Between Tradition and Innovation in ICT and Teaching

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INTRODUCTION

During the past few decades, the expanded use of PCs and the Internet introduced many changes in human activities and cooperated in the transformation process leading from the industrial society to the knowledge society.

Among other things, the above instruments played a special role in education, and two main phases can be easily recognized: the former one where computing and ICT were mostly used to enhance individuals' learning features (i.e., teachers mainly had the role of educational worker: planning, controlling and evaluating students' learning processes); the latter one, more recent and centered on ICT use, where teachers had to adopt situated and collaborative learning strategies, build communities of learners (CoLs), organize students' work for enhancing problem finding and solving, while helping the development of their ZPDs (zones of proximal development, meaning individuals' cognitive areas marked by the distance between the subject's knowledge/experience in a given field and the same knowledge/experience in the best skilled individuals in the community).

The above transformation modified not only teachers' functions, but also the whole school environment and the students' role within it.

The same ICT will help teachers and professors in finding solutions to learning problems by giving them new instruments for the analysis and continuous monitoring of students' learning processes.

BACKGROUND

As already stated, computers entered very early into educational processes, often under the influence of pedagogical and psychological theories. As regards the influence of IT on individual teaching-learning processes, one of the most relevant contributions in defining the ways computers could be used in education came from Taylor (1980), who proposed three metaphors for them: tutor, tool, and tutee. The first one refers to the computer support to teachers' work, the second one to instruments or tools autonomously used by students, and the third one to computer programming skills students must have to let problems be solved by computers. Galliani and others (1999) extended these metaphors while considering the great deal of software tools devoted to education and developed with the time. Tutor appellation describes how computer systems support or substitute (in the specific situation of auto-instruction) teachers and tutors in their work. Computer-assisted instruction (CAI), computer-assisted education (CAE), and computer-assisted learning (CAL) software are examples of the above systems. The former ones, CAI and CAE, implement into the topics to be taught the structure of the software the designer makes up (i.e., they force the user to follow a well-defined learning route within them); good examples for this kind of software are: 1) tools for theorems' demonstration or physical phenomena emulation, and 2) surveying/testing software made by questions with pre-built multiple answers or yes/no answers. CAL software, with respect to the other tools, gives more importance to learning than to teaching; that is, users can now freely move within different scenarios and can decide by themselves what to do, or can browse in a personal way the context the software proposes. Good examples for these software packages are educational games, edutainment (acronym for education-entertainment) tools, simulation systems (often used for training), and many multimedia or hypermedia tools.

A further extension of tutor metaphor comes from the results of artificial intelligence application in education and especially: intelligent computer-assisted instruction (ICAI) systems and intelligent tutoring systems (ITSs). In these systems, with respect to CAI and CAL tools, there is no pre-determined teaching route or strategy, but there are three independent modules interacting

among themselves: an expert (i.e., a knowledge basis on a very specific domain), a pupil (implementing the knowledge representation of a student interacting with the system), and a teacher (implementing the teacher behavior rules of everyday teaching and determining the didactic strategies to be adopted during the student-system dialogue).

With respect to the tool metaphor, its extended version now includes (together with the software students can use to produce information, i.e., editors or at most word processors) office automation suites and special tools for the analysis of a large amount of data and for browsing specific contexts (usually provided with authoring, co-authoring functions).

Finally, the extension of the tutee metaphor is mainly represented from tools for the creation of special developmental environments, such as the ones Papert created with LOGO.

It must be noted that Taylor's metaphors and their extensions are not the only ways for interpreting the influence of computer use in individuals' learning processes; a relevant role in the analysis of computing effects comes also from meta-cognitive hypotheses. Strictly speaking, people supporting the above hypotheses think that computer use stimulates functions' development more than learning topics so that meta-cognitive attitudes are developed by students systematically working at a computer (Cornoldi & Caponi, 1991). Furthermore hypertexts and hypermedia, due to their features, induce the development of transversal and meta-cognitive skills.

The main feature of the educational use of IT in this phase has been the introduction of computers in school and educational systems, without any great innovation in teaching and management organization (i.e., the most relevant interventions carried out by public institutions for all levels of schools were projects for teachers' training, allocation of funds for buying computing laboratories, etc.).

Radical changes in ICT influence on teaching/learning processes came from the spreading of networks and especially of the Internet (with its exponential growth in last few years). The reasons for the changes in knowledge construction hypotheses and educational effects—that is, for the passage from individual to social analysis of educational phenomena—is mostly due to computer-mediated communication (CMC) and its role on individuals, communities, and societies.

It must also be noted that the ICT influence on education can be analyzed from two different points of view: the former one looks at the possible creation of new knowledge structures; the latter one refers to the different ways ICTs can be used in learning contexts and to innovations they can induce in the same contexts.

Regarding the first point of view, many scholars proposed new definitions and interesting ideas. Rheingold (1994) proposes the concept of virtual communities as groups of individuals who can never meet themselves or physically know one another, but who use the Net for their interpersonal communication, such as for sharing information and building new knowledge. The Lévy (1996) idea of collective intelligence is strongly dependent on the increase of the interpersonal communication speed and on the great amount of information the Net makes available. Furthermore Calvani and Rotta (1999, 2000), while collecting hypotheses from many other scholars, state that ICTs introduce new elements for knowledge structure—that is, it has no more only linear, sequential, closed, and hierarchical features; in addition, it also has hypertext and multimedia features. They state also that the Net extends the social negotiation aspects of knowledge and contributes in its distributed features supporting in this way the construction of meaningful learning in the subjects using it. Actually the results coming from knowledge management experiences suggest for networks and especially the Internet the role of the technical infrastructure on which a community memory (shared knowledge basis supporting a professional CoP) can be built (Trentin, 2004).

Regarding the second point, the Internet inherits and strengthens the results of previous distance education experiences and proposes for itself two main features: 1) repositories within which information, documents, and other information can be found; and 2) virtual environments where individuals can interact and build learning communities.

The above features and the improvement in education/training requests from large layers of people induced further changes in educational systems and especially universities. The definition brick-and-click university, recently introduced to describe the relevance universities assign to the presence of online courses and e-learning in their didactical offer, gives an idea of the importance ICT gained in educational contexts. But the effects of ICT on universities are not only nominalistic; they also modified the places and the actors of educa-