follow and are influenced by present and anticipated effects of cloud computing.

In 1964 Marshall McLuhan, introduced the phrase "the medium is the message", suggesting that the means in most cases is the end. This dictum is certainly appropriate in education, where there is a tight relationship between technology and learning. That is, as technology has become an agent of immense change, it has forced upon the education system cloud computing and has given rise to a generation of students who have never known life in school and elsewhere without a computer. These changes have a significant ripple effect on education. Presently, and more so in the near future, advanced technologies in the form of cloud computing have put education within the reach of many more individuals and allow the design of improved curriculum as well as teaching and learning methodologies.

In conclusion, the effort undertaken by the SoC up to now to address the changes in school education as a result of cloud computing, shows that this technology is shaping, changing and enabling new ways of accessing, understanding and creating knowledge, and will continue to be part of all education stakeholders' lives, because it can face the requirements posed by present day and future education and market needs. Moreover, all education stakeholders need tools such as those offered by cloud computing that are more versatile and can adapt to new developments. In other words, the position suggested is that ICT in the form of Cloud Computing already is and will continue to be an integral part of teaching and learning as well as managing schools.

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