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## **AT THE CENTRE OF THE BOLOGNA PROCESS: DO EUROPEAN UNIVERSITIES TRAIN THEIR STUDENTS TO FACE KNOWLEDGE-BASED SOCIETIES?**

*Jean-Jacques Paul\**

It is generally agreed that the two main functions of universities are to transmit high level knowledge and to produce new knowledge. For centuries, these two functions have been performed in a context where only a small share of an age cohort attended higher education institutions. After the Second World War, this context changed radically, when higher education began to face a more or less continuous growth, this led to a situation where, in the developed economies, more than 40% of the young generation attended third level institutions (cf. TEICHLER, 2000).

This evolution has corresponded to the necessity to train young people for a diversity of careers and professions that appeared with the development of economies during the XX<sup>th</sup> century. Nevertheless, the permanent and stable growth enabled the well-established contents of jobs to continue. The traditional assembly-line organisation of work relied on both submitted workers with narrow predefined tasks and on managers using well-established frameworks learned at schools. Professionals evolved in structured and planned environment, based on a predictable demand.

The present knowledge-based economy imposes new challenges on higher education, which can be made explicit with reference to the characteristics of this new environment. The main purpose of this paper is to assess to what extent universities are ready to face challenges imposed by knowledge-base economies. This issue can be studied in taking into account

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one of the functions of the university, i.e. the initial training of highly qualified manpower.

This new environment is being tackled in Europe through the so-called Bologna process and the Lisbon strategy. There is clearly a link between the two processes. The first one aims at creating a new European higher education system able to cope with the knowledge-based economy promoted by the Lisbon strategy. One of the main features of the Bologna process is to put the stress on outcomes of higher education institutions, rather than on inputs. Faculty have to be more and more aware of the outcomes of their teaching activities, rather than of the contents these activities. Since the knowledge-based economy requires new competencies allowing graduates to cope with the new features of its economic process, the outcomes of higher education institutions have to be considered through the production of these new competencies.

How can we define briefly the main features of the knowledge-based economy?

According to Foray (2000; 2004), knowledge-based economies are at the meeting point between a continuous growth of investments and activities devoted to the «knowledge» on the one hand and a revolution of production techniques and transmission of knowledge on the other. This mutual consolidation between the development of knowledge-intensive activities and the production and the diffusion of information technologies can lead to new organisational models. The emphasis of new organisational models is reinforced by the globalisation of the economies, which enable their diffusion.

Knowledge-based economy requires a larger proportion of workers to be involved in highly qualified jobs. In countries such as France or the United Kingdom, the proportion of these jobs doubled, from 1970 to 2000 (approximately from 15% to 30%). In highly qualified occupations, a greater participation of workers is needed in decision-making within the organization of work. Of course, they use intensively information technologies such as computers and resources offered by the web.

All these evolutions implies higher education develops new competencies, linked to information technologies but above all enabling graduates to evolve

in a changing world. These competencies rely on behavioural features, such as adaptability, problem solving ability, leadership, etc.

As a consequence of such an evolution, initial training is no more conceived as preparation to specific occupational slots, but rather to provide workers with the basic tools enabling them to adapt themselves to varying occupational needs. This evolution is not a recent one and Thurow (1975) pointed out that workers had to learn how to perform their occupation on the job, rather at school and this was the reason why employers looked for educated individuals, who had learnt to learn and who were thus able to learn rapidly the content of their job. Nevertheless, such a vision had as a consequence to define training according to competencies more than according to occupations. This is a first step for a radical change in education systems in general and in universities in particular. However new kinds of competences linked to work organisation in the present world are not only defined in terms of capacity to learn but also in terms of capacity to perform within collective units. In the latest case, the definition of the tasks is based on cooperation and mutual understanding rather than on authoritarian ascription.

In addition, this modern conception of education leads to a new vision of the traditional human capital models. Many early papers of economics of education tried to determine the rate of return to investment in education [see for instance Becker (1964)]. In these pioneering developments, education, training and experience were supposed to increase human capital, and therefore the individual productivity. Nevertheless, human capital was measured using a rather rough method, by the number of years of education and training and by the number of year of experience. The stress on competencies leads to define education and human capital, no longer by a variable describing a process, the number of years, or even the degree, but by a set of variables describing the results of the educational process, i.e. the different competencies acquired by the educated workers.

## **I. GENERAL FRAMEWORK**

### **I.1. Presentation of the study**

From autumn 1998 to spring 2000, about 36,000 graduates from 9 countries in the European Region (Austria, Finland, France, Germany, Italy,

the Netherlands, Spain, Sweden United Kingdom), one EFTA country (Norway), one of the Central and Eastern European countries in transition (the Czech Republic) and one economically advanced country outside Europe (Japan) provided information through a written questionnaire on the relationship between higher education and employment four years after graduation. Thirteen research institutions have been involved in this project, initiated and led by Ulrich Teichler.

The project can provide some answers (by comparing between the twelve countries the labour market prospects for their graduates) the quality of the study provision, the acquired and the required competencies, the appropriateness of higher education.

## **I.2. The typology of competencies**

Graduates were asked to state in respect of a list of 36 competencies the extent to which these were required in their current work as well as the extent to which they had acquired these competencies at the time of the graduation. The question was «Please, state the extent to which you had the following competencies at the time of graduation and to what extent they are required in your current work. Scale of answers from 1= ‘To a very high extent’ to 5= ‘Not at all’». These 36 competences can be split into three main sets (the complete list of competencies is given in the appendix): theoretical knowledge, practical knowledge and behavioural knowledge.

Theoretical knowledge involves four competencies such as «broad general knowledge», «field-specific theoretical knowledge». Practical knowledge is described on the basis of seven competencies among those «written communication skills», «foreign-language proficiency», and «computer skills».

For behavioural knowledge, two levels have been taken into consideration, the individual level, which refers to the direct link between the worker and the tasks he/she has to perform, and the collective level, which considers the worker as a member of a work organisation. At individual level, seventeen competencies are rated, such as: «problem-solving ability», «working under pressure», «time management», «fitness for work», «power of concentration»

At collective level, eight competencies are described such as: «taking responsibilities and decisions», «working in a team», «planning, coordinating and organizing», «leadership».

This simple classification can be compared to the one proposed by Lundvall and Johnston (1994), which distinguishes four main types of knowledge:

- Know-what: substantive knowledge and knowledge about facts
- Know-why: understanding of basic principles and laws of nature
- Know-how: human skills and competences necessary to act intelligently in a complex and changing environment
- Know-who: social capability to cooperate, to communicate and to establish trust relationships.

Since our typology of competences is not specified to one specific occupational area, it does not refer to precise competencies describing the «know what». Probably, our theoretical knowledge corresponds to the know-why, whereas practical knowledge shared some features of know-why and know-how. The stress on behavioural competencies allows to assess to what measure universities are able to cope with dimensions that do not refer to the traditional dimensions of knowledge. Our individual behavioural competencies correspond to part of the Lundvall and Johnston's know-how, whereas collective behavioural competencies can be understood as their know-who.

### **I.3. Typology of modes of teaching and learning and of study provisions and study conditions**

The modes of teaching and learning are described by the answers at the question «If you look back to your course of study you graduated from in 1994 or 1995, to what extent were the following modes of teaching and learning emphasised by your institution of higher education and its teachers? Scale of answers from 1 = 'To a very high extent' to 5 = 'Not at all'.

Twelve items were proposed to be rated, for instance «Independent learning», «Regular class attendance», «Project and problem-based

learning», «Direct acquisition of work experience» (see the detailed list in appendix).

Regarding the study provisions and study conditions, graduates had to answer the following question: «How do you rate the study provision and study conditions you experienced in the course of study? Scale of answer from 1='Very good' to 5='Very bad'». Eighteen items were proposed, such as (see the appendix for a complete list) «Course content of major», «Variety of courses offered», «Design of degree programs», «Practical emphasis of teaching and learning», «Provision of work placements and other work experiences», «Quality of technical equipment (e.g. PC, measuring instruments, etc.).

«We shall now consider to what extent these different competences are acquired during the study period and are required by the occupational context, through the answers given by the graduates in the survey.»

#### *a) The value of competencies*

The basic model relies on a classical Mincerian approach, where the logarithm of earnings is regressed on the school years required to get the degree, (the repeated years or the years devoted to other activities than study are skipped). Professional experience refers to the duration of employment after school leaving.

On top of these two variables, the model includes the answers regarding the competencies declared by graduates at the moment of the graduation. For each one of the 36 competencies, the graduate could rate the intensity of the acquisition from 1 (to a very high extent) to 5 (not at all).

The model gives information corresponding to usual results: earnings grow with experience, the theoretical time to degree, age and the total working weekly hours. Females earn less than males. The graduates in management receive the highest earnings, while those in humanities and social sciences receive the lowest.

But the most interesting result regards the most valued competencies, and then the most required.

	Non standar- dised coefficients B	Standard deviation	Standar- dised coefficients Bêta	T	Signifi- cance
(constante)	2.976	.078		38.2 20	.000
Spain	-.181	.018	-.093	- 9.78 4	.000
France	.333	.016	.230	20.9 28	.000
Austria	.450	.016	.280	27.3 94	.000
Germany	.628	.015	.440	40.8 8	.000
Netherlands	.326	.017	.194	19.2 35	.000
United Kingdom	.509	.017	.349	30.0 33	.000
Finland	.445	.021	.191	21.1 61	.000
Norway	.661	.015	.484	43.4 22	.000
Italy (reference)					
Experience (years)	3.631E-03	.000	.109	13.2 46	.000
Gender (female=1; male=0)	-.129	.008	-.129	- 15.5 16	.000
Birth year	-7.411E-03	.001	-.064	-7.65 7.65 8	.000
Weekly working hours	8.391E-03	.000	.163	20.3 41	.000
Social Sciences	5.172E-02	.015	.032	3.42 4	.001
Management	.171	.014	.132	12.4 91	.000
Law	5.712E-02	.017	.030	3.37 1	.001
Natural Sciences and Health	.104	.012	.089	8.46 3	.000



(Continuación)

	Non standar- dised coefficients B	Standard deviation	Standar- dised coefficients Bêta	T	Signifi- cance
Engineering	.157	.013	.133	11.9 55	.000
Humanities (reference)					
Theoretical Time to Degree	4.293E-02	.005	.075	8.91 2	.000
Foreign language proficiency	1.156E-02	.004	-.026	- 3.08 6	.002
Computer skills	-1.984E-02	.004	-.046	- 5.33 5	.000
Economic reasoning	-1.118E-02	.004	-.025	- 2.99 0	.003
Analytical competencies	-1.082E-02	.005	-.020	- 2.31 7	.021
Learning abilities	-1.310E-02	.005	-.020	- 2.39 2	.017
Adjusted R2	0.415	.000			

An Explained Variable: Logarithm of yearly gross earnings (Kilos Euros).

Computing competencies appear first, followed by foreign language proficiency. Three other competencies seem to be associated to higher earnings: economic reasoning, learning abilities and analytical competencies.

These competencies are probably not required with the same intensity in every occupational situation. This is why it is interesting to identify those that are most valued according to the occupational situation in the knowledge society.

**TABLE 1. Earning models by occupational groups with competences**

	<b>Beta</b>	<b>Signification</b>
<b>Symbolic analysts</b>		
Foreign language proficiency	-.043	.002
Computation skills	-.028	.039
Analytical competencies	-.035	.008
Learning abilities	-.033	.013
Other variables of the basic model		
N	3871	
Adjusted R2	.443	.000
<b>Civil servants</b>		
Ability to apply rules and regulations	-.076	.000
<b>Other variables of the basic model</b>		
N	1634	
Adjusted R2	.370	.000

If we follow Reich (1991), we can consider as examples of two groups of different occupations, the symbolic analysts and the civil servants. The «symbolic analysts» exchange data, words, oral and visual representations. They belong to categories such as engineers, attorneys, scientists, professors, executives, journalists, consultants and other «mind occupations» engaged in processing information and symbols. they concern all the activities linked to problem solving, problem identifying and strategic brokering<sup>1</sup>.

Thus, amongst the occupations of symbolic analysts, foreign language proficiency, analytical skills, learning abilities and computing skills are the most remunerated. The results concerning the public sector occupations reveal, in a near surprising way, as it is so pertinent, that the most valued competencies are «ability to follow rules and regulations».

<sup>1</sup> A detailed presentation of the construction of our occupational categories is given in Paul (2004).

*b) Acquired and required competencies*

Altogether, the responses to this question show that graduates observe high job requirements in a broad range of tasks. On average, 24 of these competencies (amongst the 36 proposed in the questionnaire) are considered required to a high extent in their job by at least two thirds of the graduates. Nevertheless, the same criteria reveals that graduates consider themselves qualified in only five areas.

This analysis uses the answers of all the individuals. An alternative could have been to focus the attention on only individuals who occupy jobs directly linked to the production and transmission of knowledge. Though this vision would be fruitful to identify the competencies that are probably most linked to knowledge-based economies, it appeared too narrow, since every worker and every citizen, willingly or not willingly, has to evolve in this new context.

*b.1) What is the most required and the most acquired competencies?*

The most required competencies refer to broad skills rather than to field-specific knowledge items. These latter items are considered highly required by 60% of the graduates, well under the proportion of 80% or more for generic skills such as problem-solving ability, oral communication skill, working independently, working under pressure, taking responsibilities and decision, working in a team, and adaptability.

According to our criteria, graduates consider themselves qualified in only five areas: learning abilities, power of concentration, working independently, loyalty-integrity, and field-specific theoretical knowledge. The highest rated competency, «learning abilities» is also highly rated amongst the most required competencies but only at the 17<sup>th</sup> rank. A large difference between Europe and Japan can be noticed for two competencies, «learning abilities» and «working independently». If 72% of European students believe they have been trained to work independently, only 31% of Japanese graduates express the same feeling (respectively 83% and 55% in the case of «learning abilities»), which may indicate that young Japanese are not properly prepared to evolve in organisations where workers need to adapt themselves to knowledge requirements. Such a situation may not offer

the possibility of using the potentialities of new modes of production. As Carnoy (1995) states, «the highest payoff to human capital comes when labour is participate in making decisions, and that the advent of flexible production rewards endogenous innovation and learning-by-doing».

**TABLE 2. Competencies at Time of Graduation in 1994/95**  
(percent «high»; responses 1 and 2)

	<b>European Union</b>	<b>Japan</b>	<b>Mean</b>
Learning abilities	83	55	80
Power of concentration	72	62	71
Loyalty, integrity	68	70	68
Working independently	72	31	68
Field-specific theoretical knowledge	67	53	66

*b.2) What is the most under-produced competencies?*

In order to detect the competencies most under-produced by higher education, we can consider the difference between the proportion of graduates who declare a given competency to be required to a high or a very high extent, and the proportion who also state the same competency acquired to a high or a very high extent. The mean of this difference is 20% with a standard deviation of 10%. We will thus consider the competencies with a difference between the two proportions that is higher than 30%.

Six competencies can be considered as particularly under produced by higher education. Four of them are related to the skills used by the individual worker in implementing their own tasks: problem-solving ability, working under pressure, time management, and computer skills. The other two cover the collective management of tasks: taking responsibilities and decisions, planning, co-ordinating and organising.

**TABLE 3. Proportion of responses 1 and 2 for competencies under-produced**

	<b>European Union</b>	<b>Japan</b>	<b>Mean</b>
Problem-solving ability	58	39	56
Working under pressure	55	36	53
Taking responsibilities, decision	48	29	47
Time management	45	33	44
Planning, co-ordinating and organising	39	18	37
Computer skills	31	29	31

We can make two distinctions: first competencies which are largely developed, such as problem-solving ability and working under pressure, but not sufficiently in terms of the requirements (which are particularly high), second competencies which are clearly under-produced such as planning, co-ordinating and organising, on the one hand and computer skills on the other. Except for Computer skills, Japanese higher education appears to under-produce most of the competencies considered in this table.

Such a vision is confirmed if we consider the differences between the proportions of graduates who stated high required and high acquired for each competency.

In six countries, higher education appears clearly to produce two of the very highly required but generally under-developed competencies, «Problem-solving ability» and «Working under pressure». This group is mainly composed of countries of the northern part of Europe, such as Sweden, Norway, Finland, The Netherlands, the United Kingdom, Germany and Austria. On the contrary, such competencies are obviously under-developed in Japan. British, Spanish, Italian and Dutch universities also train students in time management.

There is a large lack of computer skills, especially in South European countries such as Italy, Spain and France. This lack is smaller in the United Kingdom, in the Netherlands, in Finland and in Austria.

**TABLE 4. Position of the countries regarding the production of under-produced competencies (individual tasks)**

	Under-produced competencies (individual tasks)				Under-produced competencies (collective tasks)	
	Problem-solving ability	Working under pressure	Time management	Computer skills	Taking responsibilities, decision	Planning, co-ordinating and organising
Sweden	75	68	32	29	62	54
U.K.	65	67	55	41	61	37
Netherlands	64	56	49	39	53	33
Norway	64	62	44	33	51	31
Germany	59	56	38	32	51	46
Finlande	59	54	43	37	49	51
Austria	58	59	44	36	47	38
France	52	48	45	24	46	41
Spain	51	37	54	21	39	39
Italy	47	51	50	20	39	18
Czech Rep.	41	46	36	30	38	35
E.U.	58	55	45	31	48	39
Japan	39	36	33	29	29	18

If we look at competencies related to the collective organisation of work, Sweden, Norway and the United Kingdom appear to train their students to take responsibilities and decisions and to plan, co-ordinate and organise the tasks. Spain and Italy, which are lowly rated for many competencies, seem to train better their students in this respect. Japanese graduates feel themselves ill-prepared in these dimensions.

c) *The relation between the modes of teaching and learning, the provision of study and the competencies acquired*

Is there any relation between the modes of teaching and learning, the provision and conditions of study on the one hand, and the competencies produced by higher education? Do the countries, which appeared to produce more the competencies required by knowledge-based economies, implement more a certain type of provision of learning and teaching?

In order to study such a relationship, the correlations between the variables of the two dimensions (modes of teaching and competencies) have been systematically computed amongst the 35000 interviewed graduates.

In this article, we will insist on the behavioural competencies that one considers to be under-produced (compared to the needs the graduates face in their job), i.e. «problem-solving ability», «working under pressure», «time management» in the case of individual tasks and «taking responsibilities, decision», «planning, co-ordinating and organising» in the case of collective tasks.

**TABLE 5. Modes of teaching and learning, types of provision of study which have a major impact on the under-produced competencies, and related countries**

Modes of teaching and learning, types of provision of study	Influence upon under-produced competencies		Countries providing more
	Individual level (1)	Collective level (2)	
Attitudes and socio-communicative skills		X	Netherlands, United Kingdom, Norway
Project and problem-based learning	X	X	United Kingdom, Norway
Independent learning	X	X	Italy, Netherlands, United Kingdom, Finland, Norway
Direct acquisition of work experience		X	Sweden, Netherlands, Norway
Practical emphasis of teaching and learning	X	X	Netherlands, United Kingdom

**TABLE 5. Modes of teaching and learning, types of provision of study which have a major impact on the under-produced competencies, and related countries**  
(continuación)

Modes of teaching and learning, types of provision of study	Influence upon under-produced competencies		Countries providing more
	Individual level (1)	Collective level (2)	
Teaching quality	X	X	United Kingdom
Course content of major	X		United Kingdom

(1) «problem-solving ability», «working under pressure», «time management»

(2) «taking responsibilities, decision», «planning, co-ordinating and organising»

This table have been produced in considering the highest correlation levels between modes of teaching and competencies ( $\alpha < 0.01$ ),  $N=35349$ .

It appears clearly that some kinds of mode of teaching and learning and of provision of study are more appropriate for the development of the competencies required by knowledge-based economies. Thus, project and problem-based learning, independent learning, practical emphasis of teaching and learning, teaching quality, are features which enable the development of behavioural competencies both at individual and at collective level. Whereas the course content of major seems to be more influential at the individual level. Finally, the emphasis on attitudes and socio-communicative skills and on direct acquisition of work experience stimulate competencies appears useful at a collective level.

The same evidence illustrates that some national higher education institutions provide more systematically students with the required competencies, because they use adequate modes of teaching and learning, and provision of study. This is the case of Nordic countries (Norway, Sweden) and of the United Kingdom. Graduates of other European countries and of Japan do not seem so well-prepared for the challenges imposed by knowledge-based economies. Consequently, universities and other higher education institutions should promote an assessment of their teaching practices and should assess to what extent they are adapted to the competencies required by contemporary societies.



## II. CONCLUSION

One cannot ignore the fact that universities are not changing. In all developed countries, there have been numerous reforms in their systems of fund allocation, in their internal government, in the way they enrol new students, in the relationship with companies and other external stakeholders. These changes had to be taken in order to face the increasing demand for higher education. However, the main part of these evolutions has been conceived in order to respond to quantitative pressures, which required more resources and more efficiency in the use of these resources. Contemporary challenges are different. In these countries, because of the stabilisation or even the decrease in the size of the young cohorts, more attention can be given to qualitative rather than to only quantitative adaptation. Indeed, contemporary economies require competencies that suppose new modes of teaching and learning.

Nevertheless, to some extent, it may be more difficult for universities to promote qualitative evolutions than quantitative ones. Qualitative evolutions mean changes in the way of teaching and learning, i.e. in the way in which many academics work. Are they ready to change? Since academic work relies on autonomy and self-control, what incentives could be implemented in a world where the professional careers depend more on research results than on the performance of students?

Given that there appears to be, on the one hand, a general lack in the production of skills most sought after by today's companies and on the other the fact in certain countries the situation seems better, should force us to consider how higher education institutions should change.

In the first instance, the learning system should no longer be based on the transfer of tacit knowledge through classes, teachers and libraries, and free choice of courses (as in the German model) or based on codified knowledge, but rather explicit competencies to be acquired. Traditional models such as the Humboldtian one (for instance) suppose that students will implicitly acquire the competencies required through independent research and learning. The hidden curriculum which has prevailed for a long while, could be operational as long as most students belonged to «les héritiers», who grew up in a milieu where they are used being autonomous, where taking

initiative was part of their education. At this period, the occupational world was directly linked to the academic world; universities trained for self-reproduction of academia, for high administration and had few contacts with companies and business world.

The world changed however. Many students have parents who have not been acquainted with higher education, most students have studied at a period of mass education, where a more industrialised way of teaching and learning based on prescriptive tasks. This opening of higher education also took place during a period of changes in the social relationship of production. As far as both students and employers are concerned, universities need to change from a traditionally opaque definition to a more explicit definition in terms of competencies.

Probably, it is time to move from curricula based on tacit knowledge to explicit presentation of competencies required to obtain the different degrees, first degree, master's degree or doctorate; in the same way, the contents of the different subjects should be presented in terms of competencies produced. Such practice is not so original for vocational training, but it seems rather new for traditional universities.

Another issue regards the teacher training of professors. Generally, they are not trained before facing students in a classroom, unlike primary and secondary school teachers. New professors have to improvise their role, and consequently, the easiest way relies on lectures based more on contents than on competencies to be developed. Therefore, the development of university teaching and learning centres has to be promoted, whose functions are to develop new teaching and learning methods, to train professors, to develop the use of teaching assessments.

The third dimension is assessment. Continuous assessment of teaching should enable courses contents and teaching methods to be properly questioned. Certain institutions and countries have, under pressure from market forces, taken on board these methods, and not only in the private sector. The Netherlands are a good example of a dynamic use of such procedures within a publicly driven system.

However, the success of effective university teaching requires also that the means of university teachers' pay and compensation change. If we

consider that university teachers are teachers in their own right, this means that teachers who make the efforts in their teaching are thus rewarded for doing so. Whereas the other teachers are encouraged to keep up with latest teaching techniques.

As far as the putting into practices these recommendations, it seems first of all (using the results of the study) that certain modes of practical teaching and learning could be reinforced through for instance more involvement in research projects and more placements.

The results presented by the survey illustrate that some countries have been more innovative than others. Probably, some institutions have also been more reactive than others. New universities in the United Kingdom, «Fachhochschulen» in Germany, «Ecoles d'ingénieurs» in France, have tried to adapt their mode of teaching and learning more rapidly to knowledge-based economy. Is this because of more resources, is this because competition between institutions, is this because they are younger institutions, is this because they all have a vocational emphasis? The answer is probably a mix of all these factors.

In many countries, traditional universities are presently facing many problems, due to the decrease in enrolments, the disaffection of students from sciences, the mismatch between acquired and required competencies. Given some institutions and some countries have reacted sooner, their experience could be disseminated. Certain countries such as the Netherlands, have a head-start, in the terms of using teaching assessment to improve course contents and methods. It appears probably worthwhile to copy such practices. Northern European countries use more often PBL, and have developed University learning and teaching centres. These are also practices worth sharing across countries.

Students need to be more fluent in IT and academic teachers need to know how to use adequately IT in their lectures. That means more resources for higher education institutions, as this new learning and teaching techniques are more costly than the traditional chalk and black-board one, either for the acquisition of new equipment, or for the recruitment of new support staff, to maintain this equipment. In this respect, all the fields, and not more only the traditional natural sciences, will use more capital intensive teaching techniques.

Nevertheless, it is not only a question of equipment, it is also a matter of willingness of academics to adapt themselves to new students, to new ways of teaching, to new perspectives for their students.

Probably, student migrations inside and outside Europe will help to expand these new models of teaching and learning. However, universities are institutions which change with difficulty. Nevertheless, they need to change themselves to new requirements, otherwise they will know the destiny of dinosaurs.

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## **RESUMEN**

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La economía actual se basa en los conocimientos impuestos por los nuevos desafíos que plantea la enseñanza superior. El principal objetivo de este artículo es evaluar en qué medida las universidades están preparadas para hacer frente a estos desafíos. Esta cuestión es abordada teniendo en cuenta una de las principales funciones de la universidad: formar mano de obra altamente cualificada. Las principales cuestiones que se tratan son: ¿las universidades europeas desarrollan las competencias requeridas para la economía basada en el conocimiento? ¿Cuáles son las competencias valoradas en el mercado de trabajo? En función del valor monetario de las

competencias, ¿cuáles son las más demandadas? ¿Cuáles son las competencias menos desarrolladas por las instituciones de enseñanza superior? ¿Se produce un impacto más fuerte en el desarrollo de las competencias requeridas, en función de los métodos de enseñanza y de aprendizaje? ¿Algunos países están más preparados que otros para afrontar la economía basada en el conocimiento? Estas cuestiones cobran aún más importancia en relación con los objetivos enumerados en Lisboa y la puesta en práctica del Proceso de Bolonia. Dichas cuestiones serán tratadas a través de las informaciones utilizadas para el desarrollo de un ambicioso proyecto europeo denominado CHEERS (*Careers after Higher Education: a European Research Survey*). Del otoño de 1998 a la primavera de 2000, 36.000 diplomados de 11 países europeos y de Japón han respondido a un cuestionario sobre la relación entre la enseñanza superior y el empleo, cuatro años después de la obtención de su diploma.

**PALABRAS CLAVE:** Conocimiento. Competencias. Capital humano. Economía basada en el conocimiento. Tecnologías de la Información. Modos de enseñanza y aprendizaje. El proceso de Bolonia. CHEERS.

## RÉSUMÉ

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L'économie actuelle fondée sur la connaissance impose de nouveaux défis à l'enseignement supérieur. Le principal objectif de cet article est d'évaluer dans quelle mesure les universités sont prêtes à faire face à ces défis. Cette question peut être abordée en prenant en compte une des principales fonctions de l'université, qui est de former la main-d'œuvre hautement qualifiée. Les principales questions suivantes seront traitées : est-ce que les universités européennes développent les compétences requises par l'économie fondée sur la connaissance ? Quelles sont les compétences valorisées sur le marché du travail ? Au-delà de la valeur monétaire des compétences, quelle sont les plus demandées ? Quelles sont les compétences sous-produites par les institutions d'enseignement supérieur ? Est-ce que certaines méthodes d'enseignement et d'apprentissage ont un impact plus fort sur la production des compétences requises ? Est-ce que certains pays sont plus prêts que d'autres pour affronter l'économie fondée sur la connaissance ? Ces questions sont d'autant plus importantes dans le cadre

des objectifs de Lisbonne et de la mise en place du processus de Bologne. Elles seront traitées en utilisant les informations produites par un ambitieux projet européen appelé CHEERS (*Careers after Higher Education: a European Research Survey*). De l'automne 1998 au printemps 2000, 36000 diplômés de 11 pays européens et du Japon ont répondu à un questionnaire écrit portant sur la relation entre l'enseignement supérieur et l'emploi quatre ans après l'obtention de leur diplôme.

**MOTS CLÉ:** La connaissance, Les compétences, L'économie fondée sur le connaissance, Façon d'enseignement et d'apprentissage, Le processus de Bologne, Cheers, Technologie de L'information, Capitale humaine.