ICT in Education: Challenges for the Curriculum

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Abstract

New information and communication technologies, the Internet in particular, are forcing changes upon our ways of being and thinking. Such changes, in contemporary society, create a dilemma for the education system that seems unable to respond appropriately.

In this paper we suggest a new perspective of education, emphasising curriculum transformation as a means of adapting more appropriately to the new world. We propose the concept of curriculum as hypertext and we describe the main characteristics of such a curriculum.

We argue that, the complexity of the modern world, schools have to recover their role as a place where knowledge and culture are produced if they are to survive. We also briefly describe an attempt to incorporate these notions into a post-grad diploma course at two public universities in Bahia/Brazil.

Keywords: curriculum; ICT and education; Internet;

Surfing on the contemporary world

The development of a technological culture directly linked to the emergence of Information and Communication Technologies (ICT) has brought with it great changes in our way of being and thinking. These so-called intelligent technologies attempt to imitate the operations of the human mind. They belong to the domain of electronics which has given new powers to the productive world. We are witnessing the general informatization of the planet. Computers are everywhere and data digitalized.

Before exploring in more depth the implications of such developments for education, it is important to consider the distinction proposed by Manuel Castells between information society and informational society. According to Castells

The term information society emphasises the role of information in society. But (...) information, in its broadest sense, e.g. as communication of knowledge, has been critical in all societies, including medieval Europe which was culturally structured, and to some extend unified, around scholasticism, that is, by and large an intellectual framework (see Southern 1995)\(^1\). In contrast, the term informational indicates the attribute of a specific form of social organisation in which information generation, processing, and transmission become the

fundamental sources of productivity and power, because of new technological
conditions emerging in this historical period. (Castells, 1996, p. 21)

A new concept of space / time emerges alongside the traditional external world, itself
full of contradictions and social inequalities. Real and virtual worlds converge
enabling us to enjoy a new type of existential relationship and a new kind of
cognitive-affective operation.

In Nicholas Negroponte’s view, the technological moment consists of the passage
from atoms to bits. According to Negroponte, the world has become digital
(Negroponte, 1995). Electronics is causing the dematerialization of information,
which had been bound to the physical - books, disks, tapes - and is now transformed
into bits. The circulation of information is therefore enhanced considerably, as it is the
bit that is in movement. This small computer element is the currency of networks in
the exchange of information. The bit can travel using a variety of material supports
(cables, optic fibres) or using electromagnetic waves that drive these elements from a
particular place to satellites, and from there to another particular place thousands
of miles away.

The technological origins of these processes can be traced back to the seventeenth
century when Gottfried Leibniz according to Holtzman ‘developed breakthrough in
the architectures of the first calculating machines and proposed the idea of a machine
capable of reasoning’ (1994, p. 125). Since then progress in the area of
communication technology has been staggering. It is not only that information moves
ger faster, but also the production of that information has become greatly affected. The
infinite possibilities in the manipulation of data stored in huge databases gives rise to
new ways of seeing, listening and feeling. Steven Holtzman in a book entitled Digital
Mantras, analyses the language of abstract and virtual worlds, exploring the
relationship between art and information technologies and seeking to establish an
aesthetic foundation for the use of the computer in creative expression. Investigating
how the virtual world is being constructed, he says:

Today, ideas are often expressed as printed text on a page in books. In the future,
one can imagine jacking into a system, loading the appropriate software, and
thinking the ideas. Rather than trying to work through the thought process and
follow the complexity of the development of the ideas, one can experience the
thought process and think the development of the ideas.

The software of the future will be programs that run on your computer: your
mind. (Holtzman, 1994, p. 209)
Holtzman seeks to introduce a new way of thinking and we would go further to say that the generalisation of communication and information, a process involving dematerialization and speed, has deep implications on the nature of the process of production of knowledge. This also implies new modes of thought and social relations. Computers, according to Pierre Lèvy, are more than devices with stable identity. They, ‘are networks with interfaces open to unexpected connections, which transform radically its meaning and use’. (1993, p. 102)\(^2\). To Lèvy, ‘the main tendency in this domain is digitalisation, which reaches all communication and data techniques.’ (1993, p. 102)

This new way of thinking demonstrated by children’s interaction with machines can be analysed investigating the Internet as a potential element of the contemporary world. The underlying idea in this argument is the notion of electronic networks. These are based on open interfaces which connect systems from different spaces and cultures, thus creating not only a new global system but new set of systems. By their very nature they are unexpected, flexible, fast, dynamic and pervasive and are introducing numerous transformations into our lives. Personal computers can be connected and can interact among themselves ‘forming an interactive web that is capable of processing information, communicating, and making decisions in real time.’ (Castells, p. 247) We highlight the Internet because it has the potential to promote considerable developments in communication.

The Internet, which uses digital connections among computers located all over the globe, articulates communication among different peoples and promotes the coexistence of different cultures promoting global communication. This is particularly significant when one considers that, as the Italian philosopher Gianni Vattimo observes, a general proliferation of local world views and cultures is taking place, despite the intense concentration of mass media in a global scale. (Vattimo, 1989)

Global communication occurs through connection nodes, which potentially allow the construction of a transparent network with great interactivity as well as spontaneity. We consider this situation only potential because it is important to consider social conditions especially in terms of distribution of telecommunications resources and the elaboration of new policies which take into consideration the democratisation of communication.

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\(^2\) All quotations of Pierre Lèvy were translated into English by the authors.
Despite this, the presence of information and communication technologies (ICT) makes it imperative to adopt a new approach to the communication process through these technologies, aiming at a mental readjustment to incorporate new technical possibilities. It is in this sense that we consider, as Lèvy, the Internet to be intelligent technology.

Intelligent technologies appeared when material devices were made making it possible to imitate the reticular processes of human intelligence. The Internet can be said to be an intelligent technology because it is able to interfere in the way in which humans think. It is also responsible for the emergence of a new cognitive economy. It has a structure which imitates the workings of human cognition, both functioning like networks.

With regard to the influence of technology on our thought processes, Pierre Lèvy notes:

(...) We live today with a redistribution of the configuration of knowledge that was established in the seventeenth century with the generalisation of printing. Intellectual technologies, by undoing and remaking the cognitive ecologies, contribute to derive the cultural foundations that command our apprehension of the real (1993, p. 22)

Lèvy makes a parallel between technology and human cognition using a key concept to clarify the nature of the new technologies: the metaphor of the hypertext.

Given its imitation of human cognition, intelligent technology is hypertext because it consists of a new form of artificial management of information.

Intelligent technology presupposes a hypertextual structure. It too uses networks and consists according to Lèvy, of a group of nodes linked by connections. All elements of the system (words, pages, images, graphs or parts of them, sound sequences, complex documents) are connected. According to Lèvy, ‘the information items are not linked in a linear way, as in a rope with nodes, but each one of them, or most of them, extends its connections like a star, in a reticular form. Therefore, to navigate into hypertext means to draw a trajectory in a network that can be as complex as possible. Each node can, in its turn, contain a whole net.’ (1993, p. 33)

In this sense networks are like human minds because they operate by means of complex association. To approach the subject of new technologies adequately, implies to overcome traditional visions of technology and the dichotomy between humans and machines, culture and technology. Particularly with respect education, it is necessary to examine these concepts of technology which form the basis of recent projects in the
field of education. It is also necessary to discuss the formation of professionals involved with this.

A new understanding of the role of ICT demands transformations in pedagogical practices in the education system. The novelty of these technologies for education resides in the fact that recent technological and scientific development involves the breaking of organisational patterns and social norms, as well as models representing this reality which are embedded in another kind of interaction. No longer linear interactions but non-linear interactions where proportions between cause and effects are unpredictable. Therefore the presence of these technologies in society and consequently in schools should not be seen as the introduction of modern tools for old educational practices, nor as complicator to teaching practices instead presenting new challenges to the learning process.

At this point, it might be useful to recall Holtzman’s previously mentioned study on the integration of computers into the creative process in art, music and philosophy. He concludes that computers indeed introduce substantial change in the concept of art itself. Computers themselves become creators (Holtzman, 1994). He quotes a contemporary German composer of electronic music, Gottfried Michael Koenig who said that computers may create obstacles to creativity. Holtzman writes: ‘nor does the computer have to be thought of as a tool to make familiar things easier. It can also be thought of as making a given approach to creativity possible. It may at the same time present new challenges and new obstacles to creativity. In fact, Koenig believes that obstacles are an essential part of the creative process.’ (1994, p. 219). Similarly, computers do not necessarily enter education as facilitators, tools or teaching aids. Instead they introduce challenges, new possibilities and as such new complicating factors for the learning experience.

**Curriculum as Hypertext**

Among the aspects to be transformed in education is the curriculum. This requires us to redimension the concept of curriculum itself, as well as the way in which its development is conceived. We suggest the conception of a new curriculum embedded in hypertextual logic, curriculum as hypertext.

In hypertextual logic, the curriculum assumes the function of an interface becoming a strategic element for a thorough mobilisation of those involved with knowledge

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3 We are using the word formation as development as opposed to training.
production and diffusion. More precisely, the curriculum does not have to be exclusively concerned with rational development based on abstract thought. It should aim at integrating, among others, reason, emotion and intuition articulating subjectivity and objectivity, leisure and work.

On the other hand, the concept of curriculum as interface heightens its commitment with interactivity. The curriculum becomes a strategic medium for the collective production of knowledge. In this sense, the organisation of pedagogical materials need not be in a linear, generally vertical fashion, but instead organised as multi-referential spaces of learning, where multiple treatments are possible and results differ according the agents acting upon them. This makes for as curriculum which is flexible, agile, dynamic, interactive, heterogeneous, simultaneous, belonging to collective thought, satisfying the demands of the school community and society in general.

In a multi-referential and hypertextual perspective, the different moments and spaces of socialisation and sociability bring about multiple learning possibilities and ways to construct knowledge. This leads us to think of education beyond the positivist matrix that gave rise to the curriculum organised in disciplines.4

To make the curriculum become a mechanism for promotion of collective thinking demands redimensioning the relationship between different branches of knowledge, namely, between the different disciplines of a course, overcoming hierarchical arrangements that value certain disciplines to the detriment of others. This involves rethinking even the dichotomy between formal and informal education, so that all forms of knowledge and learning can be integrated making the learning process able to mobilise the individual in a more complete way. The result is a combination of a more intellectual and professional education with an education that may include subjective issues and different forms of thinking.

Instead of the separation of subjects typical of a traditional curriculum structure, the curriculum is driven in the direction of a simultaneous multidimensional articulation of subjects, without a pre-established structure. The term discipline or subject is relativised.

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4 This is based upon an idea proposed by Teresinha Fróes Burnhant, during a meeting of PROINFO (Project supported by Brazilian Government the goal of which is to introduce computers in public schools), Salvador/BA, 13.11.98.
The curriculum has to evolve along with, and adjust to, the priorities of the school and community. For this reason we have taken from Burnhant the idea of *curriculum as a multi-referential space of learning*. Multi-referentiality means that the object is open to multiple treatments, not only because of its characteristic but also as a result of the different ways that agents act upon it. Each approach, each reference poses a limit for another. This is why we talk about multi-referentiality and not complementarity. The notion of supposed transparency does not belong here.

In this perspective, there is no presupposed transparency, nor the possibility of a complete and thus higher knowledge. One has to consider that a certain vacuum is necessary. No one point of view is necessarily better than others. No point of view can be reduced or eclipsed by any other.

For Pierre Lèvy, knowledge has become the infrastructure of contemporary world. Hence the democratisation of society is connected to the issue of the production of knowledge. He proposes to use new technologies in the collective production of knowledge, as a network articulating different modes of thought in constant negotiation and constant exchange, according to circumstantial demands. In this process, there is no knowledge more important than any other. All fulfil a specific social function and articulate with the others in a multi-referential way.

The qualitative change arising from the introduction of ICT allows intense political, cultural and intellectual exchange without having a central cause or axis orienting the whole process. This will be as rich and complex as human individuals and collectivities are.

Learning is similarly seen as an open, flexible phenomenon, not limited to previously established contents, as are the disciplines in a traditional curriculum.

We wish to emphasise the importance of the integration of areas of interest to students, teachers and researchers, contemplating the variety of points of view on the various subjects. This will increase the heterogeneity of the group, and makes a collective path possible, which takes into account the differences within the group. The communication network is a structural element in this process, in a kind of *dance in progress* (Capra) as a performance, that starts with a plan, but can be increased and transformed during the process.

An attempt to put our theoretical reflections into practice is a post-grad diploma course in **ICT and Education**. It involves several professionals of the State of Bahia
University (UNEB) and the Federal University of Bahia (UFBA). The first group started the course in August 1998.

The curriculum and the course as a whole are conceived as part of a *dance in progress*. The course has as its core the idea of *knowledge windows*, which are activated according to each person or groups’ interest. In this way they can follow their own route, creating a conceptual base which permeates the course and is negotiated throughout. That is to say, determining collectively the following steps as the course develops.

Each course takes on a specific theme and the group opens the *windows* related to their interests, as they emerge. Throughout the process the subject will be investigated over and over in a spiral manner. In each stage the subject will be approached from a specific point of view.

The hypertext has, therefore, its own dynamics, mediating and oscillating between the individual and the group and other groups, between face to face and distance contact, between formal and informal contact.

The work starts with groups of activities called *nodes*, created by the dynamics around the *knowledge windows*. These *nodes* have inter and intra blocks connecting them to external world, making them a genuine hypertext working by open and complex associations. The path followed by each student, although it is initially pre-designed, can be changed during the process. This is determined by each individual trajectory, as well as by the group interaction.

The *knowledge windows* constitute moments of reflection and opportunities to share experiences and meet others involved in the same process. The spaces between the *nodes* and *windows* will be filled with action and study, interactive, either face to face or at distance. The process as a whole is based upon day to day school life and its relationship with society, with *the school becoming an authentic true space to promote the production of knowledge and culture*.

A physical network is necessary to develop *the hypertext* and *total interactivity*. Without this it is impossible to make the qualitative jump. The new order (disorder) is only possible with digital technology and the generalisation of information and communication.
To undertake the proposal of developing a curriculum as hypertext is not simply to modify a paradigm or to substitute one paradigm by another. It is instead to render paradigms needless. We are proposing a new role for schools and for educators, changing the axes of the educational process. The educators' responsibilities increase considerably in this new scheme. They re-assume the role of transforming school and education, not as guides or providers of knowledge and information but as educational leaders, therefore political leaders, with the task of revaluing local cultures that are increasingly being made available by the new technology. In this way we might be able to prepare citizens who are able to deal adequately with their own heterogeneity and construct a better world.
Bibliography


