

## ARTICLE

# Digital Scientific-Technological Training in Higher Education

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## Abstract

The new socioeconomic and cultural scenarios of the knowledge society demand a new approach to higher education, which must find solutions not only to overcome social and cultural exclusion – particularly in Latin America – but also to the contradictions between a global digital culture and local organisational and professional profiles and needs.

For there to be a genuine development of capacities to break down barriers and to reintroduce a sense of higher education being suited to the needs of the 21<sup>st</sup> century, it must draw on and give ICTs a new significance, reassessing and adapting all socioeconomic and political-cultural means to bring about a shift from the precariousness of the social significance of research and development to its visibility and appreciation in terms of producing knowledge and scientific-technological products. This is something that must shape our times, by acknowledging the value of an increasingly virtual higher education capable of fostering greater potential for freedom of choice, participation and protagonism.

## Keywords

intersections of knowledge society scenarios, imaginative challenge for the digital reshaping of higher education in Latin America, blended and open e-learning, capacity development

## *La formación científico-tecnológica digital en educación superior*

### *Resumen*

*Los nuevos escenarios socioeconómicos y culturales de la sociedad del conocimiento desafían un replanteamiento de la formación superior que debe buscar respuestas superadoras no sólo de diversas exclusiones sociales y culturales –en general pero más aún en América Latina–, sino de las contradicciones entre una cultura digital global y los requeridos perfiles organizacionales y profesionales locales.*

*Para un auténtico desarrollo de capacidades que remuevan restricciones y recreen sentido pertinente a los tiempos y a las necesidades, el impulso de la enseñanza universitaria se halla en la apropiación y la resignificación de las TIC, para situaciones que revaloricen y adecuen todos los resortes socioeconómicos y político-culturales conducentes a transitar de la precariedad a la visibilidad de la significación social de la investigación y el desarrollo para una producción de conocimientos y*

*productos científico-tecnológicos. Ello debe caracterizar a la época actual con una puesta en valor de la enseñanza superior cada vez más virtual, para alentar mayores posibilidades de libertad y elección, participación y protagonismo.*

### **Palabras clave**

*encrucijadas de escenarios de la sociedad del conocimiento, desafío imaginativo para reformulación digital de la enseñanza superior latinoamericana, enseñanza electrónica de formatos mixtos y abierta, desarrollo de capacidades*

## **1. Introduction**

Today's critical factors for bringing about a shift towards a knowledge society have overturned the traditional variables applicable to the social and productive characteristics of production in society. The traditional variables of capital, labour, natural resources, etc. used to account for 70% of growth potential. Against the backdrop of severe national and global crises, whether economic, financial, occupational, ethical or existential, emerging new scenarios make it essential to reconsider not only the factors involved in society's sustainability, but also all kinds of organisational and professional profiles that demand a new approach to higher education.

The residual factor, which only accounted for 20% and was previously linked to education and creative and reflective thought, has changed. Along with the key issue of technology, it now requires another kind of know-how and another management capacity or organisational management that must take account of higher education, which, since the mid-20<sup>th</sup> century, has driven the information society that, in the 21<sup>st</sup> century, has become the knowledge society.

Factors linked to strengthening the production of valuable scientific-technological knowledge, the use of global information and communication technologies (ICTs) for social responsibility purposes (to address poverty, inequality, endemic diseases, etc., which have got worse in Latin America), a rise in high-quality productivity and the contribution of research and development to the growth and prosperity of all cultural and socioeconomic organisations forming part of the "glocal"<sup>1</sup> society are – with the use of digital technologies – all acknowledged as being interesting, but they are not sufficient to attain social inclusion.

Doubts and contradictions have arisen at an ever faster pace because of the Internet (and its variants), but despite

being quick and easy, reality shows that that higher education has found it quite hard to know what to do with all of that, not to mention how to do it.

## **2. New Scenarios and their Protagonists**

New scenarios need to be understood as visions of potential learning environments driven today by new technologies, which help to design and create different and suitable environments for new space-time coordinates and for new educational objectives, etc., involving students, lecturers, institutions, programmes, the employment structure, the community, world regions, etc.

New educational spaces may allude to the impact that the introduction of ICTs has on conventional education on the one hand, and to the shaping of new learning scenarios on the other. Between the conventional classroom and the potential to access learning materials from anywhere in the world through ICTs, there is a whole range of options for gaining access to learning materials and for establishing educational communications that needs to be considered, particularly when looking towards the future.

University operation and university management backed by policies, people and robust, coherent organisations should begin to establish themselves in the current context of internationalisation, regionalisation and globalisation, which, in turn, has raised the level of professional competencies required by the labour market. This should combine strategies of innovation, research and higher education with employment and with the social responsibility of these organisations, which are ultimately the ones that provide new contributions to society's sustainable development through the students' competence and collaboration. Users of newly designed higher education programmes

1. Glocal: neologism, contraction of *global* and *local*.

and projects apply ICTs, since the current trend means that university endeavours are not only more technology mediated (virtual education is becoming more and more of a reality), but also that these may unexpectedly be replaced in a not-too-distant future by emerging technologies.<sup>2</sup>

The creation of international and regional research and higher education areas in the global context also challenges national cultures and values, and demands new relationships between the State, universities and the market. Furthermore, they challenge the management and governance guidelines of such higher education and require new regional instruments (e.g., for quality assurance, the official recognition of competencies, etc.) and the creation of other approaches (now technology mediated, that is) not only for education, but also for the funding of such proposals. These approaches are becoming more and more connected with cross-border education and with systems incorporating ICTs, the aim of which is to attain the required number of qualified students that many countries' education systems cannot provide. Cross-national or cross-border education has become an important aspect of the globalisation of higher education and a complement of economic globalisation (even though it has led to worker migration and a "brain drain").

More often than not, users/clients/students of higher education proposals (including graduate ones) nowadays are young, horizontally-connected digital natives who are heavy users of mobile technologies: mobile phones and laptops for downloading all sorts of things from the Internet or for synchronously communicating using text messaging, instant messaging (IM) and tweets for any purpose, always online. They demonstrate a participative humanism that is not, however, tied to anything, since the society they inhabit is fluid and unstable: they are the wireless students of virtual space and the high-tech world, who need to learn how to develop capacities and to fit in, not only with the values of new professions, but also – and more importantly – with a new ambivalent culture.

The new scenarios bear witness to the fact the decisive factors for the construction of projects with an assessment of resources are ever more necessarily related to digital awareness and knowledge. New communication habits and new conditions for the production, distribution and cultural use of symbolic and material assets become new technology-mediated communicative, productive and so-

ciocultural practices. However, they do not always have the necessary reflexive space in higher education – as a present input – to understand life and work today.

However, we should not think that universities incorporate this fast-moving guise of youth – even if making consistent curricular proposals – to help surpass the intuitive mastery that young people have over these devices. Rather, university programmes should help them consolidate the development and application of powerful competencies in terms of their self-regulated learning and thought strategies. Abstraction, systemic-holistic thought, the capacity to take appropriate, negotiated, quick decisions, the ability to navigate through complexity and uncertainty in a critical, active and substantial manner, with a lot of creativity and a pro-active attitude, are still some of the pending issues in Latin American higher education, apart from one or two noteworthy exceptions that will hopefully become generalised as good practices.

Higher education should become the leading space for critical processes in order to guarantee the development of highly reflexive, innovative societies with the capacity to respond to the critical environments that prevail in the citizen scenarios of the new times. Consequently, several topics of debate connected with the following questions should be covered:

- To what extent does higher education foster sustainable digital development in Latin American and international contexts?
- Does this sector meet the expectations of bringing about change and progress, and of contributing to the genuine construction of a knowledge society?
- How does higher education contribute to the development of organic e-learning programmes and of the education system as a whole? What new challenges need to be addressed to achieve educational quality with social inclusion in the fragmented society of Latin America?
- What are the most significant trends regarding thought and action in the virtual field that should be present in the areas of reflexive learning, research and testing in practice?
- How are the profiles of students and various groups reaching university changing in terms of their learning, communication characteristics, etc. with the im-

2. Emerging and converging technologies, from technical-scientific systems, denoting the emergence and convergence of new technologies in a disruptive fashion, affecting the values of knowledge production and circulation in an unpredictable way for the future of humanity (including nanotechnology, biotechnology, ICTs, cognitive science, robotics, artificial intelligence (AI), etc.

pact that the use (and abuse<sup>3</sup>) of ICTs is having on digital culture?

### 3. The Meaning of Latin American Virtual University/Higher Education Today

The provision of higher education should not only channel its efforts into modernisation, diversification, integration and globalisation through alternative learning and teaching systems and incorporate flexible ways of offering state-of-the-art education as a “world-class university”.<sup>4</sup> Rather, it should also serve as a lifelong learning centre for fulfilling its inevitable share of responsibility in terms of social inclusion by making services available to all citizens as a whole. To that end, open e-learning is recognised as being one of the effective steps towards the democratisation and sustainability of a diversity of higher education programmes.

Social inclusion, in the area of reviewing virtual higher education, is understood as being the reconsideration of all forms of social inclusion that university programmes offer to users (students, occupational training, community development, lifelong learning, new technical fields, etc.), using the instruments that digital culture establishes today, in order to contribute to the implementation of e-skills<sup>5</sup> and to help them cope with life in a pertinent way; that is to say, to become a responsible, proactive, far-sighted and productive (cyber)citizen. This therefore points to being able to demonstrate a specialised education based on a range of educational content (or knowledge areas), with good technological mastery and high doses of self-regulation/independence, in order to apply knowledge to valid and valuable conducts for diverse productive and sociocultural endeavours, etc. that meet and anticipate the needs of living.

Taking account of the above-mentioned components, which have new impacts on the dynamics of virtual higher education in Latin America, the adoption of strategic plans and specific actions would aim to ensure that university education and scientific-educational research in this field should play a strategic role in the production and distribution of socially useful knowledge, if it is a matter of aiming towards an integrative, sustainable near future oriented towards increasing both productivity and human development, so that Latin America can resignify the meaning of the knowledge society.

But it is a fallacy to think that all countries, with their higher education programmes, are able offer this ideal situation, with projects that educate the required number of qualified professionals. With cross-border virtual education, the aim is to balance out these situations, to strengthen the globalisation of higher education and to attain a digital scientific-technological higher education that is both cutting edge and highly relevant.

Resignifying digital scientific-technological training in the context of higher education points to the following:

- Strengthening theoretical-practical academic studies on how scientific knowledge and technological knowledge, in their core differences, develop and organise themselves epistemologically<sup>6</sup> and socially into relevant and useful systems.<sup>7</sup>
- Developing alternative education, research and innovation offerings that are relevant to the specific needs of a Latin American country or region. This involves socio-organisational and technological innovation in order to generate and use knowledge. Thus, it contributes to the success (social, economic and financial) of these institutions in terms of their sustainability, renewing the concept and operation of the dynamic process of management, learning, productivity, etc. to develop and build transferrable socio-technological capital.

3. Fainholc, B. (2010, March). “Necesarias reflexiones críticas frente al uso (y abuso) de la web 2.0”. Paper given at the University Guglielmo Marconi, Rome.
4. Salmi, Jamil (2009). World-class university: puts forwards strategies for establishing globally competitive world-class universities, with the challenges, costs and risks that this involves. <<http://educacion-virtualidad.blogspot.com/2009/09/como-es-una-universidad-de-rango.html>>
5. e-Skills, defined as developed talents or abilities to seek, find, process and communicate information and thus turn information into knowledge. They imply the development of independent, resolute, responsible, critical and reflexive people capable of selecting and transforming sources for specific purposes, using different technological instruments as required.
6. Fainholc, B. (2008, 5-8 September). “Which scientific technological knowledge will promote the shift to a pertinent informational and knowledge society? The role of Science, Technology and Innovation in the construction of the world of the future. Science, Technology and Innovation for the Development of the Third World Countries”. Paper given at the First ISA Forum of Sociology. Barcelona, Spain.
7. Feenberg, A. “Science, technology and democracy: distinctions and connections”.

- Making the qualifications of the teaching and support staff much denser in terms of discipline, methodology, organisation and technology, with new agreed, horizontal and very flexible guidelines for curriculums, governance and administration, using specific open access educational resources (OERs) that sustainably foster the generation of competencies<sup>8</sup> in centres of excellence, in collaborative real and virtual knowledge-production communities. With these mentioned means, the technological mindset<sup>9</sup> includes, reflects and will lead to sustainable survival in the digital 21st century.

It goes without saying that the provision of higher education through ICT-mediated distance and open learning, either fully (e-learning) or partially (blended learning), helps to reach the aspirations described for Latin America and is an inevitable step towards genuine democratisation and overcoming various inequalities. It is also a key factor contributing to the globalisation, modernisation and diversification of the educational offering, since it fosters alternative systems for the production and distribution of scientific-technological knowledge, thus making state-of-the-art undergraduate and graduate education available.

Of course, to take the adoption of these proposals forward and to increase their number, new public policies are needed and the regulatory framework of many nations needs to be reformed. This applies to their international interrelation, referred to centrally, and to infrastructure and telecommunications (access to the Internet, networks and so on).

Higher education is still far from meeting all of the needs set out here, and even more so from global inclusion with regard to the international exchange of educational services and related aspects, such as institutional evaluation and accreditation, learning certification, intellectual property rights over content and materials, and incentive structures (tax relief, subsidies, fostering private-public sector cooperation, etc.), to name but a few.

#### 4. A Socially Inclusive, Responsible, Integrative and Proactive Virtual University

This proposal for a university located in Latin America is understood to be a higher education organisation that has electronic services for education, research, community outreach, and innovation and development, diversified and integrated into the global context. It includes proactive real and virtual learning spaces for the generation and application of productive and socially useful knowledge, connected with an increase in the socioeconomic productivity of the region and the countries.

It is believed that the region – some countries more than others – is on the way to attaining the mentioned objectives through the development of a reflexive, flexible organisational culture in terms of the design, production and application of cross-border knowledge in specific disciplinary or interdisciplinary fields, acting as the interfaces between specific, different and permeable spaces, to support the new digital higher education processes as mentioned. These innovative proposals are led – not exempt from fall-backs, crises and various paradoxes – by academic leaders, administrative managers, technicians, lecturers and technology experts whose discussions are based on far-sighted new representations and roles that culture and education should adopt in the digital culture.

Hence, it is a matter of ensuring (or overcoming the shortage of) the following:

- The fostering of creativity, the reinvention of processes, products and actions, the application of ideas and talent to environments encouraging self-management and the situated and distributed joint management of distributive proposals for higher education, such as articulated agencies that are socially active, proactive and integrated, with sustained funding<sup>10</sup> (accountable for the results of the proposed programmes) provided by the generation, production and multiplication of

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8. Communication, media, technology, electronic, analytical, investigation/research, systemic-holistic interpretation, citizens' socio-political and economic competencies, etc.
  9. It is characterised by the use of the project formulation methodology and by emphasising the relevance and quality of the processes and the attainment of products. Priority is given to "reflexive technological actions" that must be incorporated into the design and operation of projects and teams. It is connected with mindware, or processes that involve complex competencies linked to socio-cognitive and neural networks that are very valuable when it comes to making problem-solving decisions.
  10. Competencies that procure funding for programmes and projects with an assurance of quality, linked to performance and results, regarding academic independence, with a robust regime of informing the public about the results and a high degree of commitment to national policies consistent with the country's interests.



knowledge committed to scientific-technological, innovation and development issues, with a high degree of social relevance.

- Imagination and the creation of spaces for dialogue in real and virtual communities, for using and producing knowledge and for other similar purposes, with the articulation of specific cooperation actions committed to reforming education and research systems, to getting closer to companies, to different societal institutions, etc. in order to get rid of anachronisms, prejudices, shortcomings and gaps: the specification of agreed principles identified against the ideal profile begins to emerge.
- The strengthening and assurance of quality in virtual higher education because there is an awareness of complying with certain minimum standards that ensure graduates have the right e-skills to perform their roles and functions properly, in accordance with the needs of the second decade of the 21<sup>st</sup> century. They are based, then, on the concept and commitment to goals of constant betterment, educational enhancement,<sup>11</sup> continuing education for the teaching staff, the expansion and articulation of research and development in various community areas, an increase in social responsibility, etc., all of which are oriented towards social inclusion: today, quality education means accepting and including the greatest manifestations of diversity.

Thus, higher education is in the process of overcoming conservatism and the sectarian and corporate interests of traditional power groups – despite “single-thought” periods of continuity – to lead and incentivise electronic, effective and relevant institutions and projects with legitimate university action and management, which introduce assured new approaches and changes that the 21<sup>st</sup> century demands from Spanish-speaking countries, reflecting on them – and driving them – even though there may be doubts.

What needs to be called on? What needs to be done? It is necessary to move towards virtual education and research – e-learning or blended – not constrained by learning management systems (LMSs) or technological platforms, with frameworks that strengthen the following:

11. This points to the preparation and capacity of teaching staff and researchers, with adequate incentives to sustain and increase their productivity, with clear rules for their academic careers, ongoing appraisal of the results of the academic work done and the achievement of results for a socially articulated leadership of these institutions.
12. Lucidity: the ability to perceive reality in all its complexity, with contradictions, illusions and paradoxes. It arises from rational and intuitive contact, calling upon the ability to clarify various nuances in the understanding of reality, which must be judged and criticised.

—Personal and collective intelligence, both real and virtual, that understands the logic of the instruments and their languages, within a scientific-technological system that is innovative and oriented towards labour, social and academic research, with participative citizens locally and globally.

—Lucidity,<sup>12</sup> both critical and responsible, that re-thinks design and assesses scientific-technological processes and products in and for their production, consumption, distribution and socially useful, rational and wise use.

—Experimental practicality and creativity that evaluates, in reality, an appropriately applied transfer of material and symbolic processes, products and services to local and global contexts, organisations, companies, etc.

—Critical thought as a reflexive, self-regulated judgment of purposes leading to an interpretation, an analysis, an assessment and an inference, like testing a hypothesis in terms of the concept, methodology, context, etc. on which that judgment is based. It is worth saying that the arguments are assessed and the methodology of hypotheses and procedures used in the construction of knowledge are reflected on.

## 5. Developing Capacities to Shape and Sustain this University

For this virtual higher education proposal to be sustainable and for it to meet the mentioned needs of a knowledge society in Latin America at a time of global ambiguity and need to build equality, it must, then, link up the processes of learning, research, education, innovation and situated development with social inclusion. Articulating ICTs to increase access, evaluative analysis and an intelligent use of information, with an increase in expression and communication potential, is a duty: no-one can deny that any longer.

However, we are aware of the fact that no new technology will, in itself, solve the problem of exclusion and inequality. Public policies and action plans applied to economic, labour, sociocultural and educational fields, etc.

are the ones that will drive inclusive programmes so that citizen inclusion, existence and coexistence throughout a fair life<sup>13</sup> become a reality. It is a matter of building a new society with responsibility (or of a “new social pact”) in which the ethics of responsibility, participation and solidarity and not the marketing commercialism of technologies – as artefacts – should guide the educational spirit of citizens as a whole.

Some topics for discussion included in this context are the following:

- Distinguishing between higher education institutions using blended learning (such as polytechnics, university schools, higher professional short courses, etc.) on the basis of the degree of intensity of the approach and the type of research that needs to be done, all of which implies different models of management and new governance within each organisation: this means new institutional development with proposals for intensive knowledge generation.
- Allocating the most appropriate level of financial and human resources to develop these higher level centres of excellence – without undermining the broad base necessary for the population’s basic education – by dealing with organisational, curricular, social, semiological, educational, technological, ethical and philosophical issues.
- Underscoring the relevance of local and regional research and innovation to deal with the specific needs of students by anticipating flexible learning pathways, allowing them to choose their own pathways and approaches, to suit the characteristics and requirements of countries and regions.
- Recognising the polysemy of the diversity phenomenon, which, besides distinguishing between the strengths and weakness of virtual trends – now more and more hybrid – and the density of knowledge with its epistemological frameworks, should envision scenarios, stakeholders, educational approaches, educational levels and technological concepts underlying curricular proposals, over and beyond existing socio-economic and cultural distinctions.
- Recognising the tensions between open and non-open access, as processes that strengthen the emergence of

technological-educational centres of excellence and pathways across the whole range of educational offerings – especially for higher education programmes and research – by fostering collaborative models with OERs that go beyond local and national borders.

## 6. Some Recommendations and Suggestions

Within a framework that sustains that change in education is slow and not radical, higher education institutions gradually need to take a new approach to their mission, profile and position in the market by reconsidering their management, education, and research and development structures and hypotheses. Hence, they are confronted with the dilemma of opening up, a feature that is characteristic of the knowledge society, and with the synergy that, between formal, non-formal and informal learning that ICTs permit, typifies their operation. Both require a rigorous, planned articulation of the different disciplinary fields and other areas in short, medium and long-term strategies.

For this reason, it is necessary for university education to review its role and the function it has fulfilled and ought to fulfil in the network society, where the production, distribution and application of knowledge – ever more virtual – has changed substantially and inevitably calls for other ways of facing up to new challenges. Among them, for example, are education and the transfer of values (without knowing which ones yet), while preserving the essentials for new generations, such as an education for and the certification of new professions. Moreover, it is crucial to realise and observe the strength that competency training develops (flexible and specialised, constantly being reformulated), not only in people’s working lives, but also for the production of scientific-technological knowledge in virtual communities.

All of this demonstrates the following:

- a) On the one hand, introducing powerful technologies with innovations into these institutions is not sufficient; knowledge (interdisciplinary, resourceful, decentralised, democratic, etc.) will also need to be

13. Fair life: through public socio-political mechanisms, access to natural, material, symbolic and technological resources is assured, with effective user participation in their designs for exploitation and reasonable, sustainable use, together with the potential for generating new knowledge to meet their needs. Included thus are not only the mechanisms to make up for shortcomings in conditions relating to the distribution of goods and services, but also the design of new educational models, drawing on local technology today for socially useful and relevant production and use of scientific-technological knowledge; that is to say, in accordance with the legitimate basic needs of the lives of people and groups in the present and the future.

introduced to understand the new cultural and social processes that may emerge in order to identify their impact on people, groups and organisations.

- b) On the other hand, technology sweeps through, penetrates and accentuates – and even more so from an ethical, emotional and socio-cognitive viewpoint – all day-to-day situations (like, for example, the mass use of mobile phones and the antagonistic potential to produce knowledge and include it on the Internet with Web 2.0), meaning that all social organisations, and universities more than any others, must understand these issues to control – and teach how to control reflexively – the technology used (and not the other way round). This is even more important if it is a matter of seeking out ethical utilities coupled with credible/verifiable uses, particularly when taking advantage of global, regional and ultimately local connectivity in educational programmes.

This will tend to examine the real contribution that technology brings to education and learning, and their enhancement, because scepticism still prevails and more research and development is required to make up for the lack of more relevant results.

For the same reason, it is advisable for higher education proposals to be combinable with alternative hybrid or “do-it-yourself” models, that is to say, face-to-face offerings with e-learning and education, using virtual and pre-existing technology, which reshape conventional practices of administration, management, education and research at these educational levels. The same applies to lecturers, who will gradually use more technology, since ICTs will impact on their teaching practices.

It is necessary, then, to bear in mind the basic function of a virtual university, which is to offer e-learning educational programmes that will emerge forcefully as each university or school of higher education embarks on thinking about, anticipating and strategically predicting the strategic model for the development of future choices and combinations of technological resources to suit the scenarios and stakeholders, etc., recognising the fact that they are neither definitive nor defining. There is still a great deal to investigate, test and theorise about.

Within the knowledge economy, there is a recognised need for expansion and constant review, given the obsolescence of both the knowledge economy itself and of knowl-

edge as a whole. This means that curriculums and expert or lecturer training content need to be updated through proposals that articulate an interdisciplinary approach.<sup>14</sup>

When thinking about formulating a critical, productive and socioculturally inclusive, participative, responsible, integrative and proactive virtual higher education university, the articulation of ICTs is paramount, given that they are recognised as being in a state of constant “flux”, in order to capitalise on talent and provide a competency-oriented education.

However, at times of recession and crisis, students have restrictions on their long-term investments that will probably become more pronounced in years to come, and they call for debate on many aspects in general, and in particular on those referring to the education-technology interface, that is to say, on service, communication and expression potential, etc., which will become increasingly faster.

Hence the existence of certain powerful thoughts that must be taken into account:

- Since no-one knows where the change will really come from and what its sociocultural impact will be, but recognising the enormous need to overcome the conservatism of wholly face-to-face educational institutions, the emphasis on flexibility in all technology and ICT-mediated educational proposals should take advantage of the synergy of all learning environments – real and virtual – as contexts for fostering and managing that change.
- The importance – though with big question marks regarding quality and distributed use – of digital materials, whether they already exist or need to be produced in ever more open and public ways, establishes that there will be a greater need to assess and assure their quality for education and research in order to ensure that these educational programmes contribute towards long-term sustainability.
- One of the enormous challenges that needs to be resolved is the concern that distributed collaborative technology platforms ought to be used as means to adapt to diversity, to break down barriers and to get rid of limitations – and not as a constraint that regurgitates old approaches, while also serving as a means to help marginal countries in a disinterested manner.
- The emphasis on models and formats for alternative learning that, mediated through technology, impact

14. The new education spaces of the “creative industries” bear witness to this. In these industries, the cross between technology, culture, art and other areas turn intellectual capital into the main input through virtualisation, technological convergence and talent development.



on education and ultimately on the epistemology of knowledge, by building unlimited opportunities to develop reflective capacities (through collaboration, the tailoring of student services, etc.), must be taken into account when previously un contemplated education spaces for all are designed. That should be understood by all organisational bodies of the higher education institution, because, without that understanding, little or no success will be achieved from the educational programmes implemented.

- The need to redefine the mission – in a global digital and networked era – of what is known as distance education, since it cannot and must not be considered simply as a matter of shortening distances, due to the substantial impact that ICTs and the Internet have on removing restrictions (without ignoring the fact that there are still severe access and literacy shortcomings for critical interaction), offering materials, meeting the qualification needs of the market and putting flexibility into curriculums and the boundaries demarcating the public and private provision of programmes (with rigorous auditing of their offerings, by signalling the commercialisation of dubious titles, etc.).
- The challenge of strengthening the role of all technology-mediated higher education, which needs to balance the access-cost-quality relationship of the proposals and relationships between academia, corporations and the labour market structure, or of research and development with innovations in its programmes, materials, processes and products.
- Recognising the contradictions embodied by e-learning systems themselves in terms of the high cost of their design, because they are human-resource intensive, require highly qualified employees and are based on very refined prerequisites.
- Devoting effort to ensure that students attain successful learning, which means making sure that that they meet the prerequisites of literacy and training in the assessment of ICT resources (to ensure that they do not get lost in the existing maze of information), and that lecturers strengthen the articulation of technology in reformulated programmes with

greater professionalisation of their roles. All of this needs to be done in organisations that manage multiple-approach e-learning programmes (single mode, blended learning, consortiums, traditional extended universities, etc.), with the aim of surpassing global industrial models (with the introduction of online interactivity and participative formats) by adapting them to national contexts, of language restrictions, in keeping with the target audience and the scarcity of budgets in a harmonisation of efforts, quality assurance, etc.

- Systematically being sceptical, through various de-constructions, about the fact that the ICT-mediated educational approach can resolve (despite the fact that many people see ICTs as the panacea for a number of different issues, given the startling multiplication of Internet access and use in higher education) all the needs that the evolution and transformation of digital culture and society impose on educational processes, by offering them to all age groups throughout their lives.
- Demonstrating that OERs<sup>15</sup> can manage to consolidate, for reasons of moral justification and the attainment of pragmatic benefit (in the sense established by Popper for an open society), greater democratic options. This attitude should overcome various and varied myths that abound in traditional university chairs (beliefs like “my content is original”, “they’re stealing it from me”, “this content cannot be resituated”, etc.) with regard to the existence and harsh, disruptive and rapid multiplication of content, with its tendency to spread more and more throughout space and time.
- The production of capacity-building “open resources” needs to seek out evidence and refine the variables that intervene in the production of knowledge, which strengthens research and testing, that is to say, the tasks of learning and knowledge production communities.
- Prioritising “virtual research-action” that shapes and consolidates “collective intelligence” by perceiving its expansion through production work and common use of open resources – as part of a vast informational and participative traffic that will continue to

15. Reuse, re-elaboration, combination and redistribution indicate that OERs are going to be disseminated more and more often – not without producing contradictions or resistance – and that means that there are and will be emerging ICT tools, for the task of drawing on and relocalising them as required, since they are cheap, simple, more convenient, democratic, etc. The challenges they face include: property rights issues, since they must be shared, and the need to combine production and use. Consequently, one of the conclusions would appear to be that to remain sustainable, each user should pay for using them.

grow. This research requires a combination of methods, with emphasis on virtual ethnography, with the collaborative contribution of all participants in the redesign of interventions and materials, within programmes that experiment with designed and implemented actions, and that test them in practice, within notions of recertification, renewable validity or constant updating.

To sum up:

Revisiting a virtual approach to higher education is duty bound to present new relevant educational programmes that face up to new technological, cultural and socioeconomic realities to surpass higher education responses that are out of date, rigid and linear, and which, furthermore, have been unable to resolve the ongoing – not to say worsening – north-south divide, because they consider education (and canned e-learning packages) as a commodity.

Alongside other decisive socio-political factors, that has led to educational fragmentation in Latin American or Spanish-speaking local and regional societies regarding the innovative spirit that, with technological-educational proposals, should meet the enormous user demand for higher professional education and, ultimately, redefine what 40 years ago was called distance education, thus giving rise to other, more relevant cultural and educational processes and results.

## Bibliography

- BEREITER, C. (2002). *Education and Mind in the Knowledge Age*. London: LEA.
- BRUNER, J. (1998). *La educación puerta de la cultura*. Buenos Aires: Paidós.
- EDUTEKA. [Accessed: August 2006].  
<<http://www.eduteka.org/FormacionCiudadana.php>>
- JONASSEN, D. (2000). “El diseño de entornos constructivistas de aprendizaje”. In: Ch. Reigeluth (ed.). *Diseño de la instrucción: teoría y modelos*. Madrid: Santillana.
- MONEREO, C. (coord.) (2005). *Internet y las competencias básicas: aprender a cooperar, a comunicarse, a participar, a aprender*. Barcelona: Grao.
- MORIN, E. (1999). *La reforma del pensamiento*. Buenos Aires: Nueva visión.
- SALOMON, G. (2001). *Cogniciones distribuidas*. Buenos Aires: Amorrortu.
- SANDOVAL, R. “Sociedad del conocimiento, razón y multiculturalismo: una mirada desde el pluralismo epistemológico”.  
<<http://www.oei.es/memoriasctsi/mesa8/m08p17.pdf>>
- SCARDAMALIA, M. (2002). “Collective Cognitive Responsibility for the Advancement of Knowledge”. In: B. Smith (ed.). *Liberal Education in a Knowledge Society*. Chicago: Open Court, pages 66-98.
- “Tecnociencia para la sostenibilidad”.  
<[www.oei.es/decada/accion003.htm](http://www.oei.es/decada/accion003.htm)>
- VILCHES, A.; GIL-PÉREZ, D. (2003). *Construyamos un futuro sostenible. Diálogos de supervivencia*. Madrid: Cambridge University Press.
- WENGER, E. (2001). *Comunidades de práctica. Aprendizaje, significado e identidad*. Barcelona: Paidós.

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