Training for Development: Internet and Entrepreneurial Training in Venezuela

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ABSTRACT:

The Internet offers a unique opportunity for developing countries, as one of the few emerging fields where the industrialized countries' leverage over developing countries has yet to be established, as well as for the entrepreneurs in such countries, to sell their goods and services to an international markets. Yet in early 1998 there did not seem to exist a significant presence of Venezuelan Internet Entrepreneurship. This study examines the present limitations of available Internet Entrepreneurship training in Venezuela, by analyzing the curricula and degree requirements of four Venezuelan universities, and contrasting it with those of Stanford University. Furthermore, this study then draws from interviews with executives, professors, professionals and students to verify the results of the curriculum survey and to ascertain the perceptions of university graduates in computer science vis-a-vis the labor market.

INTRODUCTION:

As we prepare to face the challenges of the new millennium, it is worthwhile to remember that ten years ago, only a scant handful of people knew of the Internet's existence, and that, despite the commodization of the Internet Software Provider (ISP) industry, the information superhighway is still its in infancy. Indeed, the Internet's recency offers a unique opportunity for developing countries, as one of the few emerging fields where the industrialized countries' leverage over developing countries has yet to be established, where barriers of entry have yet to be determined fully, and where developed nations have not yet attained permanent market supremacy. There also exist powerful market and motivational forces, at the individual level, for entrepreneurs in such countries to sell their goods and services to an international market, at internationally competitive prices, through the Internet. Given that *Internet Entrepreneurship* has the potential to act as an engine for the developing nations' economic developmental process, we expected to find examples of successful enterprises in every developing nation connected to the Internet (or, what we refer to as *Internet Access*.) Yet in early 1998 there did not seem to exist a significant presence of Venezuelan *Internet Entrepreneurship*.

Education is undoubtedly the primary suspect to examine when seeking the probable causes for this apparent lack of *Internet Entrepreneurship* , yet before delving deeper into the discoveries this study presents, we must clarify what we understand as *Internet Entrepreneurship.* At its core, *Internet Entrepreneurship* refers to an individual's active involvement in the Internet, insofar as her or his on-line contribution adds value to the experiences and lives of the members of the virtual community. (As such, *Internet Entrepreneurship* and *Internet Involvement* are used during this study almost interchangeably.)

At first glance, the dependency of *Internet Entrepreneurship* on *Internet Access* becomes apparent: without access to the technology, even the most gifted entrepreneur will be thwarted in his/her efforts. Access to the technology of the Internet, however, implies more than merely owning the equipment necessary to connect to the Internet. Yet the technical knowledge required for *Internet Access* is only a piece of the puzzle, for without some entrepreneurial training and motivation-- explicit or implicit -- even the most gifted programmer will not start his (or her) own venture. Thus, the knowledge required to be an *Internet Entrepreneur* , both from the technology and from the entrepreneurial perspective, are necessary conditions (unlike possession of the equipment) for *Internet Entrepreneurship* , and it is precisely on this *Training for Development* , on the universities' ability to prepare their graduates to actively participate and contribute to the nation's developmental process in the area of the Internet, that we center our study.

To this end, we began our study by comparing the curricula of the most influential[2] Venezuelan universities: Universidad Central de Venezuela (UCV), Universidad Metropolitana (Metro), Universidad Católica Andrés Bello (UCAB), Universidad Simón Bolívar (USB) -- to that of American universities, both in the field of Computer Science[3] and in terms of their graduates' *Training for Development.* Two of these universities are public institutions (the USB and the UCV), and two are private (the UCAB and the Metro). In order to analyze an institution's success at this latter *Training for Development* dimension, we extended the comparison to include the more dynamic areas of each university's degree requirements, such as internships, projects, and elective courses. Finally, we interviewed industry executives, professionals, professors, and students, to verify the results of the curricula survey, and to ascertain the perception of university graduates vis-à-vis the labor market. For its unique culture and reputation[4] as an entrepreneur incubator, as well as for the dynamism and currency of their Computer Science curriculum, Stanford University was chosen as the standard by which to measure the Venezuelan universities , and as such, their core courses distribution per area is assumed to accurately reflect the training needed to actively participate in the forefront of Computer Science. Hence, by comparing the Venezuelan universities' curricula in Computer Science to that of Stanford, we can highlight which universities' training are preparing their

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[2]The "influential" character of the Venezuelan institutions rests on their recognition by industry employers as well as by prospective students and the general public as the most "selective" or "elite" of Venezuelan universities.

[3] The decision to limit the study to Computer Science graduates was prompted by the Venezuelan universities' track-based educational system -- where students decide during the application process, what field of studies to pursue. Therefore Computer Science Venezuelan students are the likeliest of their peers to have received formal internet education and to have preferential access to the school's limited technical resources.

[4] Stanford created Silicon Valley in the late 1930s, and the universities' commitment to entrepreneurial spirit rests on more than just Stanford's reputation as one of the -- if not the -- leader in Computer Science, and incubator for most of the entrepreneurial manpower for the innovative startups of neighboring Silicon Valley. Indeed, Hewlett-Packard, the first Silicon Valley company, was incorporated in 1939 by two Stanford students, and is now a company with more than 100,000 employees world-wide and net revenues in excess of $30 billion per year. More recently, from 1971 to 1993, over 300 full-time ongoing companies have been founded by members of the Stanford community, despite the fact that Stanford's Computer Science's core curriculum does not have any formal training in fostering entrepreneurship.

students competitively enough for them to actively participate in the country's development -- whether by joining the already-established industrial sector or by starting their own enterprises.

METHODOLOGY:

Because Computer Science is a very recent and constantly evolving field, there are no certified curriculum standards for either the Venezuelan universities nor the American ones yet that would facilitate the cross-institution comparison. Each university grants a different degree title, which presages the different characteristics, aspirations, and even goals of their graduates. Thus, in order to measure the strength of the training at these universities, the equivalent of the Computer Science Bachelor's degree curriculum at each university was classified into the nine Knowledge Unit areas identified by the Association for Computing Machinery's (ACM) and the Institute of Electrical and Electronics Engineers' Computer Science branch (IEEE-CS) in their most recent Computing Curricula of 1991. These areas are: Algorithms and Data Structures (AL), Architecture (AR), Artificial Intelligence and Robotics (AI), Database and Information Retrieval (DB), Human-Computer Communication (HU), Numerical and Symbolic Computation (NU), Operating Systems (OS), Programming Languages (PL), Software Methodology and Engineering (SE). In addition, the Computing Curricula also recommends including courses on discrete mathematics and calculus; at least one of probability, linear algebra, mathematical logic, and/ or advanced discrete mathematics; and at least a year-long laboratory course in physics. Accordingly, these areas were added to the initial set in our measurements, alongside with an additional area of study, Management and Finances (M&F), to reflect the fact that three out of the four Venezuelan universities analyzed include marketing and finance classes in their engineering programs.

FINDINGS :

Given the date of elaboration of the curricula, classes teaching Internet programming are not included in the classification system, nor do they appear in any of the core curricula of the universities under consideration, as a result of the instability and youth of the area, and the characteristic inflexibility of core curricula .   Table 1[5] highlights the remarkable similarities between both the USB and Stanford's core courses distribution per area, and between the UCAB and the Metro; as well as the areas each university emphasizes over all others.

To interpret accurately just how pervasively each university's area-emphasis affects their graduates lives, we must complement the numerical data of Table 1 with each university's policies regarding the less formal degree requirements (such as projects and internships) as well as the industry's perspective of the respective graduates' skill set. The pattern that emerges is quite consistent and revealing. According to employers, although quite different in their strengths and abilities, the engineers and scientists recently graduated from the three Venezuelan institutions featured in this study consistently disdained the "mere" programming jobs and sought managerial

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[5] The data from the classes offered by each of the universities under consideration was normalized, to account for differing lengths of the study programs, such as four vs. five years degree programs, and quarter vs. semester systems, and for the varying unit-weight placed on each category by each university, so that the unit of measurement for the comparison between universities is the relative weight placed on each category -- according to their curriculum -- in terms of the overall classes required.

positions. The disjunction between the required skills for *Internet Entrepreneurship* -- or, more generally, for innovation in technical fields -- and traditional managerial career paths that the interviewees' comments indicate is surprising, for these programmers -- known in the industry as "coders" -- despite being at the starting or lower steps of the corporate ladder, carry out the most crucial function of any company in the computing sector, creating the software on which the entire firm depends. Yet these positions are spurned due to the low prestige of the position, and the excruciating long hours, the repetitiveness of the task it entails. Thus, it is the very limited number of graduates of technical schools that end up filling the programming positions, even if their training may not have sufficiently prepared them for such responsibility. The apparent failure of the country to generate software, commonly alluded to by interviewees, hardly seems surprising within this context.

Table 1: Core Courses Percentage Distribution

Areas	Stanford	USB	Metro	UCAB	UCV
Math	17%	15%	21%	17%	**29%**
Physics	11%	5%	6%	6%	4%
Other Math	6%	7%	6%	3%	8%
AL	**22%**	**20%**	6%	8%	13%
AI	6%	0%	3%	0%	0%
AR	6%	12%	3%	8%	8%
DB	0%	5%	3%	6%	4%
HU	0%	5%	0%	3%	0%
NU	0%	0%	0%	3%	0%
OS	6%	15%	33%	22%	21%
PL	**28%**	15%	9%	3%	8%
SE	0%	0%	3%	6%	0%
M&F	**0%**	**2%**	**6%**	**17%**	4%

Let us now examine in detail the differences between each institution's graduates, as evidenced by the emphasis each university places on the various degree requirements (both the core curricula and the aforementioned less formal requirements), the title of the degree they award, and their graduates' aspirations and eventual positions. As Table 1 discloses, the Metropolitana's *Ingeniero de Sistemas* curricula favors courses in the M&F area over more technically-intensive ones such as Computer Architecture -- which, some argue, is one of the crucial courses of Computer Science. Accordingly, their graduates aspire to managerial positions and MBA programs, and tend to obtain positions within this segment whether at commercial companies or substituting for their parents at the family company, often changing work fields overnight. In contrast, UCV's graduates are mainly interested in the purist aspects of "doing science," and once again, the university's requirements for the *Licenciado en Computación* degree yield a causal explanation. Not only does Table 1 expose a correlation of these aspirations with a greater concentration in the area of Mathematics than any of the five universities considered, but also, of the four Venezuelan universities under scrutiny, the UCV is the only one that does not require nor give credit towards graduation for internships in the field, instead requiring students to complete a senior thesis. From the industry's perspective, UCV graduates require close

supervision to remain anchored in practical tasks, and their love of research propels the majority to seek teaching positions within their alma mater. The UCAB's *Ingeniero Informático* program was only started in 1996, and has yet to a graduate its first class -- hence, given the concentration of the core curricula courses in the area of M&F, as well as the curriculum similarities between the UCAB's and the Metro's program, one can only predict that their graduates will also aspire to managerial positions.

USB graduates, in contrast, are a prized commodity within the Venezuelan job market, due to the practicality and currency of their training, as well as to their efficient, problem-solving, entrepreneurial abilities. These claims are verified upon closer examination of the degree requirements for the *Ingenieros de Computación* , which show a pairing of most theoretical courses with laboratory classes, include a greater number of electives than any of the other Venezuelan universities under consideration (twelve to sixteen at USB compared with four at the Metro, five at the UCV, and three at the UCAB), and insist that students choose between at least two research projects or internships before graduation. As evidence of the degree's currency, the USB is the only one of the Venezuelan institutions that is currently teaching courses in the area of Human-Computer Interaction (HU), a feature that many US universities have yet to match, despite the fact that the area was introduced in the ACM's Computing Curricula eight years ago. As for their graduates' entrepreneurial qualities, Table 1 highlights the similarities between Stanford's curriculum and the USB's, especially in the areas of PL and AL, and in the lack of relative importance given to the M&F courses, which the interviews indicate to correlate negatively with the graduates' desirability in the work force.

ELECTIVES:

Unlike the core curricula, electives inherently possess a flexibility that permits rapid incorporation of the latest discoveries and trends in the field, rendering them ideal for accommodating Internet programming classes until the programming languages for this medium are standardized and stabilized. Yet scheduling limitations only allow for a limited number of courses within this category, and the same flexibility that makes electives ideal for introducing new concepts easily and quickly constrains the students' scheduling options. Even if the student actively desires to acquire *Internet Training*, and if such a course is available at the institution s/he is enrolled at, conflicts with core sequential courses and unpredictable offering schedules of the Internet electives may prevent the student from taking such a course. Despite adjusting[6] for these considerations, of the Venezuelan universities under analysis, during the Spring 1997-98 term, only the Metro and the UCV offered one course each under the *Internet Training*

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[6] In order to accurately reflect the choice students must make, this study considers only the electives offered for the Spring term -- second semester or third quarter, depending on the school's system -- of the 1997-98 academic year. The choice of such a current term is motivated by the fact that Internet Technology is so recent a field that many schools -- even in the United States -- have yet to incorporate it into their class offerings. Stanford, traditionally a leader in Computer Science education, did not feature such a class until the academic year 1997-98. Under the term "electives," this study considers all classes, workshops and seminars, not specifically included within the core curricula but offered within the School or Department of Computer Science, available to all students. Hence, Internet Electives are defined as classes training students in any part of, or all, the spectrum of Internet-related issues, methods and languages (from introductory courses to those teaching programming languages whose applications can run on-line, information exchange with servers, among others, but excludes courses exposing the network's architectural and protocol details.

categorization[7]. Comparison with Stanford yields surprising results, for although Stanford did offer one course within the *Internet Training* category for the Spring 1997-98 term and had at least two more courses listed in that year's offerings, such classes at Stanford are optional, not included within any degree program as electives.

CONCLUSIONS:

Computer Science training is offered in several Venezuelan universities, yet the differences in the nature and structure of the curricula available in each university suggest that training for *Internet Entrepreneurship* is limited. Moreover, on the eve of the millennium the recent trends within the joint ACM/IEEE-CS International task force in preparation for Computing Curriculum 2001 seem to indicate the ineludible extinction of the static large set of core curricula courses. Favored instead would be a framework where a minimal set of core courses (when compared to Curriculum 91) is complemented by a wide spectrum of elective courses and seminars, emphasizing practical involvement of students in both current research and industry projects. Such a curriculum closely resembles that of Stanford and the USB, favoring flexibility and customization of the degree according to each student's interests, over knowledge consistency between graduates. Given the exorbitant rate of change of the Computer Science field, such changes to the curricula are long overdue, and while controversial, will undoubtedly foster greater levels of entrepreneurship and a better match of the graduates' skill set with the labor force's expectations.

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[7] Although the USB does have at least one course in *Internet Training*, there were none offered during the Spring 1997-98 term. Moreover, we must once again consider the UCAB separately, since due to the program's youth, none of the enrolled students have yet taken an elective course. Nonetheless, there are no *Internet Training* courses in the proposed list of electives approved by the *Consejo Universitario*. The Director of the School argues that, due to the field's constant fluctuations, long-term planning poses a particular challenge, and given that the UCAB's *Ingeniero Informáticos* have their first elective course slot scheduled for the year 2000, the Director believes that there is plenty of time to decide on, and implement, other electives.