Information and communication technologies and human resource development

Armando Rocha Trindade, President Emeritus, ICDE
Key-note address at the EDEN - Lomonosov Moscow State University Conference, 3-5 October 1999

Societal changes and trends

The last years of this century have been rich in changes in most regions of the World, which affect the organisation of production, the distribution of products, the interaction between States, the evolution of markets, the rules of employment, interpersonal relations and even the fabric of society itself.

Some of these changes are the result of globalisation (this word including economic, as well as political and cultural features); of the increasing mobility of individuals, goods, information and ideas; of the pervasiveness of information and communication technologies in almost all sectors of human activity, including day-to-day life.

There are many positive consequences associated with these trends, among which the increased awareness on the need for protecting and improving the environment; on the respect of human and social rights and the security of individuals; on the rule of democracy and individual freedom. On the other hand, many hard, dangerous or repetitive jobs have been modified by the introduction of robotics, informatics and other advanced technologies. The common citizen can benefit from quicker and more reliable ways of doing things, from using washing machines to self-service shops, from do-it-yourself to contacting Public Administration by computer for whatever purpose and from "plastic money" to "fast food"...

Looking at the other side of the coin, some of the negative consequences of these changes are easy to describe:

- Production and trade have evolved from local, to national, to grand-regional and, finally, to global dimension. As a consequence, world competitiveness may de-stabilise markets, reduce the lifetime of enterprises and introduce instability in employment;
- The quick pace of technological and methodological evolution and innovation tends to accelerate the process of obsolescence of equipment's, products and, worst than that, of human qualifications and professional profiles;
- Any fluctuation or instability in global economic parameters can introduce *tsunami effects* in whole regions of the World, in terms of severe recession, mass unemployment and financial collapse.

Considering these trends to be confirmed in the near future, some precautions need to be taken into account in what concerns the main requirements in human resources development for the incoming millennium.

Human resources development

For a given country, whatever the degree of its economic and technological development, public wealth and individual well being are proportional to the average level of skills, knowledge and qualifications of the active population.

Highly qualified people have a higher capacity for earning good salaries; for contributing to increase the competitivity of their enterprises; or to create their own job or professional occupation. Higher individual income, multiplied by a significant fraction of the population, mean also that enterprises prosper and the State increases its taking in the form of taxes.

Well-qualified persons are also better adjusted to possible changes in job profiles; less vulnerable to possible loss of employment; able to promote their own updating, upgrading or re-conversion of skills and

competencies. If, as a part of their initial training, they have acquired the capacity for learning by themselves, one could say that these persons are well prepared for the challenges of the future.

An integrated and long-term strategy concerning human resource development means increasing the duration of compulsory schooling for all the younger generations, covering the primary and, progressively, the secondary level of education. It means also creating opportunities for access to tertiary education and training for the whole class of age, in universities, polytechnics and professional schools. And, much more difficult than this, to provide adult education and continuing training opportunities for the whole active population.

It is obvious that, nowadays, even the richest nations on Earth are not yet prepared to cope with this huge set of qualitative and quantitative requirements. However, it is always good practice for decision-makers to establish "asymptotic" goals for their long-term planning, meaning that they can progressively approach the fulfilment of these aims, without actually ever reaching them.

Changes in qualification profiles

The word "manpower" has an old connotation of raw physical strength, able to accomplish difficult and heavy tasks by using the hands and even the whole body. Agriculture, mining, fishing and most industrial jobs had this kind of requirements, even after the excesses of the first industrial revolution.

The present situation is widely different in the sense that more and more jobs require intellectual skills rather than physical ones, due to the explosion of the services sector. Even in the primary sector and in heavy industry, servo-mechanisms, automation, remote control and robotics has taken most of the burden of expenditure of strength from humankind: today, anyone can drive a ten-ton truck without even sweating, while cranes, conveyor belts, elevators and power tools make easier most manual jobs.

There is, of course, the other face of the coin. More and more human activities have included advanced technologies in their scope and the future trend goes in the sense of increasing this component. Information and communication technologies are nowadays present everywhere, requiring the professional person, as well as the common citizen, to be able to deal with them in an efficient way on the job, in public or private transportation, in shopping, in domestic activities and at home in leisure.

There is a serious risk that this "invasion" of the new technologies in everyday life will create new categories of excluded persons, the ones who are not able to use, or to have access to them. Taking as granted that the new generations will get acquainted with information and communication technologies, at least during their schooling process, the remaining part of population, and namely the older ones, need absolutely to be considered as necessary targets for educational action.

Education in the new millennium

Basic Education

There is a vague feeling, at least in Europe, that some changes must be made in what respects the objectives and curriculum of compulsory education (even if this has not led to any visible changes), for there is a consensus that basic schooling should be considered as a period of *education for citizenship*. This means that, even if these students were to leave then the educational system, they should know and understand enough about the outside world for them to be able to play an active role in society. From this point of view, basic education should have aims specific to it, irrespective of the fact that their student will continue studying or not at all. However, the generalised approach is still the old one that considers compulsory education just as a step to be taken before entering a higher level of studies

In any case, whatever the duration and the curriculum of basic education will be, there are some main necessary capacities (among others) to be developed, enabling the future citizens:

- To read, write, calculate and understand representations;
- To understand at least two foreign languages;
- To analyse and to solve problems;
- To understand human and social relations;
- To lead and to accept leadership;
- To communicate, directly or through the appropriate technologies;
- To manage a small (even a unipersonal) enterprise;
- To access and to validate information and data;
- To learn how to learn by themselves;
- To protect the environment and their own health;
- To have a basic understanding of their own society, their region and the World;
- To understand values and moral references

Secondary Education

Secondary education is usually defined as applying to the classes of age between 15 and 18 and may be included in compulsory education, as a very positive step leading to a higher average level of qualifications in a given country. We believe that, in the near future, this will happen in most developed regions of the

world.

Secondary education has usually two alternative paths, one leading to tertiary education and the continuation of studies, the other one with a more vocational-oriented nature, aiming at an earlier integration in the marketplace. The corresponding objectives will obviously differ; nevertheless, one should aim specially at the reinforcement of the capacities we define for basic education. Another natural requirement is that horizontal transit is possible between the two streams, so that second thoughts about vocational orientation does not involve too much loss of time.

In any case, it is imperative, in terms of a strategy for human resource development, that considerable efforts will be made in order to facilitate and to promote and stimulate access to secondary education, in order to increase the average level of qualifications in the whole country.

Tertiary Education

The percentage of students accessing tertiary education is steadily increasing in developed countries, reaching as much as 70% of the class of age; although in most cases this fraction is much lower (40 to 50%). We consider that the challenges of the new society require this number to be as high as possible, no effort being spared to attain this objective.

Tertiary education usually covers a more vocational-oriented stream, of relatively short duration (typically 1 to 2 years) aiming at a quick entrance in the market of employment; and the higher education stream, including institutions of varied natures, with or without a component of scientific research, which makes most of the difference between universities and other kinds of organisations.

Duration of programmes depends on the type of certificate, diploma or degree they correspond to; in the case of degree programmes, there is a succession of more and more demanding levels of knowledge, from Bachelor to Doctor. However, there is a visible trend in the sense of reducing the overall duration of degree programmes, by allowing intermediate steps to be bypassed under certain conditions.

In developed countries, it is the system of higher education, which suffers the strongest pressure, both from governments and public opinion, to increase their capacity.

New challenges for higher education

To remain tuned to the changes in society, higher education institutions need to face a number of difficult problems, in order to:

- Increase the yearly output of graduates. This requires increasing the input, without loss (and, if possible, with a gain) of productivity, measured in terms of the average number of years spent by students until graduation.
- Adapt programmes, curricula and contents to the foreseeable needs of society, avoiding future unemployment of graduates;
- Adjust learning strategies to mass (rather than élite) education;
- Keep abreast of technological, methodological, social and cultural changes and innovations;
- Adopt large-spectrum, rather than specialised curricula in first-level degree programmes;
- Consider trans-disciplinary subjects as much as disciplinary ones in curriculum development;
- Introduce more emphasis on curricular flexibility (credit mechanisms);
- Consider information and communication technologies and foreign languages as compulsory subjects, whatever the programme;
- Develop students' capacity for self-learning.

Moreover, universities should intervene more visibly in the fields of continuing education and training, in teacher training and in training of trainers, so as to use their full potential in the support of the educative and training systems. On the other hand, they will have to face the fact of the emergence of non-conventional ways of teaching and learning, implying a new approach to pedagogy and didactics.

Distance education and self-learning

The success of open universities and other distance learning institutions has shown that, besides the conventional way of classroom teaching, a strong component of self-learning can produce identical and, in some cases, better results. This stems from the fact that individuals possessing a strong motivation and having access to quality learning products can learn by themselves, even if sometimes there is a need for some interaction with different kinds of student support mechanisms.

This is true in formal education at all levels, in training activities and in continuing education and training, as many successful experiences in all regions of the World have shown.

There is also evidence that very young children can learn without the visible support of a teacher and may develop astonishing and even sophisticated skills just through a trial-and-error, intuitive approach to problem-solving -- provided they have enough motivation to do so.

It so seems that the natural human capacity for self-learning have been either ignored or underestimated

in conventional pedagogy and that new perspectives on this subject are in order. This fact may have solved the dilemma between the need for increasing student numbers in all levels of formal education and the limited human and financial resources available to accomplish this purpose. It is a fact that introducing a component of distance learning in a situation of quantitative expansion in education and training systems will reduce the need for a comparable increase in the number of new teachers, new classrooms and new running costs.

This is one of the reasons why a large number of conventional higher education institutions, all over the World, have launched new streams of distance learning, either for special programmes or for special categories of students. This is called *dual-mode* of operation, as opposed to dedicated institutions operating in a pure distance teaching way, or *single-mode*. We believe, however, that a third model is better adjusted to future needs in education and training. It is based on the idea that, for all students and for some of the subjects in a given programme, a distance learning method will be mostly used, while conventional classroom teaching will address subjects implying a strong component of experimental or laboratory work. This will be called the *mixed-mode* operation, already widely used in a in-service training context.

Requirements of distance learning operation

We shall use the acronym ODL (Open and Distance Learning) to encompass all kinds of situations wherein a component of self-learning is present in student activities. As a general description, a ODL initiative requires the following functionalities:

- Conception and publishing of quality learning materials, specially developed for self-learning;
- A distribution network, able to place these materials in the hands of the users, just in time;
- An administrative structure, able to deal efficiently with all contacts with students (including the provision of timely and accurate information);
- A student support network, designed to provide students with scientific and pedagogic information, as well as giving advice and orientation;
- A mechanism for assessment and accreditation of results obtained;
- A monitoring mechanism, to assure overall quality.

To put things bluntly, it is not enough to provide students with learning materials and to expect them to make the most of it; nor it is acceptable to put texts in the Web and hope that students learn from them, without any kind of underlying pedagogic strategy and a minimum of interaction with the teaching system.

Technology and pedagogy

Information and communication technologies are ideally suited to improve the performance of ODL systems -- but they cannot be the sole assets in designing such a system. Dual- and mixed-mode higher education institutions benefit from the existence of qualified scientific and pedagogic staff, formerly dealing with just a conventional way of teaching, but who can adjust rather quickly to the ODL operation. The corresponding institutions possess also a previous administrative structure and, probably, good communication facilities. This means that, in these conditions, the adoption of a ODL stream of operation do not require a heavy initial investment.

Nevertheless, there is a need for something like a change of cultural outlook, so that the population of students who follow the ODL mode do not feel neglected or plainly ignored, as compared to the attention given to students taught in the conventional way.

The conception of learning materials needs to take into account the isolation of the distance learning student. Materials should be self-explanatory, user-friendly and attractive, all difficulties in the learning process having been anticipated by the contents specialist. Some amount of "virtual" interactivity is usually introduced within the materials, like proposals of tests, proposed activities, etc.

Perhaps the concept of interactivity is a key one in ODL operation. We do not mean that all materials should be interactive, as in learning computer software, but that students need to have some channels of possible contact with the teaching system: it can be video-conferencing, computer-conferencing or plain e-mail; but also telephone, fax, mail and face-to-face sessions.

As a conclusion, technology can improve the operation of an ODL system, but it is not enough to make it adequate in terms of actual learning.

Continuing education and training

There is no possible way to provide lifelong learning to the population of a country just by using the existing conventional education and training organisations and institutions: there are just too much people in frequent need of updating, upgrading and re-conversion of qualifications.

The answer is, of course, the ODL approach, be it in single-, dual- or mixed-mode. Knowledge institutions, like universities and R & D Centres, have an important role to play (even if they are not directly involved in continuing teaching and training) by providing updated and advanced contents, to be used by all the direct operators in the field.

The expansion of opportunities for continuing learning is one of the more important strategies in human resource development, for it provides increased competitively to productive organisations, while playing the role of personal insurance against endemic unemployment.

Very special cases are teacher training and the training of trainers, that should be taken care of by higher education institutions, for they provide the necessary multiplying power to the whole process of increasing the average level of education and qualification in a country. The process of providing frequent opportunities for updating contents and methodologies for teachers and trainers is a most important one.

While the strength of the educational system and initial training organisations is of the highest importance, the credibility and coverage of continuing education mechanisms show that we care about our future.