

Personal View: Knowledge Deficit in Modern Societies

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There is an urgent need for a European system of continuing engineering education. Continuing education, which is basically a system of knowledge access to all, at any time, needs to be supported and justified by a natural demand, not artificially created. That demand needs to be understood in its fundamental and basic principles. A small contribution to that understanding is presented, arguing briefly about the concepts of knowledge and power, to conclude that general access to knowledge is inevitable and that universities should take seriously their role and responsibility, and exercise their share of power by taking a lead in the process of building a continuous education system.

INTRODUCTION

CONTINUING education will have to be structured as an extension of the traditional higher education system, with the participation of those institutions which are relevant to each specific area. In the field of engineering, universities, industry and engineering professional organisations will have to come together, within some loose or formal institutional agreement, in order to contribute to the structuring of continuing engineering education.

Continuing education, which is basically a system of knowledge access to all, at any time, needs to be supported and justified by a natural demand, not artificially created. It is important, then, to understand fully the characteristics of that demand, in both the short and long term.

A small contribution to that understanding will be presented, arguing briefly about the concepts of knowledge and power, to conclude that general access to knowledge is inevitable and that universities should take seriously their role and responsibility, and exercise their share of power by taking a lead in the process of building a continuous education system.

THE VALUE AND POWER OF KNOWLEDGE

From the 17th century onwards, when the bourgeoisie of Western, Central and Northern Europe developed the concept of work, as a new and fundamental value, the rate of wealth accumulation has been increasing. During the development of the industrial society the transformation of raw materials and manufacture of goods involved an increasing part of the work force; from the second half of this century more people are working in services than in industry (during the present

decade services will have twice as many people as industry and agriculture together). As services deal primarily with information, this led to the so-called information society. Another important and new value emerged, the value of information. More recently, the access and processing of information enabled the development of new technologies that have allowed an extraordinary increase in productivity, for the capacity of analysing reality through very complex models and algorithms, and for important advances in the understanding of physical, human and social systems. The process is now leading changes in our world and is responsible for the emergence of a new value, knowledge, which is here understood as the capacity of processing information and producing new concepts in a way that society may retrieve and use.

As an example, it might be said that what is important today is not to own a machine, or a process, or an algorithm, which is equivalent to having access to a certain amount of information and know-how, but to have the capacity to build and develop that machine, process or algorithm. That development capacity is only possible if society has the appropriate knowledge. It is not enough to own the know-how; you have to have the knowledge.

Epistemologists say that, up to a certain level, the history of knowledge is the history of mankind and so knowledge accumulation seems to be a natural process, meaning that without any specific effort and no necessary reason, individuals, societies and civilisations always accumulate knowledge. Indeed, the accumulation of knowledge is a natural human need and, as such, a basic pleasure, like eating or moving.

If there is any doubt that knowledge accumulation is natural and basic and perhaps the most vital process, it should be remembered that from the beginning of history, power is exercised through

the control of basic needs, like knowledge access, life, food and population growth. The oldest history book starts with the most frightful rule to the common man: '... of the tree of knowledge of good and evil thou shalt not eat of it: for in the day that thou eatest thereof thou shalt surely die' [1]. In the New Testament, St. John states that 'In the beginning was the word, and the word was with God, and the word was God' [2]. Knowledge itself and the exercise of power, through the control of the access to knowledge, seems to be a prime concern of all societies.

It is thus possible to state that, as happened during the industrial society, when 'the right to work' was developed, our society will soon impose 'the right to know'. There will be strong forces to push for a wider and generalised access to knowledge, because society will depend on it, as it still depends today on work and information.

Now, it might be concluded that if the will to learn is a natural desire, a common need, then the possibility for it should exist, to a certain degree, at all ages, everywhere, for all types of profession and occupation. Then, society's aim of open and easy access to knowledge is a very natural one. So, the demand for more knowledge is and will always be here.

And who has the will, the capacity and the power to respond to that demand?

Ontologists say that power is part of being and so its presence is intrinsic to society. In our democratic systems, power is decentralised as never before in the history of civilisations. Today, the evolution of democratic systems seems to point to the increasing importance of civil society, where universities are recognised as important institutions. Universities and the higher education sector as a whole will thus have to play a decisive role to help and promote a generalised access to knowledge, because no other institution has so much know-how on this matter and has for so long accumulated so much knowledge.

THE KNOWLEDGE DEFICIT

The first symptoms were noticed during the 1980s, when there was a simultaneous increase in Europe of both the unemployment rate and the jobs on offer. This meant that unskilled and old-fashioned labour was less in demand and there was not the appropriate supply of skills: a deficit of knowledge and a clear inadequacy between the labour and education systems [3].

During the current recession workforce reductions in Europe, in 1991 and 1992, were very important: automobile and railway industries, 50,000; aerospace industries, 22,000; telecommunication operators, 50,000; etc. Most of these jobs were lost permanently, which means that old skills will have to be substituted by new ones [4]. This implies learning opportunities.

During the 1980s the number of students in

Europe declined by 7% and the workforce increased almost 10% [5,6]. These figures alarmed politicians who needed to fulfil their voters' expectations. It resulted in new national policies to expand and reformulate the higher education sector: in one direction, transforming it into a mass education system, and in a second direction, keeping the education of élites.

Aside from the traditional public and private higher education sector, a new system of education is already emerging, dedicated to vocational training. It is in the process of being structured in most Western countries, with specific budgets, EU funding and typically independent of the national ministries of education. These new systems represent the reaction of society to the difficulty that traditional higher education has had in responding, in the short term, to the knowledge deficit. It is a common and repeated criticism of universities.

But was it wise or possible at all for the education system to respond, as the industrial world wanted [7]? During the last years of the 1980s the need for new electrical engineers was said to be for a 20% increase; during the current recession it is said to be less than 2%. An enormous change in two or three years. As can be seen, there were good reasons for the traditional higher education system not responding with the amount of flexibility in the short term the industry wanted. Let us look further into this problem.

The knowledge accumulation process for an individual's lifetime has been traditionally divided in two parts: the learning period and the professional period. The former is supposed to give the appropriate level of general information, a specific and deeper level of knowledge and some degree of skill's capability; it is a process where the individual is the prime actor and is characterised by information accumulation and the development of abstract thinking and analysis. It is mostly passive, theoretical and individualistic and it primarily applies to the youngest. It is a long-term investment. The latter is typically of a narrower spectrum, is skill's development oriented, synthetic, is mostly organised in team work and is more of a practical kind. It is what is called professional experience.

As such, the first part cannot and should not respond in the short term. On the other hand, it is obvious that a short-term response capacity is absolutely necessary.

These two parts in an individual's knowledge accumulation process are basically adequate to the present and future needs of society. The necessary transformation of the higher education sector is more of an extension type than of an internal change: to reduce slightly the number of years of full-time students and to extend the offer of short courses for all professionals throughout their lives. This second part corresponds to and implies the structuring of a new continuing education system.

The scenario I am thinking of, in its main strategic lines, for the higher education sector, is the following:

- For the traditional higher education system
 - To improve its efficiency and quality.
 - To improve its interaction with other parts of the society.
 - To reduce the time students are exclusively within the system. However, this reduction must only be done at the same rate as a new continuing education system is structured, not before and not independently of it.
 - To increase its capacity.
- For the new continuing education system
 - To be built with the traditional higher education system and other relevant actors in the society, like industry and services.
 - To be compatible with transnational professional qualification systems.
 - To be highly flexible with an appropriate credit system.
 - To be accredited by the relevant society actors and not only by the state.

CONTINUING EDUCATION AND THE 4TH FRAMEWORK PROGRAMME [8-12]

From the Treaty of Rome in 1957 to Maastricht, no European common policy in education has been built. On the other hand, an enormous effort has been made in the areas of vocational training and continuing education. In the Maastricht summit further incentives were proposed.

The new Commissioner, Professor Ruberti, announced that for the 4th Framework Programme there is space to build two main programme areas, one in training, one in education. There is a need for an open European space for training, related to professional mobility and qualifications, a space that will have to be built with two important ingredients: quality and innovation capacity. One of the important objectives will be to develop European digital telematics networks to support education and training.

Some of the European Commission DGs have already defined education and training related programmes.

From *DG XII*, within the specific programme 'Recherche Socio-Economique Finalisée', there will be three strands, the second dedicated to research on education and training. Here, two areas will be considered: (i) problems common to all member states—the common market, new qualification needs and internal development; (ii) innovation in education and training methodologies—tools, psychological, pedagogical and organisational aspects and quality management. This strand will have a budget of about 20–25 million ECUs.

From *DG XIII*, within the area of telematics applications, one of the four strands will be dedicated to the knowledge infrastructure for researchers, education and training, and libraries. Here, four fields will be covered: (i) developing telematics services; (ii) distance teaching and telematics applications; (iii) *in situ* vocational training and related problems; (iv) virtual environment techniques for educational purposes. This strand will have a budget of between 500 and 1000 million ECUs.

Also, it seems that it has been already decided that the Task Force for Human Resources will continue to be responsible for programmes in this area, following the lines of their previous experience and, finally, there will be *structural funds* for education and training, especially important for regions like Portugal.

For those who want to contribute to build a system of continuing education in Europe, as we can see, there will be plenty of funding opportunities in the next four years.

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THE KNOWLEDGE DEBIT

The knowledge debit is the difference between the knowledge available in a country and the knowledge required for that country to maintain its present level of economic activity. It is a measure of the knowledge gap between a country and the world. The knowledge debit is a function of the country's economic activity, its population, and its technological level. The knowledge debit is a measure of the knowledge gap between a country and the world. The knowledge debit is a function of the country's economic activity, its population, and its technological level. The knowledge debit is a measure of the knowledge gap between a country and the world. The knowledge debit is a function of the country's economic activity, its population, and its technological level.

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