

On some new emerging professions in the higher technical education

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ABSTRACT: The need of new qualified and differentiated employment is herein analyzed, with special reference to the contest of the Italian Universities. Such requirement derive from the strong demand of innovation which the educational systems, at the highest levels, are called to deal with. The Social contest is firstly analyzed, together with its relationship with the recent evolution of the Enterprise's policy. Then, the effects of the new Italian regulations are studied. A special part is also dedicated to the fundamental roles that IT and e-learning are paying in the innovation of the University curricula. Finally, the management of the various activities is investigated, as suggested by the Italian CRUI. The performed analysis will show that there are many emerging professions which could significantly improve the quality of education in our technical Universities.

1 INTRODUCTION

In the last years, changes in Society, Economy, and in the Cultural Processes, have induced the experimentation of new and innovative approaches, such as, for instance, FaD and e-learning. On the other hand, new epistemological models have been investigated, on which the practical didactical activities could be based in traditional education.

The new didactical methods and the new efficient didactical strategies can significantly help in the development of higher technical curricula. However, these new opportunities, known in theory, require a serious application in practice. In fact, the theoretical concepts are not always simple to be interpreted and even understood. Furthermore, not always, the teachers are able, alone, to handle the process of curricula planning and their management. For all these reasons, the Authors of this papers have decided to begin a compared analysis of all, and only those, new competencies and capability which could be conveniently applied in managing the didactical activities of the Universities, with particular reference to the technical curricula in Italian Institutions.

The process of correctly and efficiently handling a higher technical course at the University is here regarded as a crucial task for the success of students' career and for the benefit of the whole Society (specially speaking with reference to the public Universities). This important work can be performed only if the staff is qualified for each assignment. Hence, in this paper, a study on the new emerging professions

in education is presented. The existent new job assignments are reviewed, in general, and some other, simply proposed. Based on the acquired experience (Belfiore, 2002), the Authors of this paper will focus their attention on the academic environment and will propose new types of professions.

2 EVOLUTION IN INDUSTRY, SOCIETY, AND INSTITUTIONS: THE NEED OF NEW QUALIFIED PROFESSIONS.

The era of *globalization* has produced significant new varieties of effects in Society, Culture, Economy, and Politics. A progressive interdependency has grown among Countries, which has involved also the work market and the world of Education, with special effects on the Technical Education. The need of new professional specialization has now become critical with respect to the educational systems.

According to Parsons (Parsons, 1976) *the more differentiated the Social structure is, the greater is the needs of qualified employment at the higher levels of the organization's structure*. Now, since our western Societies are affected by constant technological changes, which are stimulated by the developments in the research fields, our Educational Systems, at the highest levels, must promote a strategy of permanent education as well as of innovation's research and adaptation. In this way the products of an Educational System, in terms of innovations in

research and culture's promotion, may play a fundamental role in the development of the whole Society.

2.1 *Changes in Industry.*

The importance of the role of management has recently grown in Industry, in such a way that Industrial Managers form a particular rank in Society. There are two main kinds of executives: the *leadership oriented* manager, who infuse courage and motivation to the employees, and *participation oriented* manager, who tries to stimulate the subordinates and considers important listening to them.

Nowadays, *globalization* in Economy forces the managers to strengthen their relationships with the various components of the Society. On the other hand, they have to deal with the market instabilities and the renewed welfare contributions, while the requirements of the Quality and the Environment constantly grow.

It is therefore clear how the new demands, at the medium and high levels of management and technical stuff, are enlarging the range of possible specialized tasks. According to Janossy (Janossy, 1969) *the distance that nowadays exists between the individual's and the Society's (as a whole) knowledge is greater than the one existing at the beginning of the industrialization*. Such distance is expected to grow further as the work's subdivision grows. In fact, the professional interdependencies among individuals and among groups are increasing in such a way that today knowledge is necessarily *integrated* and *interdisciplinary*. Fundamental keys in knowledge are *specialization* and *depth*, not *quantity*.

2.2 *Individual knowledge and job market's requests.*

As known, adaptability, flexibility, and dexterity have been typical demands in the Taylor-Ford era. Although these qualities are considered valuable still now, new capabilities are increasingly appreciated, such as general culture, broadmindedness, rationality and communicativeness. The interpretative capabilities are now more appreciated than the manual ones, as well as the logical and abstract representations are now preferred rather than the trial and error accumulations (Acconero, 1994). In few words, the individual knowledge's changes, along generations following one another, is not *quantitative*, but *qualitative* (Janossy, 1969).

2.3 *Mutation processes in Organized Systems.*

Complex systems are very easily subject to changes, due to various factors. The general approach may

also change, as a consequence of the environment's inputs. However, it must be recalled that new solutions and new processes require not only to be accepted, but also to be supported, developed, and tested. For this reason, it seems that changes in organized systems, such as Institutions, Enterprises, and Organizations is not only a mere consequence of a crisis. It is a quite voluntary process, which involves Society, since individuals, as member of the community, change. Mutations involve relationships at each level, in the Organization and in Society.

Mutation must be, therefore, regarded as a transformation of the way we act and operate in the various contests, rather than an ineluctable step of the human history (Crozier and Friedberg, 1977).

2.4 *The importance of the knowledge in the mutation process*

Finally, it is believed to be noteworthy to notice that a preliminary analysis of the contest over which the mutation is effective, must be always conducted. In particular, a system should know, somehow, its inner capabilities and resources in order to take the best choices and overcome the critical mutation periods (Crozier and Friedberg, 1977).

3 NEW PROFESSIONALISMS IN THE TECHNICAL UNIVERSITIES.

Mutations in Society and progress in technology have induced a great variety of changes in the higher technical education. In Italy, in particular, the process of development has been considerably strengthened by some recent national regulations which have involved the entire structure of the national public Universities. Such mutation is believed to be one of the most important reasons of the growing need of differentiation of professionalism. But there is another more general cause. Notwithstanding the temporary crisis of the so called New Economy, the acceleration of the Economy digitalization induces strong demands of changes in higher educational curricula, regarding both the methods and the contents. Teachers are called to improve their methods, and, in some cases, new approaches and new professions could be conveniently employed, even in teaching, with special recall to the adoption and diffusion of new learning media.

3.1. *The new Italian regulations for the Universities and its effects on the needs of new professions.*

Since November 1999, the Italian Universities have radically changed their didactical structure. Regulation "Decreto Ministeriale n. 509 del 3 novembre 1999", among many other important changes, has in-

troduced, for the students, the fundamental activity of a stage in an active Firms. Such activity, is no more regarded as a simply optional, but achieve the status of an actual part of the program, whom a certain number of credits correspond to. The sense of this innovation consists obviously in an attempt to make closer the fresh graduates knowledge to the ones expected by the market and the enterprises. However, the spirit of the ordinance, which must have a general approach to the problem, not always can be so easily accomplished. In fact, in many cities where a State University has a seat, there are not enough Structures or Organizations capable of receiving all the students. In these cases, the Programs can be modified in such a way to substitute the stage with a course having an equivalent number of credits, provided that that course is taught by a teacher who works in an external Structure (i.e. not in the University). This has, actually, introduced a new type of teacher, sometime called the “*docente laico*” (*lay professor*), who has the important task of giving students a first contact with the market world. Lay professors are typically selected inside the external structure top management and are called to use the *experiential* (Kolb, 1974) and *imitative* (Fontana, 1994) models of learning, in contrast to the academic teachers who usually prefer more conceptual approaches. The introduction and the permanent appointments of the *lay professors* are yielding some interesting collateral effects, such as the diffusion of more practical teaching methods, even among the academic teachers, who indulge more frequently on direct experiences in the transfer of the knowledge, specially in the description of the technical applications.

3.2. Renewed educational technologies and its effects on the needs of new professions.

Among the effects of the above mentioned new regulation over the Italian Universities there is their increasing approach to the North American, and in general, Saxon models. Therefore, it can be useful to give a glance at those systems to inquire about a possible evolution of the Italian scenario. The results of this analysis will be described in the following part of this paragraph.

A quite recent instructional technology, called “learning objects”, (LTSC, 2000) has shown very useful characteristics in applications such as reusability, generativity, adaptability, and scalability (Hodgins, 2000), (Urdu & Weggen, 2000), and (Gibbons et al., 2000). Object-orientation leads to reusable modules, which can be adopted (Dahl & Nygaard, 1966) in multiple contexts. Although the *learning objects* are commonly understood to be digital entities deliverable over the Internet, the idea suggests improvements in the didactical planning of

an academic program, which can also incorporate small pieces of e-modules.

To facilitate the adoption of the learning objects approach, the Learning Technology Standards Committee (LTSC) of the Institute of Electrical and Electronics Engineers (IEEE) has developed, since 1996, instructional technology standards (LTSC, 2000) which will be reasonably adopted by universities, corporations, and other organizations in order to achieve the interoperability of their instructional technologies, specifically their learning objects. According to these standards, a *learning object* is defined as any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning. Examples of technology-supported learning include computer-based training systems, interactive learning environments, intelligent computer-aided instruction systems, distance learning systems, and collaborative learning environments (Wiley, 2002). Examples of Learning Objects include multimedia content, instructional content, learning objectives, instructional software and software tools, and persons, organizations, or events referenced during technology supported learning (LOM, 2000).

Learning objects and their behavior have been often explained through the LEGO metaphor, in the sense that small pieces of instruction can be assembled to create one larger instructional structure like the LEGO bricks can be stacked together to form scale models of houses, cars, or whatever. Furthermore, the object can be reused in other educational programs, like the elementary pieces can be reused to compose different scale models.

The metaphor, is however considered as very restrictive since it may mislead to wrong conclusions. In (Wiley, 2002) for example, is addressed the importance of not extending some properties of the LEGO blocks to the learning object. In fact, the following properties can not be correctly referred to the learning object: a block is combinable with any other block; blocks can be assembled in any manner you choose; blocks are fun and simple that even children can put them together.

Now, the interesting thing is that there are certain distance courses which give students credits that can be used in their educational contests. The educational credits, therefore, become a general accepted educational currency that provides a general accepted measure of learning outcomes achievable in notional hours at a given level and by any learning methodology.

Since the typical learning objects deal with basic topics such as Mathematics, Physics, Chemistry, they show a possible evolution of the didactical strategy of modularity and distance learning in planning Engineering Programs, which could be more flexible and efficient. This suggests also the introduction of the on-line teacher, which is called to

have qualities which differ from the classical *talk and chalk* professor who teaches in a learning *place*. Teaching is rather held in a learning space, made of virtual electronic shape (Recchioni, 2001).

As a matter of facts, the on line teacher must have high capabilities in project management, since the aspect related to the course planning is here more relevant than in the traditional courses. A high competence in IT is also required, as well as in multimedia communications.

The most important concepts of adult education are also required, what is now improperly called *Andragogy*. We address the opportunity to change the term *Andragogy* (which seems referring to the male gender) with that we think to be the more appropriate: the Greek term *ανθρωπος* refers the *human kind*.

Finally, on line teachers should have a more strategic approach to the educational event, more conscious of the more general Company policy and more capable of identifying the individual and distinctive abilities (Costa & Rullani, 1999).

4 RELATIONSHIP BETWEEN THE NEW I.T.'S AND THE E-LEARNING: INTRODUCTION OF NEW PROFESSIONS

Research and experimentation of new learning methods is of fundamental importance in our Era characterized by the enlargement of the class of people that, by virtue or by force, is interested to the acquisition of new knowledge and capabilities. This educational demand must be considered as permanent, as permanent is the nature of the education, nowadays. In fact, knowledge tends to become quickly obsolete while methods tends to remain the same. For these reasons, methods renewal is of crucial importance, at any level of education.

The general situation is rather critical. In fact, the above mentioned market globalization put enterprises under pressure, inducing them to a competitive attitudes which can interfere negatively with the valorization of their inner resources. On the other hand, University is involved in a process of renewal of its didactical model, also oriented to communal and cooperative approaches rather than *one-to-many* strategies.

Distance FaD and electronic learning seems to fill the gap between the environment needs and the educational institutions. The main reason of this success is that the integrated procedures based on IT have a great upgrading capacity, as well as a more general attitude of stimulating the individual characteristics.

It is clear, for example, how a network based system offers resources that can be reached in any moment of the day (or night) and from any point of the globe! The learning opportunities grow, since that are more based on proper characteristics and needs.

There are less constraints to the development of personalized educational programs. Furthermore, the information flows and the interactive techniques seem more appropriate to the mental processes, which are more easy to be guided by analogy and experience, rather than by logic and rationality.

Once the new ITs are becoming part of the educational programs, they can offer and suggest a new planning in terms of contents, methodologies, and instruments. However, the actual application of these new ideas, in spite of the appearances, is rather complex and cumbersome. In fact, renewals are always bringing the risk of the unknown. Such a huge development in didactical methods should be promoted and supported under the light of new specific researches whose results should be able to overcome the lack of experience. Unfortunately, these investigations have not been sufficiently developed, and is it may be due that, generally, innovation in methods is more difficult than in technology. This is also confirmed by the relative absence of this kind of academic debates in Universities. The supremacy of the methods should be extended, in education, over the simple technical means.

The need of new methods has suggested the idea of *blended* (or *integrated*) *learning*, which is characterized by the simultaneous presence of traditional and distance activities. *Constructivism* has ideologically supported the development of the systems of distance education which promote the collaborative and cooperative activities. According to Woolfolk (1993), *students actively construct their own knowledge; the mind of the student mediates input from the outside world to determine what the student will learn. Learning is active mental work, not passive reception of teaching. In this work other people play an important role by providing support, challenging thinking, and serving as coaches or models, but the student is the key to learning.* Blended learning seems well suiting this beliefs, since there are more occasions of individual based learning experiences.

It is, therefore, clear that teachers should pay attention not only to the technical media, but, mainly, to the didactical targets, to the analysis of the learners' groups and of the social and cultural contexts in which the educational event was born. For example, the analysis of the cognitive style in that context could be certainly useful.

From what above reported, it appears that new planning criteria, new roles and abilities, both in teachers and in management, new investigations on the operational aspects of the systems are urgently needed in higher education. In particular, planning an e-learning activity requires strategic plans, management system renewals, and structure upgrades. It is not sufficient to buy the hardware without developing proper using and maintaining capabilities. The first step should be the definition the real targets and the service characteristics, being aware that e-

learning systems have a great impact over many variables in the organization and over the business.

The development of an e-learning object offers new chances in the teaching methods. The simple translation of the crude traditional material must be considered as a very restrictive exploit. In fact, it would be ignored many interesting features such as: the knowledge system management; the improvement in the capacity of analysis and testing of both the students' performances and potentialities; the creation of virtual meetings and communities; the identification of new instruments to information flows monitoring and control. Efficiency in planning an e-learning object is strictly related to the capacity of including in the system every different option and resource dedicated to learning: self-learning, virtual communities, virtual classes, practice, and tests. Media and activities have to be chosen by optimizing time and by promoting learning. Lessons should be arranged in didactical units not too much long, organized in such a way to promote the active interaction and the monitoring of the attention and comprehension levels. It is, therefore, believed that it is necessary to plan the following activities:

- analysis of the participants' characteristics and consequent planning the activities' time and media;
- analysis and valuation of the length of the planned activities;
- selection of the methodology;
- planning of the synchronous activities;
- planning of the asynchronous activities;
- planning of the monitoring and testing methods.

Once the didactical program and the activities are defined, the logical structure of the communications between teachers and students become of extreme importance. The adopted scheme will be expected to grant the correct management of the information flows among those who participate through the Internet.

On line teachers are, therefore, called to achieved new competencies in order to be able to plan the whole distance educational project and to manage the learning process. In other words, the traditional teaching capabilities must be supported by the new ones derived by the science of e-learning.

Finally, the whole process must be regarded as a sequence of important phases, namely, the target definition, project planning, selection of the didactical methods (both traditional and virtual), tutoring, and distance study.

5 MANAGING THE HIGHEST LEVEL OF TECHNICAL EDUCATION.

As the experience matured during the last decade in the planning Undergraduate and Graduate Programs has shown, the assignment of a new profession

called *Didactical Manager* (MD) seems, year by year, to have achieved an irreplaceable role that cannot be disregarded from the system.

The introduction of MDs, as well as many other fundamental innovations, much dues to the Italian CRUI (Conference of the Chancellors of the Italian Universities) which has edited a great amount of literature of valuable reference for the Italian Undergraduate and Graduate programs (CRUI, 2000).

Among the various tasks that MDs have to deal with, there are some relatively new in the Italian Universities. Firstly, the function of *didactical coordination* among the different courses. Then, as of a *connection* between the students and the professors, as well as among the different professors. Furthermore, as of a possible reference point of novel activities related to the *development of new didactical methods*, to the *orientation service*, and to the system *monitoring and testing*, with particular reference to Quality and Customer Satisfaction Analysis. At last, but not least, as a source of new proposals, concerning activities based on the new Information Technologies and the relationships with Society (Unions, Environment, Secondary Schools, etc.).

All these tasks could be conveniently split into a variety of professions, which could help much the entire structure. In fact, the didactical management should be entrusted neither to a single person nor to an isolated office. It should be better considered as a *function*, which is necessary for the success of the educational system. Such a *function* should be intended as *a set of activities conducted by well coordinated operators*, who belong to many different divisions.

Other than didactics, there are important functions such as, for example, the economic administration and the *funds hounding*, which the structure has to deal with. Actually, the representatives of the teaching stuff who have the direct responsibility of the two above mentioned activities are not always adequately supported, while the demand of an upgraded and dynamic managing style is increasing. This leads to the conclusion that the technical supporting stuff should be strengthen in order to be more specialized and qualified, which can be obtained by developing a new strategy of job assignments.

From what has been said until now in this paragraph, it should be clear the importance of personnel's (or *personnel candidates*') education and upgrading, with special reference to the Culture of Work. This concept has been, also, pointed out by the latest report of the Italian CENSIS (CENSIS, 2001) on the status of the Nation.

Finally, it is worth commenting about the ancient concept that the Universities offer (theoretically) the highest level of education that one person can achieve. At least, as a free citizen. If this is true, as it probably is, then, those who teaches in the Univer-

sity are expected to possess the best qualification as possible over the subject to be taught. As a standard, this qualification is obtained at the cost of years and years of hard work, passed both studying and working in labs, and this capability is not replaceable. On the other hand, it is not said that a good researcher is also a good communicator. Hence, it may happen that at the highest levels (such as for example at the PhD Programs) professors pay a low (or even null) attention to the research of the most efficient teaching method. This drawback is, however, not much troublesome because at that level there are, mainly, *adult* students who are able enough to afford some efforts in order to learn from the best researchers. For example, in the North American Universities graduate students seek for qualified and referenced (better if *famous*) scientists, rather than for good communicators. This consideration put under the spotlight a twofold aspect of the instructional process in the University: professors should be good in teaching as well as in achieving results that are interesting for the scientific community. Such withstanding task is not easy. Sometime, it is not easy to try to talk to professors about new didactical methods, either. Certainly, professors *should* pay attention to the new didactical methods. At least, they should *care* about them. A Nobel Prize in Physics, Richard Feynman, for example, wrote about the argument something interesting that we report (Feynman, 1985) as a stimulating conclusion of this paragraph: “If you’re teaching a class, you can think about the elementary things that you know very well. These things are kind of fun and delightful. It doesn’t do any harm to think them over again. ... The questions of the students are often source of new research. They often ask profound questions that I’ve thought about at times and then given up on, so to speak, for a while. It wouldn’t do any harm to think about them again and see if I can go any further now. ... I would never accept any position in which somebody has invented a happy situation for me where I don’t have to teach.”

6 CONCLUSIONS

The Authors of this paper have attempted to give a contribution to the development of new didactical strategies in the planning of curricula at the University level of education.

Hybrid approaches, namely, those based on the blending of traditional and distance methods seem very promising, as well as the less traumatic. In fact, while the typical needs of the highest level of scientific and technical instruction are saved, the benefits of the new methodologies, such as those referring to the spheres of distance learning and of Information Technology, could be saved and made available to

the system, with great advantage for students, teachers, and the whole Society.

The renewal process will be possible, provided that the theory came into practice correctly, and this means that new qualifications, such as those mentioned in the paper, namely MDs, *lay professors*, IT and e-learning experts, customer satisfaction experts, orientation and counseling operators, will be of fundamental importance for the educational systems.

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