



# Only technology can save our schools

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## Abstract

Schools and in general educational organizations are among the most conservative institutions in society. Society changes very quickly but schools and the way of learning at school have been the same for centuries. For this reason many people are convinced that schools, as we have known them so far, have come to an end. The most important social change in schools is the appearance of the digital technologies of information and communication: visualizations, animations, interactive interfaces, simulations, computer games, the Internet, shared virtual reality. These technologies, and in particular simulations, allow us to learn not by reading or listening to words, but by seeing and doing, for example by altering the parameters of a simulation and by observing the results of these variations. Educational organizations are closed to new technologies because these would determine a complete transformation of the entire educational system. But the use of the new technologies at school would make it possible to reduce the distance, today so large, between children who are "born digital users" and school, to push the development of these technologies in directions which are more positive from the cognitive and the social points of view, and to have a school which really works for both boys and girls.

## 1 The end of the school system as we know it

Educational structures are the most conservative of all social organizations. From the time they came into being, they have not changed. Society has changed and continues to change from every point of view, but the structures called to educate the new citizens have remained the same and have been using for centuries, if not for thousands of years, the same learning methods. In this paper we will talk about schools, but our considerations can be applied to all educational structures and activities, such as universities, professional training courses, management education, retraining programmes and life-long formation.

At school it is centuries that the contents of what is taught is the same, that the methods used to teach are the same, that the physical and organizational infrastructure made up of buildings, classrooms, programmes and time-tables is the same. The professional figures, teachers, directors and principals are the same, as is the economic context inside which schools operate, with most of the resources coming from the State and destined mainly to pay the teachers' wages. Also the social context to which schools refer is the same, that of a society made up of an elite and the rest of the population. A society where schools are designed for the elites. Is it possible for such schools to work in a society which has changed so much and which continues to change so quickly? Should schools not train us to enter society? Should they not have as an objective that the new citizens work well in the society they live in and give their contribution? How is it possible therefore that schools remain the same and continue to function in this changing society?

And in fact the school system does not work. There are exceptions, but they are exceptions. The general rule is that schools make everybody unsatisfied. Unsatisfied are the teachers, who are no longer able to teach what they should be teaching, and who are not even able to get themselves accepted as teachers by their students. Unsatisfied are the parents who see that their children are not learning what they should be learning at school. Unsatisfied are the students, who simply cannot understand what is school nowadays. Many students do not like school because school forces them to do what they do not feel like doing. Nowadays students live school as if it were extraneous to them, something they do not understand. Unsatisfied is the society, which sees that schools are not able to give to the new citizens the training in terms of content, capabilities and behaviours that is expected from them. And schools are not able to carry out the important function of reducing the differences in the starting-off opportunities among students. The dissatisfaction is so radical and generalized, and at the same time, the conviction that the school system cannot change is so widespread, that today an internationally appreciated analyst of school systems such as Norberto Bottani thinks that schools as we know them have come to an end.

## 2 The new digital technologies create a “new ecology of the mind”

Many are the changes which have taken place in society and which schools should take into consideration. The most important change has been the appearance and the spreading in society of the information and communication technologies, which in the second half of the Twentieth century became digital, making a great step forward in comparison with the previous ones, that is books, newspapers, cinema, radio and television. We are talking of technologies that concern what schools deal with: receiving, producing, using, communicating information, and thinking, learning, interacting with others. The new digital technologies are invading our society, but they have no place inside the schools. Outside school everybody uses them, at work, in organizations, in the economic system, in everyday life, to look for, to receive, to spread information, to interact with other people, to play and enjoy other kinds of entertainment. We use them in art and in scientific and technological research. Schools are enclaves in which these technologies do not enter. How is it possible for such schools to work? Students at school learn by reading books and by interacting with a teacher who talks, teaches, and asks questions, and the only technologies used at school are books, blackboards, pens and pencils. Instead, as soon as they go out of the door school, students find that new technologies invade society and also their lives.

The situation has changed in recent years. In 1997, an American professor of business administration, Don Tapscott, wrote a book entitled “Growing up digital” about what it means to grow up in a digital cultural world (Tapscott, 1997). In 2008 the same author published another book entitled “Grown up digital”, about what it means to have grown up in a digital cultural world (Tapscott, 2008). What has happened in eleven years between the publication of one book and the other is that a possibility has become reality. The general diffusion of the new digital technologies, of computers, of the Internet, of computer games, of virtual realities started twelve years ago, but young people still did not have access to them. Today things have changed. Students leaving school nowadays have spent their pre-school and school years interacting, outside school, with these technologies, and this has changed their way of communicating, of gathering information, of thinking, of speaking, of writing, of interacting with other people, preparing them for jobs equally full of such technologies and for a society where these technologies are predominant. How can these students not feel distant from a school system that knows nothing about these technologies and does not use them?

### 3 The opportunities offered to schools by the new digital technologies

The new digital technologies make change necessary for schools because there cannot be such a great distance between what the students have experience of at school and what they have experience of as soon as they leave the school. But these technologies do not only create a problem for the school system. They also offer an opportunity. The new digital technologies introduce new ways of learning which would be of great help to the schools. The most important characteristic of the new technologies is that they make it possible to learn by seeing and doing and not only by listening and reading, that is by exclusively using language (Parisi, 2000). At school language, especially written language, is the main channel of communication, of cultural transmission, of learning, of mental work. When we say that schools have not changed since they came into existence, that is, since 2500 years ago, the first thing we means is that the centrality of verbal language has not changed. At school students learn by using language. The contents of knowledge are described and explained with words, and students understand and learn (or should understand and learn) listening to or reading words. There is no doubt that language offers important advantages when it comes to learning, thinking, searching for information, interacting and debating with other people. But language also has many limits, especially in today's school system which is open to every girl and boy and not only to girls and boys who belonging to the social elites, as was in the past; and in a society in which girls and boys are used to technologies which tend to be visual and interactive, and not verbal. The limits of language concern the understanding of what is said or written because to learn by using language requires that you know language well (which is not the case for many students), that you remember what you have listened to or what you have read, that you use what you have listened to or read to connect it with what you already know, and especially that you are motivated to learn. This is the first problem of schools today, in particular because today the motivation to do something must come from the students themselves and cannot be imposed from outside.

Visualizations, animations, interactive environments, simulations, computer games, specially those made not only to entertain but also to learn (“serious games”), virtual reality, robots, make it possible to learn by seeing things and not by listening to or reading descriptions and verbal explanations of things. They make it possible to learn by manipulating things and by observing the consequences of your actions. Among the new technologies, the technology which appears to be the most innovative and with the greatest potential to change how students learn at school, is computer simulations. A simulation reproduces in the computer not only how things appear (for this visualizations and animations are enough) but it reproduces also what lies behind things, in

other words, the mechanisms and the processes which lie behind what one sees and explain the phenomena we have to know and understand (Parisi, 2001). To interact with a simulation does not just mean to give a command to the computer which changes what we see but it means to manipulate these mechanisms and processes and to observe the results of our actions. This makes it possible to understand things, and not only to see them.

Why learning by interacting with simulations can be a radical change for schools? The use of simulations can have for learning the same revolutionary effects that the adoption of the experimental method has had for science. Modern science took off when it stopped being philosophy, that is, something made only of words, conceptual analyses, reasoning, and discussion to become an experimental science. In an experimental laboratory a scientist looks at things directly with his/her eyes, he/she does not listen to or read descriptions and explanations, but rather manipulates the conditions in which things happen and observes the consequences of such manipulations. The new digital technologies make it possible to apply the same methodology to learning. To learn in real, “physical”, laboratories, for example of physics or chemistry, is not the solution not only for economic and organizational reasons but also because many of the phenomena to be studied at school simply cannot be brought into a “physical” laboratory. On the contrary, everything can be learnt in a virtual “experimental laboratory”. The student can observe visualizations/animations/simulations of every type of phenomena: physical, biological, behavioural, social, and even conceptual and abstract. He/she can change the conditions and the factors which influence the phenomena and can see the consequences of such changes. This active and non verbal way of learning makes it possible for the student to understand better the nature of the phenomena, helps him/her to remember them better and to connect them to what he/she already knows. And, what is even more important, it makes the student more motivated to learn, for example when he/she faces challenges similar to those of computer games. In addition, with Internet learning can occur in a social context, that is, by interacting with other students and with teachers, tutors, and experts.

Other changes schools that tend to ignore are those which should result in modifications to the subject matter of teaching. These changes are necessary not only because research makes continuous progress but also because important changes take place in society. Today the economic system has become a very important part of society and it strongly influences everybody’s life. Yet schools do not try to give some knowledge about the working of the economic system to all future citizens, with the paradoxical consequence that citizens are called to elect rulers who take crucial decisions on economic issues that only a few of their electors know and understand. Economics is a science known only by those who study it in universities. Computer simulations and other

digital technologies, such as computer games and shared virtual reality, can help to make economic and financial issues interesting and understandable to (almost) everyone.

#### 4 Why are the new digital technologies not used at school?

Why school systems do not use the new digital technologies? Why is it decades that we talk about schools and these technologies but nothing happens and the school system continues to work as it always has? School systems, as we have already said, are among the most conservative social organizations, and their conservatism is revealed here as elsewhere. Or rather, here more than elsewhere, because the use of the new technologies as learning tools would change the entire school system, its “culture”, its organization (physical and social), its required professional competences, its economic framework. The move from learning through verbal language to learning by seeing and doing means to deprive verbal language of its absolute predominance in learning and in the workings of the mind. In addition, if learning systems are technology-based and are no longer based only on books and, more generally, verbal texts, who produces them must have different competences from those who produce books and verbal texts, and this is another problem for traditional school “culture”.

But the use of digital technologies as learning tools changes also other aspects of school systems. Physical and organizational limitations (buildings, classrooms, time-tables, courses, programs, texts, etc.) are weakened because the new technologies make it possible to learn anything, everywhere, at any time, in any way. Professional competences change also in another sense because many of the functions (those of delivering content, of evaluating improvements, of coordinating and supervising learning) are automated, passing from teachers to technological systems. Teachers can therefore concentrate on the social formation and on the personal character of their students. In addition, with Internet the learning process becomes more social than it is in the classroom without compromising order and discipline. Learning takes place thanks to the interaction among students and to the interaction between students, teachers, tutors, and experts. Also the economic framework of the school system will change because the professional competences required are different, as it is different the formation of such competences. The destination of public funds for schools changes as well because part of the funds destined to pay the teachers’ wages is diverted to developing and evaluating technological learning systems. The type of companies that work for schools change too because they are no more only the traditional publishing houses. What is even more important, the entire educational system is diversified and it is positioned differently within society. The state is no longer its only supporter.

So the answer to the question why the new technologies are not used at school is that they would bring a radical transformation of the entire school system, and nobody wants or is able to imagine a radical change of this kind. Yet it is impossible to see the future of our schools without the digital technologies having a central role. This also because the presence of the new digital technologies in schools would have other positive consequences for the entire society. We conclude this paper talking about three of these consequences.

## 5 Three positive consequences of the presence of the new digital technologies in schools

The diffusion of the new information and communication digital technologies has created a “new ecology of the mind”, that is, a new environment where the mind lives and with which it interacts. And the consequences of this “new ecology” are not necessarily positive. For example, we ask ourselves if “Google makes us stupid” and we write books like *Distracted* (Jackson, 2008) and *The dumbest generation* (Bauerlein, 2009) which discuss the possible negative consequences of the new technologies on the minds of those who use them. This is a topic which deserves to be discussed more deeply and in greater detail, and here we just want to mention the role that schools should have in dealing with this problem. Schools should not only realize the potential advantages that the new technologies offer for learning but they should also contribute to the development of digital technologies which have positive and not negative consequences on the minds of those who use them, especially because we are dealing with children and teenagers whose mind is forming within the “new ecology”.

The second positive consequence of the introduction of the new digital technologies in schools is that they could attract the students back into the school system. We have already said that today students experience school as something extraneous, or rather as something that they simply do not see. This is not due only to the fact that schools ignore the new digital technologies that have such an important role in the life and in the world of today’s children and teenagers. It is also due to the extreme individualism of today’s societies, which tends to remove any external constraint and any “authority” that limits individual freedom. And schools are a system of constraints and “authority” for their students. But today’s children and teenagers no longer accept to learn from parents, teachers and, more generally, adults. To introduce technologies which replace teachers with technological learning systems would make it possible to get round the problem. Teachers would no longer appear as the source of all knowledge and learning would be closer to the ways of communicating and interacting used by the students outside school. Perhaps then schools would



seem less extraneous to the students than they do now.

The third positive consequence of a school in which students learn by using the new technologies is that such a school could aspire to be a good school for all students, a good school for all the members of the society, since a school which has been created for an elite has become a bad school for everyone. The new digital technologies are flexible learning tools and they can make it “possible for mass education and education adapted to personal needs to coexist” (Bottani, 1986).

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