



## **Sustained development and educational technology: promoting elements of socio-educational changes**

Desenvolvimento sustentado e tecnologia educativa: elementos dinami-  
zadores de modificações socioeducativas

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### **Abstract**

The continuous development of ICT (information and communication technologies) produce, as it happens in other areas of activity, its connection with education, emerging the action field of educational technology, as a training area, becoming indispensable to carry out a continuous reflection and conceptualization about it, based on their development over time and the social influences associated. Taking into account the multiple socio-educational impacts generated by educational technology, always based on their main theoretical and conceptual propositions, indispensably connected to basic elements in this area, such as the representations that arise from the combination of concepts as education, didactics and technology, it is essential to address, similarly, an urgent need nowadays, based in technological literacy, critical to achieving a full integration of technologies in society and education, allowing to achieve all relevance

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in these areas today. Looking ahead the applicability of ICT as tools in education, encompassing its potential to create spaces and contexts of teaching-learning and all contributions they can provide to increase the effectiveness of training processes, is worth detach the relevance of integrate educational technology as a key element of sustainable development strategies, representing an essential feature for optimization and enhancement training, for individuals, groups and communities.

**Keywords:** Educational technology. Training. Sustainable development. Literacy. Social change.

### **Resumo**

*O contínuo desenvolvimento das Tecnologias da Informação e da Comunicação (TICs) conduz, como em outras áreas de atividade, à sua interligação com a educação, emergindo o campo de ação da tecnologia educativa. Como espaço de caráter formativo, torna-se indispensável efetuar uma persistente conceitualização consubstanciada na reflexão sobre a temática, no seu desenvolvimento ao longo do tempo e nas influências sociais associadas a ela. Considerando os múltiplos impactos de caráter socioeducativo fomentados pela tecnologia educativa, tendo sempre por base os seus principais pressupostos teóricos e conceituais, imprescindivelmente conectados a elementos basilares da área, como é o caso das representações que nos oferecem a conjugação dos conceitos de educação, didática e tecnologia, revela-se fundamental abordar, de igual forma, uma necessidade cotidiana premente, que surge enquadrada no espaço da literacia e da alfabetização tecnológica, essencial à plena consecução de uma integração social e educativa das tecnologias, permitindo abarcar toda a relevância nessas áreas na atualidade. Do ponto de vista da aplicabilidade das TICs como ferramentas educativas, englobando o seu potencial criador de espaços e contextos de ensino-aprendizagem e toda a contribuição que poderão facultar para incrementar a eficácia dos processos formativos, importa destacar a pertinência da integração da tecnologia educativa como elemento-chave de estratégias de desenvolvimento sustentado, representando um elemento fundamental para a otimização e potenciação formativa, no nível dos indivíduos, grupos e comunidades.*

**Palavras-chave:** Tecnologia educativa. Formação. Desenvolvimento sustentado. Literacia. Mudança social.

## Introduction

The role of technologies in social, cultural and educational daily life arises without us being consciously aware of its importance except when for some reason they fail leaving us without access to the services they facilitate. As such, the fact cannot be questioned that “today, machines more similar to living beings populate our desks, the science of computing uses biological concepts and human biology is reformulated in terms of deciphering a code” (TURKLE, 1997, p. 37). In the case of educational technology, besides the understanding of its historical evolution and the main concepts to which it is associated, the analysis and reflection relative to its foundations, namely processes and conceptual principles, constitute an essential element towards understanding the educational procedures developed involving its use, also contributing towards better education, the production of pedagogic materials and the development of strategic models more adequate to present educational contexts.

The principles which traditionally supported educational technology have evolved and adapted. Yet, on facing the need for new foundations there is lack of a paradigmatic evolution that might incorporate the knowledge offered by theoretical support models, aiming at a continual and substantial restructuring in response to technical-scientific developments which continually arise and to the fundamental need of permanent response to emerging educational needs (SALINAS, 2007). This concept has embraced an integrating, alive, polysemic, contradictory and significant perspective by the importance taken by the transformations it has been involved in and the different ways it has been perceived, characteristics which arise from the fact that various scientific trends are integrated, from physics and engineering to psychology and pedagogy, besides the theories of communication.

The developments occurred as a result of advances made in its foundational sciences along with the different senses it has been assigned, dictated by the cultural, social and scientific context in which

it operates, end up contributing to its consolidation as an ever wider field of study as a result of its integration into more comprehensive lines of intervention, alongside the growth of its importance which is evident in the attention it raises and in its increasing daily implementation (CABERO, 2007). The sustainable technological development, which motivates the assertions made, covers a wider field, the educational field and society itself, as an area of contemporary existence in which the preponderance of the economy market, associated with the influences of political powers and corporate logic, tend to redesign the educational system and the training strategies.

Being at present open to critical thinking regarding the effective radicalism of the implication of technology in education, even though the impact is greater than expected, some critics argue that it can reinforce phenomena related to educational inequality, technological poverty being associated with other needs which have a negative impact on educational contexts, besides the lack of aid often found in many teaching institutions, in financial, patrimonial and human terms.

### **Conceptual bases of educational technology**

The expression technological education is often associated to the use of Technologies in education. Although it is legitimate to establish a link between educational technology and the need for teaching tools in the 60s of the 20<sup>th</sup> century, audiovisual development in the following 70s, and the computer from the 80s onwards, it is important to adopt a vision less centred on material resources, which includes the increase of technologies employed and the need to apply scientific principles to education. This perspective is rooted in a systemic vision, with a view to assuring a rational analysis of the teaching-learning process, based on a perspective which adds value not only to the results obtained but also to the way these are obtained, this being the context where a rational use emerges, simultaneously supported in practice and reflection

on educational technology, leading to the production of new knowledge and skills in this field (DEPOVER, 2009).

One of the main driving forces of educational technology, as we see it today, was created within what may be called the technological paradigm of education, based on the external aspects of educational interaction, to the detriment of global aspects and full value of education, pointing to the improvement of teaching methods, especially those which focus on the use of technical equipment to resolve educational problems, comprising two intermingled conceptual streams (PEREIRA, 1995):

- a) a) *Systemic theories*: reinforcing the analysis of training processes through the general systems theory, paying special attention to planning procedures;
- b) b) *Media theories*: highlighting interactivity, computer programs, multimedia solutions, as well as their combination and integrated functioning.

Salinas (2007) establishes how educational technology is influenced by elements from other scientific areas which contribute to reach its objectives, establishing three extensive basic sources: psychology (theory of learning/other cognitive aspects); the general systems theory; the sciences of information and communication. With regard to the psychology field, it is noted that, initially, educational technology was not based on a general theory of learning but on a behavioural vision, which can be found in Skinner's perspectives, according to which the educational processes would directly lead to concrete objectives.

Although the main theoretical and practical support for educational technology arose from the learning theories proposed by the behavioural sciences, other contributions appeared from other fields of knowledge. Since behaviourism has not enjoyed unanimity in the educational field, for insufficiency of explanations for more complex learning, other theories arose seeking to outline the learning processes, of which

we highlight the cognitive theories of learning, as a dominant paradigm in this field, the adoption of which does not signify the preliminary rejection of the previous theoretic principles, but rather the predominance of conceptions of a constructivist and media nature.

As their main aspects, these theories have peer interaction and the social construction of knowledge which results, at the level of educational technology, in a more exhaustive and rational use of human and technological resources, leading to a model of real commitment between the constructivist elements of learning and the media and systemic elements of teaching. "The cognitivist theories are concerned with the control that the subject has on mental processes" (DAMÁSIO, 2007, p. 126), therefore, cognitivist educational models are less structured, promoting the use of individual cognitive competences, as well as the dynamic interaction among all the individuals involved in activities targeted at solving problems, increasing creative attitudes, and cooperation.

Present desire to understand this field through a systemic approach represents a certain independence regarding ongoing technological developments, not having a global reinvention as a priority every time a new technology enters the field of education, but rather focusing on its presence in this field through a solid body of structured knowledge where technological developments are dealt with in an integrated way. Thus, the search for notoriety by those who use these technologies can purely and simply be avoided, mainly favouring and valuing the continuity and quality of educational practices by those who apply them as a tool for educational and social development (DEPOVER, 2009).

Considering the theory of communication, an aspect which appears to generate certain unanimity is the admission that educational technology is intimately linked with the media. Initially the focus was more on two aspects: the technological development of the *media* and the perception of their integration in the educational processes. This development is often overlooked if you take the psychological theories as a basis. However, this scenario has been changing with recent contributions from sociology, communication psychology and

communication science, in general. The application of communication analysis from a practice-based technological perspective makes it possible to improve the understanding of the educational phenomenon. However, despite the systemizing role that the communication model may play in terms of the teaching-learning process, the communication paradigm does not exclude other formal models of analysis of the educational reality. However, the contribution of the communication field is decisive, not only in the communication analysis of the educational processes, but also in the application of new communication technologies in educational settings (SALINAS, 2007).

This perspective is found within the social theories eminently directed towards the analysis of the learning contexts and the relevance of collective experience in the construction of knowledge, deepening the active development of knowledge communities supported by learning contexts, situations and interactions, on a cognitivist basis, whereby it is the function of the *media* to make it possible to effectively consolidate knowledge and promote interaction and communication among individuals (DAMÁSIO, 2007).

Kelley and Kellam (2009) present a theoretical framework for technology education – the *Archway to Meaningful Learning*, which is based on Constructivist Theory to Learning through a perspective that arises from pragmatism or from philosophical experimentalism (of a more wide-ranging character) as the theoretical foundation on which other learning theories and educational approaches are conceptually based. Contextual learning, problem-based instruction, and project-based instruction create the foundations for Engineering Design and Systems Thinking which promote meaningful learning through the real context, encouraging learning experience. At the top of this *Archway* is Student learning, as a corner stone, being the reason for the need to encourage teaching based on a constructivist approach, supported on the remaining elements, very significant for technology education.

A conclusion emerges from the reflection regarding the theoretical and conceptual models on which technology education is supported.

Technology education needs to be understood not only as an isolated event, but as a part of a more wide-ranging process, which implies the way in which teachers teach and students learn when faced with the obvious evidence that, despite the arguments of many critics, computer resources do not represent a threat to teachers, they are not their substitutes but merely tools that should carry out a specific role in the educational processes. Those teaching and those learning are responsible for negotiating and defining what this role is, its predominance and relevance in the specific context in which learning takes place, requiring a suited perception of its implementation on a didactic level. This use of technology education may and will surpass the simple exercises carried out automatically by students, spreading to the more wide-ranging scope of solving complex problems, increasing their capacity regarding abstract thought and the application of solutions (WENGLINSKY, 2005).

Their scope and latent potential has led to the introduction and implementation of these technological tools in the educational field, encouraging the need to define a pedagogical area – that of educational technology – and therefore the need to conceptualize and fundament the practices developed within this scope, presenting models that represent a contribute to improve the quality of educational processes, because its effective introduction into teaching practice means rethinking and reviewing pedagogical procedures, as well as the different elements included in it (GONZÁLEZ SANMAMED, 2007).

### **Interconnecting education, didactic and technology as contextual educational elements**

Education was defined by Durkheim, at the beginning of the twentieth century, as an activity performed by adults about individuals not yet suitably capable, in terms of social potential, the main objective being to encourage the growth of determined physical, intellectual and moral elements in children and young people, taking into account the



global context in which they grow and will potentially develop their activity in the future, giving rise basically to “the idea that education is a process of preparation of new generations, by the older ones, for a social role” (CARMO, 2001, p. 243). Currently there is a tendency for a decrease in the relative importance attributed to initial educational cycles, more and more linked to the learning of basic skills which will develop over time, together with the growing importance of lifelong learning, due to a marked decrease in the period of legitimacy of knowledge, resulting from the constant evolution of knowledge and the exponential development of technical and scientific innovations, associating these factors to the actual increase in human life expectancy, of which it is also a consequence.

Although the expansion of education has been connected to training of a workforce, in terms of learning and organization through the twentieth century, the continuing evolution of educational practice points to the development of education’s latent potential with regard to reducing glaring inequalities still subsisting at global level, although in some social contexts that overvalue the more formal aspects of education it is used to reaffirm persistent inequalities instead of diluting them (GIDDENS, 2000). These perspectives lead to an educational activity not upheld in space and time (which have exceeded their action and traditionally tend to preserve) but in the plurality of access to a multiplicity of points of view, which it is in a privileged position to access, allowing a wide definition of the framework where the educational process occurs, as well as the conditions for its development (CORREIA, 1998).

Currently two important factors can be considered as capable of increasing the success of the educational process: on the one hand, individual motivation to learn; on the other hand, availability of various learning opportunities. The need to raise the demand for learning as well as its supply, most especially for those who at some point of their lives benefited least from education and training, results from the social imperative to provide open learning pathways, tailored to the needs and requirements of each individual, rather than the other way round, as was evident in the traditional presentation of pre-defined educational structures,

leading to a specific training goal (COMISSÃO DAS COMUNIDADES EUROPEIAS, 2000).

Keeping in mind the objectives each student wants to achieve, three basic groups of learning activities can be included: *formal education*; *non-formal education*; *informal education*. Taking into consideration this extensive and polysemic perspective, including different areas of educational intervention, education takes the form of a process that will accompany the individuals throughout life, in the context of multiple aspects arising from two main branches of the educational process, according to the degree of institutionalization of the learning structure: formal and non-formal education (CARMO, 2001). The increasing complexity of the concept of education arises from a set of systemic perspectives of everyday social context, the tendency to speed up change, social inequalities and changes in power systems.

Present functional areas of formal education are not limited to initial education, which includes basic, secondary, professional and higher education, also comprising further education, at a wider level of professional and higher education. However, it does not include the whole spectrum of educational needs, therefore leading to the expansion of non-formal education, both in terms of education for citizenship and in terms of educational processes of adaptation to change, amongst others. The qualitative growth and spread of educational practices reflect the increasing importance attributed to continuing education in the professional field, representing an expansion of educational logics (with consequent structural adaptations) to the sphere of the individual's working life, having as their main objective the recall and deepening of knowledge acquired in initial education settings, with a view to (re)evaluating and (re)discovering skills and to personal, professional and social development (CANÁRIO, 2003).

Present perspective on education, incorporated throughout the lives of individuals, stems from a social context in permanent metamorphosis and increasing complexity, which drives from a set of developments emerging from changes in the expansion and democratization of knowledge and from constant social development. These are associated with other aspects

such as the implementation of new educational methods in response to the evolution of mass media and the labour market, as well as the imperative to achieve goals of a global nature, associated with quality of life and transcendence of civic values, to compensate for the gaps present in community settings, promoting social welfare (LUCIO-VILLEGAS, 2005).

Lifelong learning has *technological evolution* for support, resulting from the transformations which characterize present day society, marking the transition to the knowledge era, *production efficiency*, which emerged from growing demands of the labour market in terms of productivity, competitiveness and employability, and *social cohesion*, represented by the importance of preventing or eliminating phenomena of conflict and social exclusion which limit the harmonious growth of societies. These conditions lead to the development of methodologies which innovate the educational processes. They can be included in three different levels (CANÁRIO, 2003): individual; organizational; design of educational and training processes. "Lifelong learning is no longer just one aspect of education and training; it must become the guiding principle for provision and participation across the full continuum of learning contexts" (COMISSÃO DAS COMUNIDADES EUROPEIAS, 2000, p. 3).

Given the innovations introduced by technologies, the didactic and pedagogical challenge lies in the multiplicity of instruments and structures arising in the organizational, technical, social and economic fields. This implies an appropriate and consistent definition which might connect the available resources to the contexts of use, allowing some of the comfort that is provided by the normalization and standardization of procedures, obviously including in this consideration the role of political and institutional interest in the growth of innovations in education (OLLIVIER; THIBAUT, 2004). In this elucidation of the interpenetration between education and technology, didactics plays a fundamental role by presenting the dimensions underlying practice and action, thus clarifying their meaning, being aspects of technologic character that do not disparage the scientific character that emerges from the application of theoretic models appropriate to

the teaching-learning processes, besides the contributions from other areas of knowledge that didactics integrates in a logical, systematic, precise, verifiable and reliable whole.

In current educational context, it is essential to create fruitful teaching-learning environments based on different pedagogic practices and organizational infrastructures and also on a proactive approach leading to institutional development strategies suited to everyday realities, making technology an active part, relevant and structurally integrated in the learning process. Didactic strategies represent educational facilitators, integrating a set of activities which promote the interaction with the contents broached, providing students with motivation, information and orientation necessary to accomplish learning, paying attention to some fundamental aspects (MARQUÈS, 2001): students' characteristics; students' motivations and interests; organization of educational processes; access to necessary information; active methodologies; questioning of educational processes; learning control; collaborative learning activities; learning evaluation.

The full integration of concepts underlying education, didactics and technology, evident in the definition of educational technology, is related to the social context associated with the emergence and evolution of the ICT and the steady and progressive increase of the volume of information circulating, covering the whole educational system as a privileged field of diffusion and analysis of knowledge. It also allows us to verify that "the evolution of the education process is both a cause of the production of new technological contents and a consequence of original ways of using technology" (DAMÁSIO, 2007, p. 324).

Education by and for technology represents a social constant in today's world, being essential to acquire and expand technological skills, with a view to effective and full social integration. According to Castells (2007), in the information era, given the dominant logic of global networks, broadly disseminated and incisive, the only way of not integrating their sphere of influence implies a radical self-exclusion involving context (re)construction based on values and beliefs different from the current ones and on a somewhat fundamentalist

and marginal attitude regarding current social relations that govern life in the community.

Despite the ICT potential to promote equal opportunities and social equity, due to political strategies regarding its expansion and integration at global level, the ICT can become an instrument of social division and exclusion, if there is no place for developing individual and community skills, which emerge in a new educational field capable of addressing the learning needs to adapt to change, given present marked rate of change, and to manage this change, including its content and potential, on current experiences as an existential asset (CARMO, 2001).

The effective reflex of human integration in the information society is patent in the advent of the concept of educational technology, essential to the development of a potential integrator of individuals in their contexts of everyday existence, stated as “an educational practice in which literacy is used as a tool for discovering the logic of each technology individually considered and the patterns of interaction between each of us, as learning subjects, and such technology” (DAMÁSIO, 2007, p. 334). The development of new forms of instruction implies the construction of educational and didactic processes, involving and increasing the use of technological resources, as elements that promote new structures of innovation and social, cultural and educational change, based on a perspective of technological literacy which spreads a new attitude supported by the concept of individual and collective growth, participation and responsibility, leading to the emergence of *world citizens*, increasingly capable of adopting new ways of thinking and acting socially.

### **Final considerations: the socio-educational impact of technology**

It is no coincidence that the technological revolution and consequent diffusion originated in a historic period of global restructuring of socio-economic contexts for which it constitutes an essential tool.

The new society arising from this process is both capitalist and informational, while presenting considerable historical variation in different countries, according to their history, culture, institutions and their specific relationship to global capitalism and information technologies (CASTELLS, 2002, p. 15).

The needs, ideas, values and beliefs of a social group in a specific space-time period generate the emergence of technologies that represent constructions and products of social conditions resulting from political, economic, cultural and ideological processes, converted into institutional decisions. There is no doubt that progressive development and implementation of technology transforms the same society that generated them, because behind technological design there are ontological decisions with contextual consequences.

These conditions support current concepts of *technological determinism* and *technological imperative*, giving the perspective that all that can be done, all that is technically possible, should be done or will be done, though implying the risk of the gradual suspension of ethical judgment at the level of social regulation in this field, making individuals and society hostage to the demands of technological systems when they wish to achieve their goals, transforming daily needs and problems into technical obstacles requiring technological solutions (AZINIAN, 2009). The gains in productivity, defended then as today, can be translated into fewer financial and administrative burdens, more rapid and efficient communication between trainers and trainees, efficient preparation of material by teachers, better academic results and more standardization at a global level, the main objective being to make teachers more productive, valuing the educational process, and not completely substituting them.

Many considered that traditional ways of teaching would become obsolete in the information era, giving rise to criticisms that often contrasted the traditional educational model with active learning models, in which teachers assume the role of coaches rather than instructors,

providing students with the option to choose the learning method, instead of limiting them to a pre-established form of increasing knowledge (CUBAN, 2001a). Sometimes there are accusations that educational technology does not have the capacity to effectively and clearly communicate its aim, seeming appropriate to consider the need to establish *de facto* a theoretic base which details its area of intervention and implementation. Furthermore, new requirements continually arise to develop educational programmes to respond to a generation of individuals who are trained to survive and prosper in a global economy, making imperative the precise definition of a conceptual framework for educational technology.

By cementing this structure in the theoretic bases of pedagogic approaches, which are the backbone of the successful use of educational technology as contextual learning, such as problem based education and project based education, new learning perspectives and thoughts are integrated, such as constructivism, engineering design and systems thinking (KELLEY; KELLAM, 2009), while training is simultaneously adapted to the needs arising from the predominance of a global economy which governs daily life. It falls to the trainers (responsible for preparing individuals to live and work in this global society) to define the structure of the training process, dealing with educational technology as a space encouraging reflection on and transformation of practices, uniting processes of sustained and sustainable development.

Technologies have the potential to decisively influence educational processes. They can play an important role in enhancing the efficiency of teaching/learning methods, making the students more creative and providing them with an individualized training environment. Technological literacy represents a crucial factor in preparing learners to deal with the constant changes in the present Information and Knowledge Society, whose potential for social change seems similar to that resulting in the Industrial Revolution, being essential to progressively include, implement and develop this dynamic in educational programmes (YADAV, 2003).

Structural alterations occurring in society compel transformations at professional and educational levels and the need to rethink

labour and training processes in order to create a predisposition for the development of effective skills, capable of allowing individuals to find successive possibilities of adaptation to a reality in permanent change throughout their lives (MARTÍNEZ, 2007).

It is important to clarify the concept of technological literacy including the teaching of technology, not viewing it in its more common perception, linked to the obtaining of reading and writing skills of a certain form of expression, but in a broader scope, included in the educational process of new methods of expression, in which digital and media are integrated, operating as a set of factors to consolidate individuals' elementary literacy aptitudes, not representing this broader conception to the exclusion or detriment of the importance of the more traditional concept of literacy, but its important adaptation to socio-educational daily life (DAMÁSIO, 2007).

Technological literacy implies expansion in four capital areas (BARROSO; LLORENTE, 2007), operational (use of computers and communication technologies), semiotic (application of various types of language which converge in the multimedia universe), cultural (integration in an intellectual context directed to the information society), and civic (incorporation of skills, duties and rights related to the current technology context). Included is the capacity to recognize and interpret a set of forms of symbolic representation, arising from different literacy processes (AZINIAN, 2009): *technological* (establishing and understanding the relation between society and technology), *computing and informational* (basic skills to use resources), *visual* (interpretation of images based on the general characteristics of syntax and visual semantics) and *media* (comprehension of global reality by the discerning translation of messages from various sources and via multiple perspectives).

Technological literacy is a social and educational imperative due to the growing requirements of responsibility of the educational system in the widening of student aptitudes, which provide them with an effective backup for social integration, centred on the development



of autonomous reasoning abilities and civic participation acquired through adequate literacy processes (CUBAN, 2001b). Investment in technological literacy as a social target of educational systems is not limited to the fulfilment of technical activities, but rather to the development of a repertoire of skills relevant to labour, community and social contexts, which comprises the ability to manipulate and evaluate the relevance and reliability of available information through an innovative attitude before the increasing challenges of digital literacy in the fields of *education, labour skills* and *civic commitment* (BARROSO; LLORENTE, 2007).

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