A UNIVERSITY TOWARD THE KNOWLEDGE SOCIETY

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Summary

It is a truism that we are quickly entering the so-called "information society". To respond to the dynamics and challenges of this society, it is necessary to redirect and focus the learning model at the post-secundary education. We present here the results of a proposal of a new learning model that we have developed at the Informatics Engineering program of the Colombian Jaime Isaza Cadavid Polytechnic.

Introduction

We could shortly characterize the "knowledge society" like that one where, to the traditional wealth-producing factors, namely: Work, capital, and land, the "knowledge" factor is added[1] with always increasing comparative importance.

We arrive to such a society thanks to an interesting feedback phenomenon, by which the advances in knowledge facilitate some technological developments[2] which in turn allows efficient information and knowledge handling. So, a self-sustained cycle ensues which brings the production of new knowledge.

If we, from our position as educators, reflect on this type of knowledge society, which is already a reality at least in a significant part of the world, we find out that the educational models and practices in our country are not adequate to prepare the current and future generations for such a society. In our educational system there is excessive slackness and lack of focusing in order to guide the students to be active participants of that new society, to which they must productively contribute from their particular vision.

However, precisely in such a society, information and technology are becoming a species of transnational commodities, so that spite of the fact that much social inequalities subsist, knowledge quits being a privilege of a few[3] in order to be accessible -and really necessary- for everyone who is willing to acquire it and devotes with zeal to this pursuit.

This last observation enables us to see the situation as an opportunity -and perhaps the last one that we will have- for the Colombian society to jump in its development and insert itself in the worldwide development, provided that we tailor our educational system

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[1] Drucker, P.: *Managing for the Future*
[2] Specially information and communication technologies (ICT)
[3] From the perspective of the history of human societies.

with aims to this new society. Then it is necessary carry out a transformation in education, and particularly in its medium, technological and professional levels.

The new stage

Acknowledged historians and development analysts agree on the fact that we are leaving from a time whose economy was mainly determined by agricultural and manufacturing activities, now known as "industrial economy era", and that ending the twenty century and beginning the current one, there are important changes in the socioeconomic landscape, brought by simultaneous and interlinked factors like the following:

- The power and worldwide diffusion of information and communication (IC) technologies, markedly manifested in the interconnection and integration by nets like the Internet and the business intranets and extranets.
- Knowledge Management, defined as "the leveraging of the collective wisdom, in order to increase the organizational responsiveness and innovation capacity"[4]. For each organization it is of vital importance to find the best form to generate, communicate and apply knowledge, taking maximum advantage of its "intellectual assets."
- The increasing comparative importance, for all the economical activities, of the service sector and of the labor force dedicated to it[5].
- Market changes: Now the clients not only demand a more immediate response, but they are also better informed, they have more power[6], and they should be converted in technological partners of the companies, involving them from product conception in the production processes[7].
- The speedy innovation, as a requirement for competitiveness facing the market requirements.
- The redefining of the middleman role: As a consequence of the capacities that computers and communication gives to producers and consumers, the middlemen must provide an added value which is valid in the new circumstances, or else disappears.
- The virtualization: The emergence of innumerable "virtual communities," with partners geographically scattered but united by common interests, reaping the benefits of the IC technologies in order to carry out effective and efficient interactions, in spite of distances and geographical dispersion: virtual teams, virtual government[8], virtual employment, virtual corporations, virtual education,....
- The importance of developing international-class competitiveness in an increasingly interconnected world (the true coming of the "Global Village").

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[4] Koulopoulos, T.M. and Frappaolo, C.:*Knowledge Management*
[5] Quinn, J.B.: *Intelligent Enterprise*, p. 4.
[6] Naisbitt, J. y Aburdene, A.: *Megatrends 2000*,
[7] Quinn, J.B.: *Intelligent Enterprise*, p. 178, and Tapscott, D.: *The Digital Economy*
[8] Tapscott, D.: *The Digital Economy*

- The technological and sectorial convergences: As these among computing, telecommunications, consumer electronics, media and entertainment industries, and among computer science, biotechnology and nanotechnology. This is one of the reasons which compels the companies to “reconceptualize the industries with which they compete"[9].
- The generalized digitalization of all types of information: Upon recasting any information into a "common language", no matter their origin (text, images, sounds, etc.), one can manipulate information and knowledge in ways that were unthinkable some decades ago.

These concomitant factors justify then that we speak of a "new economy"[10], which compared with that of the industrial era, does require, among other things: Life-long learning instead of a more or less static knowledge, work-teams instead of the split between labor and management, the acceptance of calculated risk instead of assuming security, a state of competition instead of monopolies, the coming into play of intelligence instead of the security that gave the possession of an industrial plant, and to give the clients a customized election instead of assuming that they will accept a standard product.

The university for the new stage:

The improvement of the formal educational systems has been a decisive factor for the upswing in the competitive capacity of the countries, their economic growth and their social development in general[11]. Then, and now more than never before in order to compete in the just sketched socioeconomic stage, it is necessary that the university refurbish their utopias and pedagogical models, as the formative institution of the intellectual capital, having therefore a major social function.

Given the characteristics of the new circumstances, the academic programs in the area of computer and information sciences are specially required to be enhanced to fulfill a key social function, since they could offer us a precious opportunity in order to achieve a jump in the country development, toward a society where each citizen has an equitable access to the knowledge and to better options and opportunities.

We should move away from a reactive university toward a proactive one. From an university that responds -often belatedly- to its milieu, toward one which points out the future. The university could not remain passive in front of the state of things in the society, but it must play an active role in social transformations. It should clarify the desirable future of the society in which it exists. "It should be the head in quest of continual improvement, being futurist and not only the trainer of new professionals"[12].

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[9] Quinn, J.B.: *Intelligent Enterprise*, p. 23.
[10] The document “Connectivity Agenda” [Colombian Ministry of Communication et al. 2000], defines the New Economy as that “based in the interacction of las information technologies and the traditional economy”
[11] Llinás, R.: *El Reto: Educación, Ciencia y Tecnología*, p. 9.
[12] Monterrosa, A.: *Docencia Universitaria: Reflexiones*, p. 71.

We should move away from an isolated university toward one linked with their socioeconomic surroundings. In particular, we should design and implant new mechanisms of relationship between the university and the business sector, gradually covering all the possible cooperation levels[13]: Offering laboratory and consulting services to the productive sector, internships from a sector in the other, joint R&D projects, up to lasting cooperative efforts of greater economic span (i.e.: gestation of joint R&D centers[14]). A proposal we are developing in this sense is the project named "Entrepreneurial Talents for the New Economy" which we will deal with later on.

Also, we should move away from a university with traditional models, toward one guided by new models, like "learning to learn", innovation and research, problem-based learning and "learning by doing". Toward this vision of education are guided the pedagogical changes that we have carried out in the informatics engineering program, upon structuring it around a series of workshops, as a species of backbone that gives to the curriculum a base on creative thinking and problem solution.

In order to achieve these transformations it is necessary that professors and students change their attitude about learning. If the students are not convinced of the citizen roles they have, and about the significance of the effort they should make in order prepare themselves, and aren´t committed with their own learning to improve their academic level, and if the professors don´t bring up to date their knowledge and aren't convinced that they should commit themselves with the social function of their work, no transformation will be possible.

The workshops

With the workshops sequence along the engineering program, we are aiming to the "learning by doing" principle, where the subjects of study support the objects of work to which the student applies immediately the acquired knowledge. This strategy is seamless tied to the "learning to learn" principle, trying to sensitize the students in order to wake up their motivation about research and innovation, as well as their self-confidence, upon realizing that they are capable of carrying out projects, work in a team and get concrete, tangible, results.

The workshops sequence was designed based on solid pedagogical criteria, aiming to give them up-to-date contents put into context, as well as coherence, continuity and a logical development. Each workshop lasts a semester and is supported by the others courses like mathematics, physics, humanities, social and managerial subjects, as well as other technical themes of computer science. The sequence is the following:

- Creativity and inventiveness workshop.

[13] Campo, A.: *Ciencia Tecnología, Educación Superior, Gerencia Ambiental e Integración: Reflexione*s.
[14] Colciencias: *Nuevas Tecnologías para la Modernización*, p. 20.

- Workshop on foundations of logic for computer science, centered in the concepts and principles that allow one to conceive solutions based on models and algorithms, with the prevailing focus in object-orientation and software reusability.
- Workshop on information structures, concerned with data structures and files, and their algorithmic handling.
- Workshop on databases, from the traditional topics of models, DBMS, and SQL, up to the modern concepts of datawarehousing.
- Workshop on information systems design, which deals with the features of the software product, from their conception, design and development up to the real-world issues of implementation and life-cycle.
- Workshop on hardware architectures.
- Workshop on telecommunication networks.
- Workshop on software-projects management.
- Advanced workshop, with variable content according to the topics of current relevance.

Recognizing the necessity of continuous learning, the workshops philosophy tries to erase barriers between the workshops and other learning ambiences like self-study, other elements of the so-called "hidden curriculum" and the real life. Specifically, we have established some incentives in order to reward other projects developed by students related to workshops themes, but carried out independently and not as responsibility of the workshops proper.

Analyzing an experience

The creativity and inventiveness workshop is particularly important and interesting, not only because of their theme, but by being the first for the students, a trait which gives this workshop a key role in the shaping of attitudes concerning: research, pragmatic issues and teamwork, attitudes that will serve the students for the following workshops along their study.

It is an interdisciplinary, pedagogical and innovative workshop, aiming to the development of inventiveness and skills for research and innovation. We conceived it like a prototype of the new school of learning, problem-based learning and learning-by-doing, that becomes a nursery for young researchers.

The interdisciplinary feature of this workshop is evidenced in the fact that the great majority of projects carried out within it involves al least mechanical, electronic and computer elements and their application domains span very diverse fields.

The focus on problem-based learning is motivated by the reflection that the real problems crop up in the society, in the life outside of the academic cloisters, and therefore we consider that a fundamental function of education is to prepare the student in order to face and solve real-life problems.

Given the importance of this workshop, we had begun with it in order to perfect the workshops methodology, so we now have a more complete analysis of it, which allows us to profit from the experience.

Antecedents

Under the direction of the Dean, with participation of the Area Coordinator of the informatics branch, for this shop we relied on a valuable team composed of a coordinator, professor-advisors and lecturers, all of them having experience from past semesters and great interest in collaborating.

The successful experience with this workshop during several semesters has originated institutional support, good repute among the students of the following semesters -which had already participated-, as well as a favorable expectation among new students.

At the beginning we perceived some weaknesses we must address, as: inadequate initial comprehension and appropriation of the workshop, as well as the scanty zeal, academic level, self-discipline and liking for study of the new students coming from high school.

Strategies to convert weakness into strength

In order to face the difficulties and perfect the creativity workshop, we have applied several strategies, from which we highlight the following:

- To improve the comprehension of the workshop among the students. To this end we deliver the students written information on informatics engineering, and on the objectives, norms and procedures of the workshop, as well as on the forms of assessments and their dates.
- To improve the integration and synergy among the workshop and the others courses of the first semester. To this end we carried out meetings with all involved instructors, in order to coordinate actions and share information.
- To improve the initial preparation of the students. The first week we carried out an evaluation of the students in order to classify them in groups and apply leveling strategies in several subject matters.
- To improve the monitoring and continuity of the workshop: Producing written information, records of experience and guides that will help the future workshop development.

It is essential that, from this initial phase in the formation of the students, we do utilize the adequate means in the university in order to achieve that these students take care of their own learning process, that they understand that they are the true accountable builders of their knowledge.

In the workshops, and especially in this one on creativity, we aim to create a different learning culture, by rescuing important elements that have become wiped out of formal

education such as the enthusiasm to learn, the inventiveness[15], and the happiness that should arise from discovering things and learning.

Outcomes

As concrete outcomes from the experience with the creativity workshop we could highlight the following ones:

Development of research skills: Owing to the workshop essence, the students should make use of their genius and resourcefulness, developing abilities toward research and problem-solving.

Entrepreneurial abilities: In the workshop each student team must form a "company" to execute its project, the team must conceive the company vision, mission and structure. In this way the students begin to develop their own entrepreneurial thinking, within a strategy in which we aim to achieve that each student become the self-propeller of his/her own professional future.

Tangible products: As material outputs of this workshop, we could mention that in its last cohort, from the first semester of 2001, a total of 54 ingenious devices were produced, which typically involved know-how and components from several disciplines like mechanics, electronics and computer programming, and are applied to diverse fields such as agriculture, industry, commerce, home, and aids for disabled people.

Liaison with companies: According to our desire to achieve an university more linked with the entrepreneurial sector, as well as in order to explore the social projection and commercial possibilities of the projects, for the final projects assessments we invited not only knowledgeable people from other educational institutions but also from diverse companies.

The Talents Project

As a complementary strategy to the pedagogical changes, we are developing the project "Entrepreneurial Talents for the New Economy", which has two fronts: The first one as a pre-incubator of companies, taking advantage -for example- of opportunities in the software industry,[16] and the second one is aimed at improvement of extant organizations.

In both fronts we will launch calls for project proposals in order to select the most brilliant feasible ones. Then, each project team will be accompanied and trained in order to strengthen the required technical and managerial capacities to assure the success in the development of each initiative. Moreover we will help in getting the financial resources required by each proposal.

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[15] Wiener, N.: *Inventar*.
[16] Colciencias: *Nuevas Tecnologías para la Modernización*.

Besides the Colombian J.I.C. Polytechnic, as executing institution, this project requires the engagement of other promoters and participant organizations.

The promoters and participant organizations will benefit in varied ways such as: negotiable participation in profits of sponsored projects, participation in courses and workshops served by the executing institution, utilization of the Laboratory of Advanced Development -established as part of the project-, expansion of companies by hiring graduates from the academics programs, profiting from the R&D groups for specific problems whose solution requires the organization, and the realization of joint projects.

For the accompaniment plan we are setting up contacts with national and international advisors, as well as liaisons with companies and universities of international prestige.

Conclusions

The university, as an intellectual realm and space for human and social dignity[17], can't rest on its laurels, it must renew its pedagogical models in order to contribute in guiding and building the society's future.

With the proposal of pedagogical model we are developing, we consider to be carrying out a revolution in the learning process in our country and in Latin America.

The positive experience and what we have learned with the creativity workshop will be applied to the other workshops, in order to improve the methodologies. Our ideal also aims to achieve a continued work with the workshops along the informatics engineering study program, that later on will allow us, so to speak, "to award diplomas to companies" and not just to students.

Concerning the Talents project, it also obeys to our interest in mobilizing to action the university, the state and the business sector, in order to don't waste the talents of individuals and don't sacrifice the mental, physical, cultural, and scientific potential of Colombia[18], in a society that will penalize the squandering of cognitive, cultural and organizational capabilities.

Acknowledgments

It would not be fair to finish this article without thanking all people who directly or indirectly contributed in order to make possible this experience. Special thanks deserve the following people: the engineer and entrepreneur Jorge Aramburo Siegert, for their incessant questioning to educational institutions so that they respond to the demands and realities of the social and organizational development; the engineer Jorge Johnson, professor whose vision and expertise played a key role in the conceptual direction and design of the workshops sequence; the engineer and entrepreneur Luis Carlos Gaviria,

[17] Monterrosa, A.: *Docencia Universitaria: Reflexiones*, p. 71.
[18] Llinás, R.: *El Reto: Educación, ciencia y tecnología*, p. 9.

professor and coordinator of the creativity workshop, for their dedication in order to carry out and perfect this experience of pedagogical innovation, and the engineer and professor Pedro Guerrero for his unrelenting work with the students at the workshops. We are also greatly indebted with all the professors and students who during the past two years have participated in the workshops, and accepted to share this experience contributing their collaboration and making it so valuable an undertaking.

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