The Technological Barrier Issue in Design of Learning Resources

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Abstract

The irruption of technology in educational processes has introduced several questions or problematic situations closely connected to the displacement that some people undergo in their professional role due to the pressure of the new technologies. We think the design and production of quality electronic educational resources implies recovering the creative capability of educators, by means of author tools that enable them to co-exist with this technological revolution without being exiled by it. This article presents this real problem and gives some guidelines to tackle this problem based on the author's experiences in the Laboratory of Multimedia Educational Design and Tele-Education at the Educational Sciences Institute of the University of Salamanca (Spain).

Keywords

Technological barriers; Information and communications technologies in educational context; Digital learning resources.

Resumen

La irrupción de la tecnología en los procesos educativos ha introducido varios interrogantes o situaciones problemáticas muy próximas al desplazamiento que sufren muchas

personas en su rol profesional debido a la presión ejercida por el avance de las nuevas tecnologías. Desde este artículo los autores pensamos que la producción de recursos digitales educativos de calidad conlleva la necesaria recuperación de la capacidad creativa de los autores, educadores en este caso, lo cual implica la creación de herramientas de autor adecuadas que les facilite su coexistencia con la revolución tecnológica que se está viviendo hoy en día, en lugar de apartarse de esta corriente irreversible. De esta manera este artículo se centra en este problema real, ofreciendo algunas guías para abordarlo que se basan en las experiencias personales de los autores después de trabajar varios años en proyectos educativos llevados a cabo en el Laboratorio de Diseños Educativos Multimedia y Teleeducación sito en el Instituto Universitario de Ciencias de la Educación (IUCE) de la Universidad de Salamanca en España.

Palabras clave

Barreras tecnológicas; Tecnologías de la información y de la comunicación en contextos educativos; Recursos educativos digitales.

1. Introduction

The introduction of the Information and Communications Technologies (ICT) as an instrument and context of communication has led to a great potential which reaches almost every element in our society. However, this irruption of technology introduces several questions or problematic situations closely connected to the displacement that some people undergo in their professional role due to the pressure of the new technologies.

This situation is not new in the history. A clear example was the introduction of writing that caused a "generational fracture" between those who wrote and those who did not. The effects of this fracture gradually became evident over the centuries, until the problem of illiteracy became a major social problem. The ICT have created a new generational fracture. Negroponte (1995) expresses this clearly: *the true cultural division is going to be generational*. When in our surroundings a group of adults is discussing the computerised society, it is most likely that they have children at home who use computers or handle computer interfaces with surprising skill.

Here the generational fracture has ramifications, since underlying informational communication there is not merely a technique, but a "theory" and a "technology". This generational fracture is not only a reference to a life cycle, although it is also that. The cycle combining childhood with education and adulthood with occupation is definitively broken. Life-long education and the adult as a genuine subject of education has become the norm, with greater intensity in the more developed countries. The break is also professional; generations can be divided as being before or after ITC. It is not merely a process of functional differentiation; it also entails a process of functional "disqualification", of the potential loss, very often real, of the condition of actor in a large number of occupational sectors. The masters of the communication networks appear, the owners of the technologies, the owners of the programs, those who possess

the complexity of knowledge and skills necessary for the creation of cultural resources in the communicational space defined by the ICT.

Years ago this same kind of fracture gave us the term *functional illiteracy* when literacy was incomplete, when although possessing the technical instruments for reading and writing, the cultural use of them was incomplete and did not allow the person to enjoy and use the basic core of cultural wealth (basic culture), either in the cultural-scientific or the professional sphere. Both social participation and professional practice require this incorporation of basic cultural wealth, because the democratic states found the practice of citizenship on great transfers of agreed upon information and professional practice requires huge and continuous amounts of information on instrumental and technical designs. Nowadays, nobody doubts that maintaining one's professional occupation and incorporation into the new professions require a constant recycling of one's education.

This state of things fosters the appearance of new kinds of marginalization and disqualification, which were analogously present in the illiterate condition in literate cultures: how can one continue to be an actor in the Information Society?

This article is focuses to answer this last question. Thus, the rest of the article is organized as follows: in section two the intersubjective nature of the term "culture" is established. The next section studies the nature of the educational materials. One of the factors that clearly introduced distance into learning processes was the appearance of writing, a situation that could be compared to the current entry of computers and communication networks, in the sense of the situation of rupture they have entailed in society; thus, in section four these effects are studied and made manifest. Section five deals with the educational process in the Information Society. Finally, section seven concludes the article.

2. Intersubjetivity and communication

The colloquial concept of culture refers, above all, to its objective aspects. Herodotus, without using the term "culture", in order to explain the hostile nature of the relations between the Greeks and Persians, sought the origins of this situation and travelled to more than fifty different cultural communities, recording tales about their origins, showing the differential natures of their religion, artistic manifestations and practices of daily life (Cole, 1996). Along the same line we find Samuel Baron von Pufendorf (1632-1694) who used the term "culture" to refer to the state of things proper to social life and included in the concept human discoveries and constructions, tasks and way of life, institutions for aid and assistance within social life. The most traditional definitions of the anthropologists are situated along the same line.

However, the concept of *cultural asset* refers to two elements: an objective element with a *material medium* (objects, constructions, sounds, words, books or telematic platforms…) and to another symbolic element or element of meanings and value recognized by a person or group. Both elements are inseparable (Cassirer, 1951, p. 68). Meaning is only established, i.e., takes on a social form, when it is recognized by the group and acquires *use value* when it is incorporated-enjoyed by the subject. Hence, one of the features of all cultures consists of the *criteria and procedures of distribution of cultural assets* and of processes by which culture becomes accessible. Among these criteria in many cultures it is seen that, for example, the sex variable (culture of men and of women) or the age variable have worked as distribution criteria. The revision of the legitimacy of these criteria and their confrontation with personal and collective aspirations is a permanent objective for *cultural criticism* and the foundation of the non-discriminator principle of culture for all.

Hence, the term "culture", besides having an objective nature, also necessarily has an

intersubjective feature. To be exact, the Latin word "*cultura*" designated "cultivation" (land, trees, animals…) and, by extension, the "care" of something. It seems that the first time the word culture was used metaphorically, in an educational sense, was in Cicero's "Disputaciones Tusculanas" (106-43 a.C.), where it is affirmed that "philosophy is the culture of the soul" (Ad, II,5,13: "*Cultura animi philosophia est*"), because, through it man reaches the ideal of humanity, our truly human condition.

3. The materials with which the mind operates in culture

The materials the mind works with arrive first through the channel of communicative action. In this process of communication, above all, the body, bodily expression and language are involved. From their integration there arise not only the declarative utterances susceptible to truth and falsehood, but also the set of different categories of "speech" acts. Not only do we utter, but also by communicating, we "do" many other things: convince, insult, bequeath, pray… In this communicative environment, the main process is conversation. From this perspective, culture appears as a system of conversations and cultural confrontation reflects that it is a "closed" system of conversations. It leads to understanding inside it and promotes a lack of understanding towards the outside.

Within interpersonal communication, within the intersubjective situation is where all cultural tradition and the whole stream of cultural assets and services gain meaning (Cole, 1996). Hence, the enormous importance in pedagogical work of *building the scenario and the suitable context* from which the learning project takes on meaning. This approach brings face to face two pedagogical, often uncompromising, perspectives: that of those who think that the main part of the teaching process is knowledge of the subject and that of those who think that the main thing is the stage constructed. The activity of knowledge production has two facets: that referring to

the creation of knowledge and that referring to the ability to spread knowledge. The mind works from the content of knowledge and from the "communicational artifices" for knowledge.

Since Vigotsky (1978) we have been used to calling the objective components of culture *tools of thought*, because within the intersubjective area, the social sphere, the area of construction of knowledge… changes from the "store of experience" into instruments for generating knowledge.

Since the introduction of the expression *homo faber* we have become used to understanding technical activity as the most characteristic skill of human beings. The epistemology of techniques took the *artefact* as its main point of reference. In this article we defend the need to broaden the notion to that of *artifice*. If this change in perspective is not made it becomes impossible to note the wealth of communicational artifices that conversation sets in motion, we lose sight of the importance of the literary artifices through which new forms of thought became possible as a consequence of the introduction of writing, and we will not see the importance of working on the artifices of information to develop the forming of thought in the Information Society. If this is not included, the philosophy of techniques will find it difficult to intersect with the primary objective of culture as a system of the systems for forming human beings. Rarely does the philosophy of technology incorporate into its horizon the web of artifices that were generated in history for the "transmission", incorporation (Vigotsky, 1978), and assimilation (Piaget, 1970) of cultural contexts.

Human instrumental action produces objective modifications in the human world as a consequence of activity addressed to achieving goals. Among these goals, there are also those of training and those of facilitating access to knowledge. We include all this in the general concept of Pedagogy. This is the approach that legitimises the use of terms such as *narrative artifice* or

curricular design. In their design these artefacts-artifices for teaching contain resources for human mental activity, a form for thought. The objectives of education are formulated verbally, but, above all, they take form in the artificial materiality of the design that holds them: these instrumental designs are at the same time material products and mental products, matter and idea.

Reflection on educational action completes reflection on cultural resources in the sense that the intersubjective processes that characterize social life act as mediators of the process of subjective appropriation of culture. On doing so, they show all the facets of the cultural resource: 1) its materiality as a product of an action in the world of culture; 2) its mental contents as regards design; 3) its quality as an artifice expressing knowledge; 4) its value as a socially shared resource. The first facet is the medium, and the others are the significance of each of the cultural resources.

4. The importance of writing

Writing is usually described by taking into consideration its nature of instrument at the *service of symbolic communication*. This means highlighting, above all, its subordination to the spoken word, as is shown in the operation of reading: writing as the mere transcription (Saussure, 1952) of speech. Writing shows many aspects of dependence on the word, especially in cases of syllabic and consonantal writing. But it has many other aspects where the graphic expressions work as a complex scheme, comparable to the phenomenon of speech, but different: as *another way of speaking*, a field of symbolic production (Cardona, 1994) created by man. With writing some authors consider that a new mental area was born, a new ecosystem for thought, which marks the subject in such a way that it makes it impossible for him to return to his oral past (Illich, 1991); they value writing as "a tool superior to speech", because it makes expression more public, more accessible to more people, it makes meaning more reconstructable.

Apart from exaggerations and evaluations, writing would represent a second milestone, the one that follows the word in the cultural evolution of humanity (Havelock, 1963). Perhaps the most influential exaltation of reading-writing is the one made by M. MacLuhan (1962) in his work "The Gutenberg Galaxy", where he affirms that the form and meaning of Western man was constructed from the integration of a sound without meaning and a graphic sign without meaning. In this case, we are considering its aspect of techniques and artifice. Thus, Olson (1994) calls written productions "literary artifacts".

Some authors think that the cultural changes associated with the changes in the communication media contribute to the transforming of social and institutional practices; cognitive practices are maintained almost constant because they are specific. Others believe they can demonstrate that these cultural changes are linked to psychological changes, of representation, of growth of rationality and of forms of conscience (e.g. Olson and Goody). That is, besides being a new *mnemonic register* (previous ones, among others, were the word and the rite) writing involves a new *epistemic function*: the very structure of the activity of knowledge was affected; hence it is understood to constitute a decisive factor in the appearance and development of science. All coincide notably in the conviction that "a written system is a visual phenomenon at the same time that it is a set of cognitive skills" (Bennett & Berry, 1991). The main problem is to identify the mechanism by which the transformations attributed to written culture are produced.

Goody (1986) indicated that in at least three general spheres of cognitive processes there is substantial, although not systematic, evidence of effects deriving from writing: the extraction and organization of information, the forming of behavior plans and the elaboration of general theories. The progressive dominance of information mediated by writing modifies the system of

social relations and roles, for example, the social role of the elderly and the formative role of the family. It creates an unbreakable tie between school and writing, foments the predominance of the visual channel of information over the auditory channel (the argument of having read it) and the role of the textual quotation as an argument, the verification of content by text, the reorganization of the information in the content, the increase in the visibility of the classifications, the growth of the timeless dimension of language, a deepening of the hierarchical nature of the meanings and sequence of argument, a predominance of memory by packets of meaning versus word for word memorization, an increase in the role of mechanical memory of content imposed by the fixed nature of the school text, separation of the roles of cultural transmission (composer-interpreter, playwright-actor, author-editor…).

Writing introduced *new forms of communicational distance* associated with the fostering of knowledge. The book is an artifact of distance communication full of literary artifices in agreement with it, through which it becomes possible for the medium to move with the knowledge, eliminating the need for presence between the communicators. Moving the medium solves cultural communication. In order to make learning possible a new competence is thus required: to know how to read. Writing modified the field of human opportunities and opened a new order of *initiatives* to be taken. Reading and writing historically establish a value of humanity and set a technical objective of education and an objective of technical education.

From these studies it is derived that reading-writing is not mere instrumental learning, but rather the incorporation to the system of resources (beyond mere transcription) which are provided by writing with a view to a whole set of personal and social tasks; these resources evolve in co-derivation with the learning of the skills for exploiting them according to highly diverse social and cultural goals. The complex resources of the reading-writing system and the

skills developed for using it in action provide the higher mental functions with new qualities of operation. It cannot, however, be affirmed that all this entails a change in the structure of the mind.

5. Educational Process in the Information Society

The perspective we have applied to the analysis of educational communication in oral and reading-writing contexts is now being extended by many authors to the study of the pedagogical applications of the ICT: *technopoly* (Postman, 1993), *telepolis* (Echeverría, 1994), *telepolitas* (Echeverría, 1995).

All human society and all culture are established within the flow of information. Culture is a functional system that operates from information and produces information (Mosterin, 1994). The introduction of a new system of communication, not a new language, or a new system of gestures or body movements, but rather the invention of a communicational artifice with the direct intention of expanding the properties of the biologically arranged human system of communication, will entail the recomposition of a whole stratum of the system of interactions in the area of knowledge building, to be exact, the most public one. The recomposition will bring in its wake a reorganisation of the social structure, of the organisational possibilities of the social fabric and evidently a generational fracture because it situates the adult generation face to face with the new ways of informational dependence generated by the intruder. To paraphrase the thought of Castells (1998, p. 86), this new cultural paradigm is characterized by the following:

- Information radicalizes its nature as a raw material; the technologies that act on information dominate versus information that operated on technological development.
- Technological mediation interferes in the globally of the action of the social

system.

- Deepening of an *on net logic* of the applications, reticular morphology of the places of activity they promote, overcoming spatial restrictions.
- Deep changes in the categories from which we think all the processes of human practice, introducing the categories of complexity, as a new way of considering diversity, and the creation of places of information of shared activity.

The basic process of development of all this technology is still that of separating the construction and analysis of the sign from the meaning it carries. The immediate consequence is the separation between "digitalized textuality" and the experience of its "reading through a given programme". There has always been an integrated, but parallel, development between the interfaces of the medium and the evolution in complexity of the communicational content. But in the case of the ICT there is a considerable difference from the other communicational systems referred to before. In the ICT content a mathematical theory is constructed which makes it possible to translate the representation of any reality (visual, auditory, iconic or models of dynamic systems) to a binary numerical code (digitalize); the equivalence between the logic of this theory and the properties of circuit commutation allows the construction of electronic tools that act as a medium for the identification, storing and processing of the signs of a communication system.

But the question is: how we can deal with the achieving of the adequate conditions to develop high-quality educational resources for the ICT environments?

Generally one begins by indicating that the first condition refers to equipment. Our work experience in the Laboratory of Multimedia Educational Design and Tele-Education at the Educational Sciences Institute at the University of Salamanca has convinced us that the first

problems to be overcome have more to do with social intelligence than with technical capability.

The creation of teams for activating processes for the production of educational resources is becoming essential. Increasing the technical capabilities (i.e., capacity of the network, speed of calculation, storage capacity and so on), is simply increasing the potential capacity of the quality of action that can be carried out within the possibilities of the technical system. The objective is once again to reuse the available human resources to reconstruct the educational functions made possible since the new system of communication was introduced into the context. This requires a capacity for integrating the knowledge from communication and software engineers and from the accumulated experience and relational skills.

The value of the symbolic content is not constructed by the ICT. The new materials produced by "e-authors = interdisciplinary teams" are becoming more and more necessary. The speculative changeability of ICT enterprises has meant that, for some, the objective is the production of educational resources that could invade the market. The main objective is not economic but rather that of not squandering human resources that the new ICT context marginalizes that of recovering the author capacity disqualified by the very nature of the ICT context. A priority objective in educational institutions is the creation of "e-author-interdisciplinary teams" with the intention of recovering the capability of creation in the new area. We are aware of the difficulty entailed in the creation of these teams and the production of these materials, since we have been involved in starting them up. In the future it ought not to be possible to have an education faculty or teacher training center without the existence and activity of a laboratory for the design and production of educational resources that could be applied both to pure distance learning and to reinforcing traditional teaching activities.

At present the production of resources is linked to the use of ICT, regardless of whether

they are produced for distance or presential learning activities. It is a gross error to associate the ICT with distance education. ICT are not instruments for distance learning, but rather instruments for collecting, elaborating, storing and distributing information.

From the point of view of education, the most pressing concern is the production of educational contents, contents which, given the current situation of the knowledge building area created by the ICT, as yet do not have such a defined, clear, diversified and recognisable market as the book. Furthermore, the ICT are creating author tools that allow the construction of educational contents, but the complexity of handling them removes the condition of author from most educational agents. We find that the main problem of an educational policy is once again teacher training in the new information context: the education of educators. The priority is not to train them in the use of sophisticated computer tools. The plan for teacher training should correspond with the project of action in which they will be involved. Also, teacher training should be diversified, personalized, permanent and situated in a context where ICT can be taken advantage of, within which they are asked to be educational agencies. We must recover local and regional initiatives for pedagogical renewal.

6. Conclusions

This article gives a series of reflections that the authors have made taking as a basis their experience in the development of author and utility software, as well as educational contents, all applied to virtual education areas, in the Laboratory of Multimedia Educational Design and Tele-Education at the Educational Sciences Institute of the University of Salamanca.

First, it gives the diverse determinants that must be taken into account when creating teaching material, where social intelligence for the forming of interdisciplinary teams is an aspect with at least as much relevance as being up to date with the latest technological trends.

Moreover, and in the authors' opinion, the creation of educational contents or resources using the ICT is not limited to distance learning, and should be taken advantage of both in distance educational processes and as reinforcement in the traditional or presential educational processes. The context that the Internet and especially the Web offer us is suitable for exploiting this potential.

One of the major concerns of our work group is the barrier that the ICT impose on many teachers, who find themselves technologically ostracized and excluded from current educational processes. Our intention is to recover them as authors of educational resources, creating tools made to suit them rather than computer and communications experts, with easy to use and integrating pedagogically designed interfaces.

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