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Leadership Training for Science & Technology Parks

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Executive Summary

A successful science & technology park must create an environment that integrates knowledge and business. Therefore, it is essential to develop highly skilled leaders who can organize and operate an environment that fosters the generation of innovations. Within this context, ANPROTEC, with the support of the Brazilian Micro and Small Business Support Service – SEBRAE, created UNIANPROTEC, a training program for professionals involved in the generation of innovations. The goal of this training is to create the next generation of leaders for the different innovation environments: science & technology parks, business incubators and ecosystem of innovation. Although UniAnprotec's proposal encompasses managers of different innovation environments, this article will address the training course for managers of technology parks. The goal of this course is to train professionals so that they are able to create and operate environments for the systematic generation of innovative projects from an international network of scientific and technological institutions. The methodology used in the course is based on Enactive Learning. In addition to the contents addressed and the practical application of the knowledge learned, the course is a strategy for the consolidation of the network of institutions involved in planning, implementing and operating science & technology parks. Thus, companies supported by the Brazilian parks now have an effective support to operate in the global market.

Keyword: Science & technology park. Training of leader. Collaborative learning. Environment of innovation. Internationalization.

1. Introduction

The use of science, technology and innovation to increase the population's quality of life and the quality of competitiveness of a region has increased significantly in recent decades. In this sense, regional leaders have made use of different environments to promote the development through the systematic generation of innovative enterprises.

Within this context, a widely used strategy is the creation and operation of environments and mechanisms that promote innovation, such as technology parks, business incubators, accelerators and others.

Thus, the number and the diversity of innovation environments have grown significantly. As a result, there a fewer boundaries between the different types of environments and the performance of each one of them cannot be seen individually, but as part of an Ecosystem of Innovation.

Thus, the teams involved with the different types of environment of innovation need to have training both broad (knowledge on the different types of environments and their specificities and complementarities) and detailed (in depth knowledge of the type of environment of innovation in which the individual is operating). Thus, the professionals must know the Ecosystem of Innovation, but also need to know the individual environments.

The goal of this article is precisely to propose a training methodology for professionals to be able to create and operate technology parks and other innovative environments, in order to generate systematically innovative enterprises of success, from an international network of scientific institutions and technology.

2. Learning Theories

For centuries, researchers have been trying to answer questions related to the nature and the process of learning and gaining knowledge. From Plato and Descartes, many scholars from different work fields have studied these issues, seeking to better understand the human mind.

Researchers from different disciplines have come together to study issues of common interest related to the human mind. These researchers usually worked in the area known

as cognitive science, as all these disciplines are concerned with studying cognition, i.e., how the acquisition of knowledge happens.

Through a careful analysis of the evolution of both the individual disciplines and the Cognitive Science as a whole, we can identify the roots of the main learning theories that have been or are being used in education. Each of these theories is based on an epistemology, i.e., a notion of how knowledge takes place.

2.1. Apriorism

According to apriorists, the basic skills of every human being are basically "ready" at birth (GARDNER, 1996). As Hessen (1987, p. 77) highlights, "knowledge has, in the sense of this school of thought, elements a priori, regardless of experience."

Thus, at birth, the individual already has the conditions of knowledge and learning that will manifest immediately or gradually, with maturity.

Thus, as pointed out by MOURA, AZEVEDO and MEHLECKE (2001, p.3), “all knowledge activity is part of the individual, the medium does not participate”.

The relationship between individual verse object, apriorists accredit more meaning to the first. So, there is nothing in the object that defines it as such and the image we make of it does not account for its content.

Thus, the apriorism understands thought as the main source of human knowledge, stating that the essence is inaccessible to the senses. In this school of thought, the thought does not behave in a passively and receptive way to experience, but spontaneously and actively.

Due to the indicated characteristics, aprioristic epistemology cannot be used as a basis for the development of leaders for technology parks, since, according to this approach, there are no learning methods: the student, according to its capabilities, follows his own paths.

Based on the foregoing, we conclude that the aprioristic epistemology has the following basic principles:

- **Fatalism:** If the student is not born with the necessary skills, education can do little for him/her.

- **Individualism:** The student already has the knowledge; therefore, he/she only needs to bring it "to life"
- **Customization**: How a student interprets a stimulus (and the type of response provided) depends on his/her previous experience.

2.2. Empiricism

Empiricism opposes to the thesis that thought (reason) is the true source of knowledge, considering that experience is the only source of human knowledge.

According to Hesse (1987, p. 68), "the human spirit is empty by nature; it is a clean slate, a blank page in which experience writes. All of our concepts, including the most general and abstract, come from experience".

According to the empiricists, ideas are not innate, but created by the individual in contact with real things through sensory and perceptive experiences. Thus, there is no way to be aware of something without their having a chance to experience it in some way.

The empiricist epistemology was adopted by behaviorism, which originated at the United States in the early twentieth century, through the works of John Watson (Slomp, 2002).

According to Komosinski (2000, p.41), behaviorism "officially arises in 1913 when Watson releases his 'behaviorist manifesto'. Its goal was to fight introspection and subjective research methods used by psychologists on the nineteenth century".

Thus, all behaviorist theories are also known as "antimentalists". The source of behavior, according to behaviorists, is the environmental stimuli that affect the body, forcing it to give an answer.

Thus, behaviorists (empiricist) believe that the environment determines the individual's behavior. Thus, these researchers have an opposite view of the one presented by Humberto Maturana and Francisco Varela, that the environment "conditions" but does not "determines" what happens to the being. Applying the principles of behaviorism to education, the emphasis of the process becomes about planning the learning environment.

Behaviorists consider learning as relatively permanent transformations or changes in behavior, which result from the practical performance of certain, specific tasks or experiences. These changes or transformations, due to occurring in the behavior, are observable and measurable.

The great advantage of behaviorism was to unequivocally demonstrate the inadequacy of the innatist approach. Behaviorists have shown that anyone can learn a certain subject, as long as the environment and the learning contingencies are strictly planned. Thus, it was shown the importance of environmental and social factors in the development of people. However, behaviorists completely ignored the interdependence between the living organism and its environment, giving great power to the environment.

According to behaviorists, the human being cannot be autonomous since a behavioral manipulation could be as precise as physics or biology.

Based on the above, it can be concluded that behaviorism has the following basic principles:

- **Heteronomy**: The individual is subordinate to an external power, i.e., there is no autonomy.
- **Autodidacticism**: The didactic material is developed in order to privilege the individual study. Therefore, there is no interaction among participants (student-student or student-teacher).
- **Reproduction:** The student does not build anything new. He just reproduces the content passed on by the teacher.
- **Massification**: The content is not adapted to individual differences, being the same for all students. In this sense, the didactic material is developed before the students are even known.

2.3. Constructivism

Constructivism is an epistemological stance that understands knowledge as originating from the interaction of the individual with the object. Thus, constructivism does not recognize the predominance of the individual or of the object in the learning process.

As Becker (1993) points out, the individual acts on the object, assimilating it: this assimilative action transforms the object. The object, when assimilated, resists the tools of assimilation that the individual has at the time. Therefore, the individual reacts by redoing these tools or building more powerful new tools, with which he becomes able to assimilate, that is, to change increasingly complex objects.

In this same direction, Ramos (1996, p.37) states that: if the environment is not solely responsible, if the individual as body, mind and consciousness also has an active part in

the development process, then the development takes place in the interaction of the individual with the environment.

This is the understanding of the interactional school of thought that emerged at the beginning of this century. Among the constructivism representatives, we can highlight the genetic epistemology of Jean Piaget.

Although Piaget has not developed a learning theory, his epistemological theory of how, when and why knowledge is build had a great repercussion in the education area.

As pointed out by Piaget (1996, p.15), knowledge does not consist in "copying the reality, but acting on it and changing it (in appearance or in reality), in order to understand it in terms of transformation systems to which these actions are linked".

Thus, knowledge cannot be conceived as something predetermined from birth (innateness), nor as a result of simply registering perceptions and information (empiricism). It results from the individual's actions and interactions in the environment where he lives. All knowledge is a construction that is being developed from childhood, through the individual's interactions with the objects that he/she seeks to know, whether in the physical or cultural world.

According to the Genetic Epistemology of Jean Piaget, knowledge is understood as a construction process where the individual is the agent of his/her own learning. As highlighted by Guerra (2001, p.60), "the learning process is, at first, personal, i.e., a first-person experience".

Thus, based on Piaget's work, we can relate as principles used by the cognitive approach:

- **Autonomy**: Based on equality and reciprocity of partners, freeing both from the anomie of egocentrism, heteronomy and coercion.
- **Interaction**: Communication is multi-directional, taking place between teacher and student and among students.
- **Construction**: The emphasis is not on reproduction, but in building artifacts that are meaningful to the student.
- **Customization**: The learning process takes into account the specific characteristics of each student. Thus, rather than a massified didactic material, there is the construction of contents throughout the process.

2.4. Enactive Learning

The Enactive Learning methodology arises from the work of VARELA, THOMPSON and ROSCH (1997), in which cognition is not seen as the solution for issues based on representations, but as the creation of a world from a history of structural coupling. So, there isn't a passive absorption of an objective, pre-existent world.

This is also the proposal of Paulo Freire, known as investigative methodology. For this reason, the work of Paulo Freire, which is in line with the principles of the Enactive Learning epistemology, will be used to define the basic principles to develop learning environments.

Freire proposes a problematical and liberating concept of education, which is opposed to what he calls “banking education”. In the banking concept, “the education becomes a depositing act, in which the students are the depositories and the teacher is the depositor” (FREIRE, 1987, p.58). In this “banking” approach to education, the educator's job is to fill the students with contents that are clippings of reality, withdrawn from the context in which they would gain meaning.

In this concept, according to Freire (1987, p.58), “the best educator is the one who ‘fills’ its containers the most with its 'deposits'. The best student is the one who most obediently lets itself be 'filled'”. According to the problematical and liberating concept of education, teaching is not transferring knowledge, “but creating possibilities for knowledge to be produced, built on its own” (Freire, 1997, p. 52). Thus, education should allow a critical reading of the world, recognizing the men and women as historical and unfinished.

Another key aspect of the investigative methodology is cooperation, without which there is no autonomy. It is important to emphasize the connection between autonomy and cooperation, where autonomy does not mean individuation, seeing that autonomy is only obtained through cooperation.

Thus, we see that the proposal of Paulo Freire cannot be evaluated by the number of issues on which the students are able to expound, or the time in which it can fill the students with data on reality. As pointed out by RAMOS (1996, p.63), “for Freire, the quality of the educational process, should be measured by the potential to transform the world acquired by the students”.

Thus, we can conclude that the problematical proposal of Paulo Freire is based on some principles, among which we can highlight:

- **Autonomy**: Based on equality and reciprocity of partners, freeing both from the anomie of egocentrism, heteronomy and coercion.
- **Interaction**: Communication is multi-directional, taking place between teacher and student and among students.
- **Construction**: The emphasis is not on reproduction, but in building artifacts that are meaningful to the student.
- **Customization**: The learning process takes into account the specific characteristics of each student. Thus, rather than a massified didactic material, there is the construction of contents throughout the process.
- **Cooperation**: The isolated human being can never come to know; the communion is essential between people.
- **Devenir Constant**: Reality is not static and is open to unpredictability. Is worth noting that Paulo Freire does not understand the observer as independent of the world. For him, if the world is perceived by men such as it is, having nothing else in cognition besides what is offered by the world, the human consciousness would be overwhelmed by the world and would have to conform to it.

From the presentation of some learning theories, we have seen that different approaches differ among them in terms of principles on which they are based. Therefore, is crucial that these principles are clearly known so that we do not use approaches based on conflicting principles, such as heteronomy and autonomy. The approach used to create, develop and implement the innovation environments training for leaders, will be the Enactive Learning.

3. Approach

In Brazil, training for professionals working in innovation environments (technology parks, business incubators, among others) generally do not follow the foregoing on learning and knowledge generation.

The trainings usually have two common characteristics: specific (focused on one type of innovation environment) and unilateral (transfer of content).

Due to this context, ANPROTEC, with the support of the Brazilian Micro and Small Business Support Service - SEBRAE, created UNIANPROTEC, a training program for the professionals involved in the generation of innovations. The goal of this training is to create the next generation of leaders for the different innovation environments: technology parks, business incubators and innovation ecosystems.

Although the UniAnprotec's proposal encompasses managers of different innovation environments, this article will address the training course for managers of science & technology parks. The goal of this course is to train professionals so they are able to create and operate environments for the systematic generation of innovative projects from an international network of scientific and technological institutions.

The methodology used in the course is in line with the aforementioned, in terms of collaborative learning, and is based on the logic based in "learning by doing", since the participants experience the day-to-day of a technology park.

4. Training Structure

Following the principles of collaborative learning and of "learning by doing", the proposed leadership training on Science & Technology Park is based on four basic elements, as shown in the following figure.

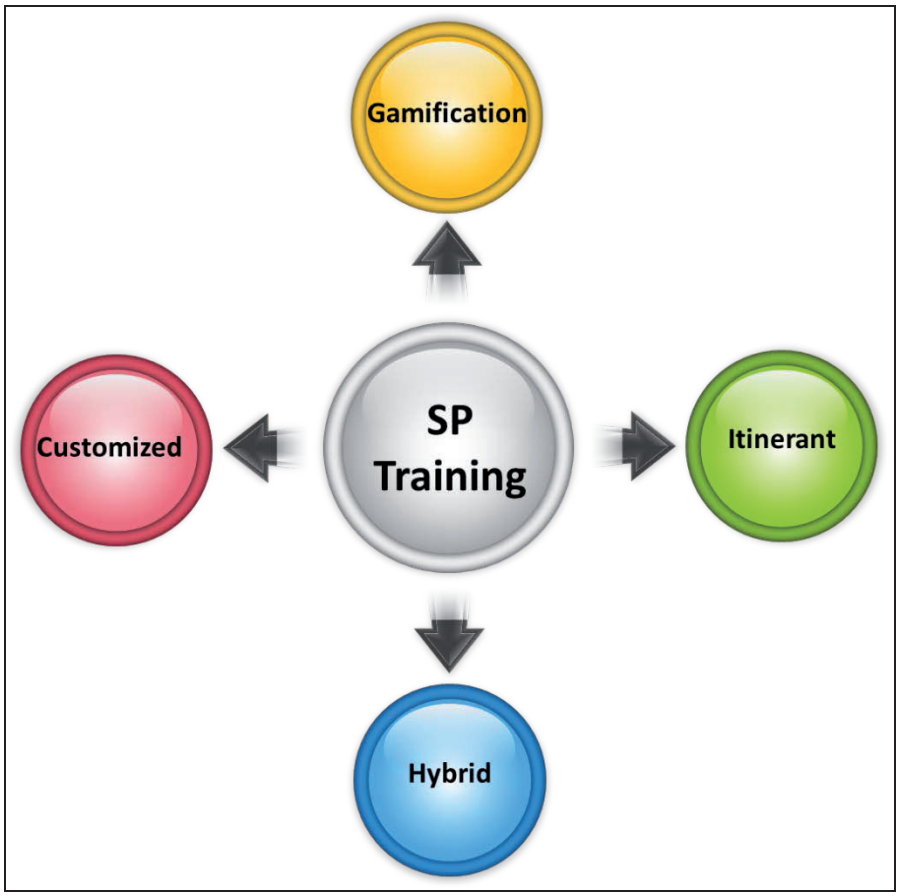

Figure 1: Training structure

- **Gamification**: the contents to be worked on during the course will be structured as a game, that is, applying game mechanics and game design techniques to engage and motivate people to achieve their learning goals.
- **Itinerant**: each course module will be carried out in a different region of the country and will take place on the premises of a technology park. Thus, the participants will be able to experience different regional realities and different models of technology parks.
- **Hybrid**: the course will have in-person and distance learning activities. Thus, participants will have activities that will be carried out in an online learning environment and others that will be carried out in person.
- **Customized**: throughout the course, each participant must use the contents and activities carried out to prepare its own proposal to improve the technological park in which he/she operates.

To meet all the needs of professionals working in technology parks, the contents to be worked on have been organized into four distinct and complementary axes, as shown in the figure below.

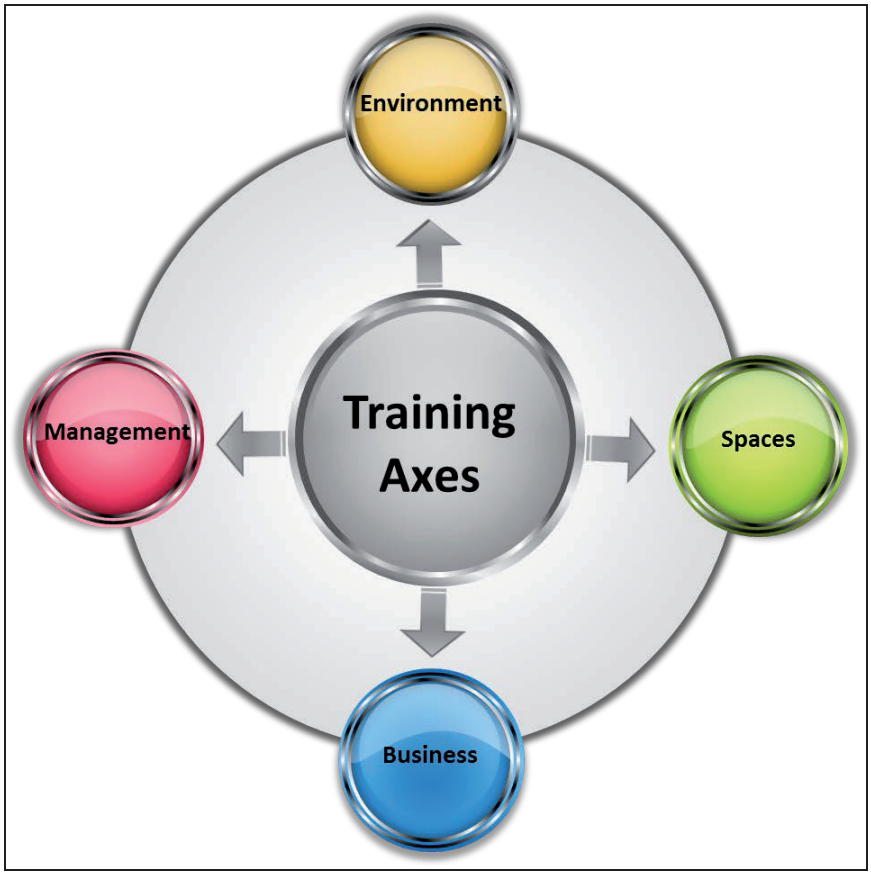

Figure 2: Training axes

- **Environment**: this axis deals with the interaction of the technological park with its surroundings, emphasizing the role of the park in the Innovation Ecosystem of the region and the interaction with other institutions. The disciplines to be offered in this axis are:
    - **Innovation Ecosystem**: addresses the development of models based on innovation, the identification and interaction with different agents to promote innovation in the region and the establishment of the park's role within the context of the region
    - **Governance**: deals with the way the park is managed, monitored and encouraged, involving the practices and the relationships between the management team, the park's board, the control agencies and agents in the innovation ecosystem of the region.

- **University-Enterprise Interaction**: addresses the knowledge related to joint projects with universities and research institutes.

- **Spaces**: the focus of this axis is the analysis of different areas that the park must have to fulfill its role within the Innovation Ecosystem. The disciplines to be offered in this axis are:
  - **Physical and Technology Infrastructure:** includes aspects related to the location of the park and the infrastructure and technological resources elements necessary for its operation and to give support to the projects;
  - **Innovation Environments**: approaches the key concepts, processes and practices to plan, implement and operate different innovation environments: business incubator and accelerator, coworking.
  - **Anchor-Projects**: includes the knowledge related to the identification and the attraction of projects aligned to the role of the park in the region and which will contribute to attract new projects.
- **Business**: the goal of this axis is to explore the different strategies to enable the successful operation and growth of the technology park as a business. The disciplines to be offered in this axis are:
  - **Business Model**: deals with the strategy adopted by the park to generate value for customers and capture value for the park. This includes the identification of customer's segments and the development and validation of the value proposition for each of the defined customer's segments, in addition to the definition of the revenue model to be used. Moreover, other elements proposed by the business model canvas will be addressed.
  - **Marketing**: includes the knowledge related to the positioning of the park in the region and the good communication practices commonly used by successful parks.
  - **Internationalization**: addresses the knowledge related to the development of internationalization plans, the strategies to attract international business, the strategies to internationalize the supported companies and the creation of networks with international institutions.
  - **Capital**: addresses the strategies to attract capital for the park and for the supported companies.
- **Management**: in this axis the emphasis is on the activities of planning, execution and control of the technology park. The disciplines to be offered in this axis are:

- **Management**: addresses the key concepts, processes and practices to plan, implement and operate technology parks.
- **Legal Aspects**: deals with laws and regulations related to the operation licensing of a technology park.
- **Intellectual Property**: deals with the law and tools for knowledge protection of both the park and the supported companies, as well as the partner institutions.

These contents will be organized in three sequential modules, one per week, and each will be carried out in a different technology park, which has good practices on the issues to be addressed.

From the knowledge covered during the course, the participants will be able to plan, implement and operate successful technology parks. As the final paper, students will write a paper presenting the results of the application of the knowledge learned during the course in a real case.

In addition to the contents addressed and the practical application of the knowledge learned, the course is a strategy for the consolidation of the network of institutions involved in planning, implementing and operating technology parks.

This happens because the teachers of the course are experienced managers of technology parks, professionals from development institutions, researchers involved in technology transfer, entrepreneurs and investors from innovative ventures, enabling the strengthening of the relationship with the course participants.

With that, it is expected that this course can be a "watershed" for the movement of technology parks in Brazil, mainly due to the following:

- Professionalization of park managers;
- Expansion of joint projects between the participants;
- Implementation of concrete actions for the international positioning of the Brazilian technological parks;
- Improvement of the knowledge and the best practices to plan, implement and operate technology parks.

5. Conclusion

Training leaders to operate in the process of promoting innovation is key to the growth and consolidation of the movement of technology parks in Brazil. In this sense, ANPROTEC, in partnership with SEBRAE, is implementing an integrated training program for professionals to work together with the innovation environments.

Thus, it is expected that the different types of innovation environments work in concert to expand the social and economic impacts on the region where the technology park operates.

Instead of organizing a traditional course, Anprotec sought new teaching and learning methods in order to emphasize the collective learning and the "learning by doing". In addition to training of professionals, the development of a network of innovation environments is expected as a result of the program, so that this network can position the companies supported by the Brazilian technology parks to have an effective support for operations in the global market.

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