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**Alternative Learning and Research
Leading to Development**

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Alternative Learning and Research Leading to Development

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Abstract

The objective of this work is to report an experience of learning and research not following the traditional track, which is successful in preparing individuals to get a doctoral degree and, while getting the credentials, engage in research related to the needs and desires of the regions where they live. The Centre for Innovation and Educational Development (CIDE) is a Mexican private organization created by academics working in public universities, in an effort to contribute to the application of science to solve local/regional problems. CIDE emerges from the recognition that Mexico, as well as many countries of the economic South, need more scientists, since the independent economic development of societies in the world is not possible without the creation of a critical mass capable of solving the scientific and technical problems which allow them to grow. CIDE aims to create *regional scientific communities* to help reduce the deficit of scientists in the country. The model combines: Learning based on problems (PBL), self-study as well as group-study, flexible curriculum, *intensive use of ICT's*, and the acquisition of generic competencies for research. The emphasis is changed from *teaching to learning*, based on personal and group study carried out by the students concentrating on specific topics of research. The individual learns to do research as part of a general process of learning. CIDE has no physical infrastructure. Professor-advisors do not receive a salary. Students and advisors meet once a month for two full days to socialize knowledge and advance the students' projects. Students usually already teach full time in educational institutions. CIDE attracts students that are unable, for different reasons (age, workload, family obligations), to join conventional PhD programs. This leads to the formulation of individualized programs. CIDE has proved that the preparation of highly qualified, motivated scientists could be done with very limited resources. In this context we understand as development *the ability and desire of improving the individual and group quality of life with the means at our disposal*.

Keywords: alternative learning and research, community development, science for development

Introduction

The Centre for Innovation and Educational Development (Centro de Innovación y Desarrollo Educativo, CIDE) is an exceptional institution in terms of its generous offering of higher education leading to research at practically no cost. The question raised by its founders is the same as we set up as our research question: how to increase the number of scientists dedicated to local/regional development in Mexico? The answer is given by a number of university professors, not necessarily inserted into mainstream science, who take advantage of some features of globalization to help nonconventional students to get a PhD degree in sciences, putting in practice an innovative way of learning and research aimed to prepare new scientists and, concurrently solve specific research problems detected by the students in their own geographic region. In the decade of the 80's, Dr. Miguel Arenas, a university professor, had the idea to support higher education geared to research with alternative methods, in some official universities of the Mexican provinces. He and his colleagues were convinced that:

The education imparted in universities was not appropriate for the learning of students. Mexico needed to produce more scientists to cover national needs and the official system was unable to carry out that work by itself (CIDE, 2003).

Dr. Arenas and associates gradually developed a learning method that is a combination of Learning Based on Problems (PBL), self-study as well as group-study, flexible curriculum, *intensive use of ICT's*, and the acquisition of generic competencies for research. The emphasis in education is changed from *teaching to learning*. Indeed, these professors realized that: *The objective of education is learning, not teaching* (Ackoff and Greenberg, 2008: 5) and *Motivated students and adults learn without being thought; they do so by means they select* (ibid., p. 10). CIDE starts from a didactics addressed to the adult population (andragogy), inter-disciplinary, multi-age and multi-level where students with both different interests and motivations concur to learn how to proceed as a scientist in formation, that is, individuals meet in the same space sharing the knowledge each has and learning from each other (CIDE-CEJUS, 2015). One of the most active members of CIDE, Joel López-Pérez and Susana Juárez-López, put together the principles of the method and baptized it as *Método Arenas* (Arenas Method) in honor of the academic who initiated this effort (López-Pérez and Juárez-López, 2012).

In terms of infrastructure, CIDE lacks any physical installations or laboratories. They meet in edifices belonging to other organizations. The student whose project requires the use of a laboratory, is recommended by the members of the CIDE network with a scholar who has access to one. Professor-advisors do not receive a salary. The socialization of knowledge, fundamental in the learning process, takes place once a month for two full days of intensive work. Students and advisors meet to report the students' progress in their personal academic programs. Since these meetings are multi-level, and multi-

thematic, they represent a unique opportunity to learn even outside the particular topic of their research.

Our methodological approach in this research is case-study, stressing participant observation, documental analysis and in-depth interviewing.

Relevant Literature

Training scientists to attend regional problems. Keane and Allison (1999) assert that *knowledge* and *learning* represent two necessary elements for the achievement of economic development; therefore training scientists for addressing problems not necessarily in good currency is an important issue for the economic South. In fact, as Wu, Zhang and Zhag (2008) show, there is a positive correlation between income distribution and level of education per capita. For that reason, all efforts to improve the level of education in a country, as CIDE does, should be most welcome. The above leads to understand the need to prepare a larger number of professionals, scientists and technologists that will generate innovations, not only within the overall framework, but also within specific contexts. Sun (2015) emphasizes the need to produce consensus among society to help migrate toward a greater local knowledge generation, which finally will help to provide more ad hoc solutions to specific problems, and may have a favorable effect on the development of regions, not only from an economic point of view but also socially. Finally, Arocena, Göransson and Sutz (2015) assert that basic capacities have been developed, in some cases, to achieve high level results in the economic South.

Community development. The roots of community development, both theoretical and applied, may be found in thinkers as far back as Marx and Engels. The literature includes a number of authors who have contributed to an abundant theoretical and practical body of knowledge, particularly associated with action research, including Freire (1970), Stavenhagen (1971), de Schutter (1983), Fals Borda (1981, 1982, 1987) and others. These authors emphasize community participation as the way of enhancing development in rural (and other) areas by taking the political control of the communities and then making the “right” decisions. The orientation taken by CIDE is more in the sense of community developing not as an act of power but as the result of the conviction that development has to come from *within*, regardless of the power struggle. There is a common misunderstanding between *development* and *growth*. Following Ackoff: *To develop is to increase one’s ability and desire to satisfy one’s own needs and legitimate desires and those of others* (Ackoff, 1986: 24); whereas *growth* is the increase of some tangible object. For instance if the number of cars produced in a plant increases, we rightly may say that the car production is *growing*. Whereas if the quality of working life of its workers is increasing, then it is clear the plant is *developing*.

A Brief History of CIDE

Miguel Arenas and a group of concerned academics started to prove his methodological ideas in the early 80's at the Faculty of Medicine and Nursery, University of Zacatecas, central Mexico. Perhaps the first time he implemented his method in full, was in 1987 at the same University, with the creation of a Masters' Program in Animal Production in Arid Zones. In two years, the students lived the experience of reading, reflecting, experimenting and writing in a way they have never done in the past (López-Pérez and Juárez-López, 2012: 24-25). *It could be said we transformed a part of the reality and, by doing so; we transformed ourselves*, points out Raúl Villegas, a student of this program (López-Pérez and Juárez-López, 2012: 25).

Earlier in 1985, Arenas and associates proposed the creation of the University Centre of Research in Agriculture and Livestock at the University of Colima, campus Tecomán, central Mexico. The Centre's aim was to support the academic improvement of the staff, to promote the scientific research of production in this dry tropic region, and to find answers to the regional problems of these eco-regions. Ten years later the Tecomán group of researchers, all alumni of Arenas, consolidated and became the first *regional scientific community*. In 1998, a group of researchers who got their doctoral degrees in Tecomán, headed by Arenas and collaborators decided to create a new *regional scientific community* in the State of Coahuila, Northeast Mexico. They were well received at the Antonio Narro University, campus Torreón. This new academic adventure led to formalize the Arenas group by making official the existence of the Centre for Innovation and Educational Development, as a civil association, in June 23th, 2000 (López-Pérez and Juárez López, 2012: 25).

In 2003 some CIDE members participated in the design of the higher education program of the Justo Sierra Studies Center (Centro de Estudios Justo Sierra, CEJUS). CEJUS is another outstanding alternative educational project located in the mountain range of the state of Sinaloa, Surutato, Northwest Mexico (CEJUS, 2004). The professional studies deal with disciplines related to sustainable exploitation of natural resources in congruence with the Surutato natural wealth. Later in the same year CEJUS and CIDE agreed to let CIDE take charge of CEJUS' higher education. Since CEJUS had official recognition for granting academic degrees, it became very attractive for CIDE students dispersed around the country to register in CEJUS-CIDE to formalize their academic work and eventually, get the corresponding degree. Why did both institutions agree on working together? Because both professed the same educational philosophy, and a coincidence in the application of learning methods: *emphasis on learning not teaching; education centered on the student, PBL, individual and group studying*.

The Arenas Method

The Arenas Method (AM) was developed by the initiative and knowledge of Miguel Arenas and a group of scholars interested in the creation of scientific communities in some of the marginal areas of Mexico (López-Pérez and Juárez-Pérez, 2012: 19-40). They had adjusted a conjunction of learning methodologies in an innovative and useful way in order to solve real problems in a specific region. Their main objectives are to contribute with the regional development and the creation of socially responsible scientists interested in improving their milieu.

The main components of the AM are as follows: a) problem-based learning; b) construction of scientific competences and their related learning products; c) continuous socialization of knowledge; d) reflective practice; e) mentors as transformational leaders; f) learning-by-doing; g) team working, g) peer reviewing; and h) inquiry action method (López-Pérez and Juárez López, 2012: 19-159).

The socialization of knowledge is being done in inter-disciplinary and multi-level groups throughout periodical discussions, peer collaboration and the use of ICT's. The method enhances that students identify the global leaders in their field of study, the state of the art, and the main recognized journals in the field. Because, "We are what we read" (López-Pérez and Juárez-Pérez, 2012: 21), students should be lifelong learners and consider the benefits from the collective intelligence created by sharing knowledge and learning from others' experience.

Horizontal collaboration between learners and mentors is a key feature in order to allow a self-directed learning in the absence of mentor's oppression (López-Pérez and Juárez-Pérez, 2012: 117, 123). It is feasible due to the enhancement of trust among members, intellectual independence, and constructive discussion related to ideas not to individuals. Education is identified as a shared learning responsibility between learners and mentors, in which the metacognition and the inner development of each individual are essential. The development of particular learnings associated with a specialized field is important as much as developing research-scientific competencies and self-development. For instance, self-esteem, self-efficacy and self-regulation are seen as relevant traits of learning related to motivation and freedom.

The AM is based on the democratization of knowledge, a humanist psychological perspective, and the pedagogy of freedom of Paulo Freire (1970). The AM asserts that we can transform our reality by transforming ourselves. Hence, the AM creates not only scientists but citizens (López-Pérez and Juárez-Pérez, 2012: 31) who will work as discoverers and significant-pertinent problem-solvers.

Brief Account of the Centro De Estudios Justo Sierra, (Justo Sierra Studies Centre, CEJUS)

The Justo Sierra Studies Centre, CEJUS, is a very important project of alternative education of high regional impact. It is located, as mentioned earlier, in the rural community of Surutato, Northwest mountain range of Mexico, Sinaloa State, in an area of vast natural resources. In addition to a large forest area, the region's climate is ideal for cattle breeding and fruit and flower production; it also is highly propitious for the storage and preservation of grains as well. The Centre is created in 1978 as a result of the demands of the local parents to improve the quality of elementary education for their children (Comité de Planeación Educativa, 1980: 19). In subsequent stages, their demand broadened to include pre-school as well as post-elementary education up to high-school. The aim was to prevent the *flight* of the youth to the state's capital, Culiacán, as they were forced to abandon their community if they wished to continue studies. On the other hand, the area is within the bounds of what is called the *golden triangle*, a large region that spans three of the country's states, where illicit activities, namely the production and traffic of narcotics, take place intensively. Therefore, the parents are confronted with the dilemma of letting their children go or exposing them to be absorbed by the regional delinquency.

Since 2003, the Centre boasts of the creation of the Universidad de la Sierra (University of the Mountain Range), offering from the Bachelors', Masters', and Doctoral degrees in disciplines related to the sustainable exploitation of the natural resources of the region (CEJUS, 2004). The fundamental reason why the community created this educational opportunity is expressed by the following text taken from the foundational document:

..... perhaps the most worrying of penuries and problems is the violence that the production and commercialization of marihuana and poppy produce in the communities and roads of the region. Unemployment, lack of communications and the call for easy money, in a frame of violent dispute for the drug market, cuts off lives and makes uneasy the daily life of individuals, families and the region (CEJUS, 2004: 15).

Participative planning is successfully practiced in Surutato by both adults and students. The community is aware that the future can be modified by communally made decisions and actions. They are in a process of development, not in the conventional sense of continuously acquiring more goods and services, but in Ackoff's sense expressed at the time as the "capacity defined by what they can do with whatever they have to improve their quality of life and that of others." (Ackoff, 1977: 210). The entire project is imbued with a philosophy of development similar to Ackoff's. In the words of Surutato's Educational Planning Committee:

The fundamental objective of basic education is to help human beings to understand their immediate problems, and provide them with the proper training to solve their *problems by themselves* (Comité de Planeación Educativa, 1980: 2).

Some Results

Since the CEJUS-CIDE agreement, fifteen doctoral degrees have been granted some of which stand out for their quality at the forefront of both biological and medical science, and climate change. Table 1 shows the examination date, name, age, and sector of work of the graduates. The average age of graduates is 49 years, showing that these are not ordinary PhD students, but persons who, while attending a full-time job, decided to go for the degree and made an extraordinary effort to achieve their objectives. Likewise, 93% of the graduates work in the public sector.

Table 1. *CEJUS-CIDE PhD Graduates since its Association with CEJUS*

	Examination date	Name	Age	Place of work
1	July / 2008	Rocio González	48	Public Health Institute
2	July / 2008	Víctor M. Wilson	40	Public University
3	July / 2008	Ángeles Verduzco	59	Independent
4	Nov / 2008	Rosa Xicohténcatl	52	Public University
5	Nov / 2008	Carmen Reza	38	Public University
6	Nov / 2008	Nora Fernández	53	Public University
7	Aug / 2009	Marcos Bucio	47	Public University
8	Nov/ 2009	Ramiro Álvarez	50	Public University
9	Jan / 2013	Norma E. Dominguez	48	Public University
10	Nov / 2013	Félix S. Juárez	55	Public University
11	Nov / 2013	Alberta L. Granada	58	Public University
12	Nov / 2013	Victor M. Salomon	48	Public University
13	Nov / 2014	Maria N. Herrera	43	Public University
14	Nov / 2014	Ana F. Sandoval	46	Public University
15	Dic / 2014	Miguel A. Aguilera	52	Public University

Source: personal communications and CIDE-CEJUS, 2015.

A brief description of some dissertations presented at CEJUS-CIDE follows, extracted from Jiménez (2012: 121-122):

Rocío González's dissertation was on "Molecular identification of *Coccidioides* SPP in the Comarca Lagunera Region, in North-eastern Mexico: a new endemic area for *Coccidioidomycosis*". The *Coccidioidomycosis* is a lung mycotic illness, endemic of the Southwest USA, Northern Mexico and several semi-arid regions in

Central and South America. Dr. González’s research was able to identify an endemic area of the disease located in the “Comarca Lagunera” region, Northeast Mexico. The identification of the endemic area helps diagnose the illness correctly, often mistaken as pneumonia, thus giving patients the right treatment, and saving many lives. Figure 2 shows the areas where the endemic illness takes place.

Figure 2. *Regions where the Coccidioidomycosis Takes Place, both in Mexico and South USA*



Source: Own elaboration from Rocío González dissertation

Víctor M. Wilson’s dissertation in phyto-mining is titled “Hyper-accumulation of gold chemically induced in eight vegetable species”. In 1998, it was discovered that gold absorption may be induced in plants. This procedure known as “induced hyper-accumulation” has drawn the attention of both scientists and entrepreneurs. Mexico, with a long mining tradition did not have a team of scientists to do research in “phyto-mining”. Víctor contacted the only two existing specialists in the world, one in New Zealand, the other in Switzerland. With the advice of the experts, Víctor experimented with eight plant species. Three yielded a profitable gold “crop”. With his results, Víctor was able to defend his dissertation and get the doctoral degree. Now he is considered a world specialist in phyto-mining.

Marcos Bucio Pacheco made an important project with transcendental significance for the global warming issue. Dr. Bucio worked on tele-detection, via satellite imagery, of chlorophyll stress

in an arid corridor in the state of Sinaloa. He composed a periodic series of satellite images that led to important implications for global warming. Dr. Bucio began work on this project after he detected a kangaroo rat population, i.e. a desert rodent, some 300 kilometres beyond the desert boundaries in the state of Sinaloa. Dr. Bucio's work provided accurate statistical data on changing climatic conditions for a period of three decades beginning with the 1970s.

One of the most important characteristic of CIDE's model is the emphasis on the analysis and exploitation of the frontier literature in the students' corresponding area of research. This allows them to eventually get in personal communication with top scientists in the field, as mentioned before, enhancing their national/international network, opening the door to participate in international conferences and, in some cases, collaborate with "global" scientists, thus gradually inserting into mainstream science. Table 2 shows examples of renowned international contacts made by some of the graduates during their dissertation research" (Jiménez 2012: 123). The model promotes knowledge production *from the bottom-up* by recognizing locally felt problems of regional communities and working on the solutions, thus making it more socially responsible.

Table 2. *Examples of "global" Contacts Made by Ph D students in the Course of their Dissertation Research*

Name	Field	Impact	Intl. Contacts
Rocío González	Mycotic Diseases	Regional / Global	Dr. Demostenes Pappagianis. Faculty of Medicine, U. of California, Davis.
Víctor M. Wilson	Phytominy	Regional / Global	Dr. Christopher W. N. Anderson. Natural Resources Inst., U. Of Massey, New Zealand.
Rosa Xicohténcatl	Animal Genetics	Local / Regional	Dr. Wilfred Goldmann. Roslin Inst., Edinburg, Scotland.
Marcos Bucio	Global Warming	Regional / Global	Mario Molina, Nobel Prize, MIT.

Source: From personal interviews.

Conclusions

CIDE's proposal represents a fresh and innovative approach to scientific knowledge, going straight to the core: doing research that leads to the solution of regionally felt real problems. It has the virtue of promoting learning and research that forms leaders in a specific field. As well, it is accessible to all

those that are willing to carry out work in an ordered, systematic and scientific manner.

It is an innovative approach also in the sense that it reflects the needs of a less privileged segment of local societies in which the students are immersed. Thus, CIDE is an example of a social-academic entrepreneurial approach that serves as an example of Mode 3 knowledge production, which we discuss elsewhere (Jiménez, 2009). It dares to do things differently from the mainstream. It is not aimed at making a profit, but rather to the formation of people who take the responsibility upon themselves for developing Mexican society, from the bottom-up, at local level. By combining various educational tools, as outlined above, the Centre promotes better access to education for people in the provinces and already working professionals, as well as learning that involves research projects that will have a direct impact on local communities.

CEJUS-CIDE's efforts are a valuable educational contribution in Mexico. This is reflected in its official recognition by the Ministry of Public Education and Culture of the State of Sinaloa. Through the various scientific communities CIDE has created in different regions of the country, students in diverse graduate programs become capable scientific researchers. This is verified through the experiences of its graduates (López-Pérez, 2004), which helps to legitimate CIDE in the opinion of mainstream scholars, who have sometimes been skeptical about the alternative educational model for innovation and development.

To focus on the shift from teaching to learning based on problems is one of the strongest aspects of CIDE's approach. CIDE's experience demonstrates that it is possible to reach desired objectives with a system whose parts enjoy ample flexibility, without the need for a costly physical and human infrastructure. The "glue" that brings together the different parts of this system is, convincingly, the *motivation* that each member has for reaching his/her particular objectives as well as CIDE's general objectives.

Though it has thus far had a limited impact nationally, it is nevertheless very important regionally and as such makes a significant contribution to modern Mexican society. Clearly, the production of just a few PhDs does not solve the lack of scientists in the country. However, it proves that:

- It can be done with a minimum of resources.
- A number of CIDE's methodological features should be incorporated in the official higher education.

The research question: "how to increase the number of scientists dedicated to local/regional development in Mexico?" is positively answered with the CIDE model for the formation of scientists dedicated to the regional Mexican problematic.

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