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Pernambucoders How Porto Digital uses Programming Clubs to address the future of Science and Technology Parks and Areas of Innovation

Plenary Session 6:
"The future"

Author:
Polyana Targino (polyana@portodigital.org)
Porto Digital, Brazil
www.portodigital.org

Co-author(s)
Guilherme Calheiros (guilherme@portodigital.org)
Porto Digital, Brazil

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EXECUTIVE SUMMARY

Qualified professionals are key for a company success and its competitiveness, especially in knowledge-based organizations, that is the case of Science and Technology Parks (STPs) and Areas of Innovation (AOIs) residents. However, this sector is facing a global lack of good professionals to fill their jobs vacancies.

As an important player for their companies' strength and for a region economic development, STPs and AOIs can contribute to reduce or even eliminate this bottleneck, like Porto Digital is doing. In 2016, it started to run a project, named PERNAMBUCODERS, to teach programming in schools in order to contribute with better qualified professional in the future.

This paper will explain in details how the project works, its results after a year, as well as how it will impact in the future of the sector and how it addresses future issues, also showing how this experience can contribute with others STPs and AOIs.

Keywords: Science and Technology Parks, Areas of Innovation, Programming, Future.

1. INTRODUCTION

The shift for the 21st century was marked by many changes in how society faces economic, political and social issues (Shifting Thinking, 2015)[313] as well as the way people see and use knowledge and technology. As Meira (2016) affirms, for example, since 2010, every little thing that the people have contact with is surrounded by an additional layer of hardware and software, allied to one another, connectivity, that change the reality and the way people live and consume[314].

Additionally, this period was important to Science and Technology Parks (STPs) and Areas of Innovation (AIO) around the globe, because policies to strength them in order to promote integration between science, government and the private initiative were actually restructured, making them very important in the development of the countries.

Considering this new reality which brings together a series of innovations accumulated over the years (hardware, software, networks, smart devices, internet of things…) and the understanding that STPs and AOIs are institutions that promote culture of innovation and technology transfer among their enterprises and knowledge-based organizations (Sanz, 2001)[315], addressing issues of the future, it can be understood that the most important input in this ecosystem is the high qualified human capital that must be fit for this future. So, one of the main focus of these initiatives is the people, the way they learn and their knowledge production.

[313] Shifting Thinking (2015). The Knowledge Age. Retrieved from http://www.shiftingthinking.org/?page_id=58.

[314] Meira, S. R. L., (2016). *As coisas, seus Dados e as Mudanças na Indústria*. Retrieved from http://boletim.de/silvio/as-coisas-seus-dados-e-as-mudancas-na-industria/

[315] Sanz, L. (2001). Science Park (IASP Official Definition). Retrieved from http://www.iasp.ws/knowledge-bites

In this context, there is a growing appreciation of the importance of stimulating the computational thinking since primary education because it can contribute transversally with other knowledge areas, what is becoming essential in the contemporary society (Barr and Stephenson, 2011) (Wing, 2006)[316]. Believing that the future is going to be made in this direction, the American Computer Science Teachers Association – CSTA that is part of the Association for Computing Machinery (ACM), recommends the introduction of computing in basic education through different ways such as programing (CSTA, 2011). Additionally, in the video *President Obama asks America to learn computer science* (2013), the former American President, Barack Obama, supporting the Hour of Code campaign for Computer Science Education Week 2013, affirmed that computers are going to be a significant part of the future, and if the Americans wanted to stay at the cutting edge, people would need to master the tools and technology that would change the way people do everything. With that, Obama suggested that with the knowledge, people would be able to shape the future[317].

In accordance with this view, believing that teaching programming to children and youth will develop skills to help them to learn computational thinking as well as problem solving, planning designing and collaboration, inspiring them to be an active part of future of the sector and also from the local, regional and national economy, Porto Digital Management Unit (NGPD) developed a project called PERNAMBUCODERS – Code Clubs of Pernambuco. It is an outcome of a triple helix initiative articulated by NGPD which involves the State Government of Pernambuco (through its Education Secretariat - SEE), the Rural Federal University of Pernambuco (UFPE), and local companies such as CESAR – Centro de Estudos e Sistemas Avançados do Recife (Centre of Advanced Studies and Systems), an innovation centre in Porto Digital, and Softex Recife, a local company association of technology-based firms and research and educational institution also a Porto Digital resident.

More specifically, the initiative has as object the development of a self-sustainable, incremental and scalable strategy for creating programming clubs for computers in schools of the state of Pernambuco, also establishing a Coordinating Centre and studies to monitor the medium and long term impact on learning and careers of the students involved, as well as its consequences caused throughout the state's innovation ecosystem. Additionally, the project developed, can also be replicate in other regions and countries considering the appropriate limitations and proportions as it will be possible to realise at the end of this paper.

2. ABOUT FUTURE

As Ortega and Gasset (cited in Lombardo, 2008, p.1) suggest, the contemporary thinking about the future is a specific characteristic of the humanity[318]. According to them, the mankind is capable to imagine futures inventing and attempting situations. Lombardo (2008) complements saying that these thoughts involves both fears and hopes in people's head related to the theme that is on the agenda. So, it is possible to say that "we live in a mental universe of inspiring dreams and threatening premonitions regarding what lies ahead" (Ibid) so

[316] Secretaria Estadual de Educação (2016). Plano de Trabalho do Termo de Colaboração No 006/2016

[317] Code.org (2013, 8 Dec). President Obama asks America to learn computer science [Video file]/ retrieved from https://www.youtube.com/watch?v=6XvmhE1J9PY

[318] Lombardo, T. (2008). *Contemporary futurist thought: Science fiction, future studies, and theories and visions of the future in the last century*. AuthorHouse.

people can speculate about anything such as politics, sports and also about the future of a specific sector such as the Science and Technology Parks and Areas of Innovation (STPs and AOI). In this scenario, to imagine hopes and fears related to STPs and AOIs sector concerning tomorrow, is, actually, an obligation of their governances that are responsible to understand the environment, design an adequate strategic plan and develop initiatives to contribute to the ecosystem competitiveness and, by nature, it must address the future.

3. ABOUT STPS AND AREAS OF INNOVATION

In this context, it is perceived that more than be organizations to stimulate enriching relation between market and universities (Grayson & Culshaw, 1993)[319] and also to contribute to the growth and development of new technology-based firms (NTBFs) in order to increase employment and spin offs[320], according to the International Association of Science Parks and Areas of Innovation – IASP (2015)[321] STPs and AOIs are important institutions to contribute for the economic development of a region through their governance specialized initiatives and rich network with actors from universities, market, government and society. Additionally, according to Sanz (2001)[322], STPs and AOIs, in order to contribute to the companies strengthening and to increment their access to the market, must promote culture of innovation and must think about the sector future.

So, as the United Nations Educational, Scientific and Cultural Organization - UNESCO (2015) affirms, STPs are more than qualified institutions with a state of the art structure and facilities to offer to their companies[323]. Their governance role and relevance are more complex than some studies can predict. In this paper context, for example, it is possible to understand that STPs and AIOs must think about the future, reflecting how some technology, political, social, cultural, educational, market and other kinds of trends will impact them and their environment. They must think of how they will response to all changes and novelties in order to develop projects and actions to be a step ahead and still contribute to the environment, addressing their bottlenecks, reducing the risks that the sector may face and taking advantages of opportunities that may appear, remaining, in that way, relevant for the sector and also for the economy.

A relevant number of STPs and AOIs that are in operation may have been working in this direction. Each of them, probably, in their own way, with their particular expertise, methodologies and priorities. With that, it means that lots of projects that addresses the future are may being executed by different parks and there is not the best or the worst one, even a right or a wrong one. What can be identified is a number of interesting and different cases that can be replicate or with which, at least, the others can learn from.

[319] Grayson, L., & Culshaw, S. (1993). *Science parks: An experiment in high technology transfer*. London.: British Library.

[320] Siegel, D. S., Westhead, P., & Wright, M. (2003). Science parks and the performance of new technology-based firms: a review of recent UK evidence and an agenda for future research. *Small Business Economics*, *20*(2), 177-184.

[321] International Association of Science Parks and Areas of Innovation. (2015). *The role of STPs and areas of innovation*. Retrieved from http://www.iasp.ws/the-role-of-stps-and-innovation-areas;jsessionid=93a974e15d1416984ab7cf00c65a

[322] Sanz, L. (2001). *Science Park (IASP Official Definition)*. Retrieved from http://www.iasp.ws/knowledge-bites

[323] United Nations Educational, Scientific and Cultural Organization. (2015). *Concept and Definition*. Retrieved from http://www.unesco.org/new/en/natural-sciences/science-technology/university-industry-partnerships/science-and-technology-park-governance/concept-and-definition/

4. ABOUT PORTO DIGITAL

Porto Digital, in Recife, is one example of STP that is always working addressing the future. It was founded in 2000 as a public policy with the aim to insert the state of Pernambuco in the world technological and innovative scenario[324]. Its scope includes two activities heavily based on knowledge and innovation that are: (i) Information and Communications Technology (ICT), and (ii) Creative Industries, especially game, cinema, video, animation, music, photography and design[325]. To implement the governance model and the structuring projects of the park, it was created the Porto Digital Management Unit (NGPD), a non-profit civil association that is responsible to run the Park and also to maintain strategic connections with various partners that can help to promote the region economic and social development.[326]

Porto Digital currently has 271 companies with about 8500 employees. The NGPD itself runs three business incubators, one business accelerator, two pre-incubator programs, an Internet of Things (IoT) laboratory and 5 laboratories focused on the Creative Economy activities. In its territory, it is also possible to find another business accelerator, two research institutes and, at least, five innovations centres, of each three are national and two are from multinational companies.

Nowadays, Porto Digital has 22 contracts that, together, accumulate more than € 50 million in financial resources to run 39 projects focused on its eight Strategic Plan axis that are: (i) Companies Creation, Attraction and Development in Porto Digital's Territory; (ii) Porto Digital Internalization and Support to Local Production Chains; (iii) Technologies Development for Cities and People Well-being; (iv) Human Capital Qualification for Entrepreneurship, Innovation and Business Competitiveness; (v) Development of Technology Cooperation Projects With Universities and Companies; (vi) Studies and Research for the Digital Economy Future in Pernambuco; (vii) Expansion of Porto Digital's Real State Infrastructure, Technology and Services Supply; and (viii) Institutional Management and Market Promotion Improvement.[327]

Until now, after 16 years of operation and all this projects, NGPD already qualified more than 7.000 professional and certificated around 600 in tools, languages and methodologies; incubated more than 60 enterprises; supported almost 90 productions of the Creative Economy local scenario; revitalized and refurbished more than 80 square meters; supported more than 165 IoT projects, received about 400 national and 200 international missions, meetings or conferences in the last four years, and others. (Ibid)

So, through its history, stimulated by the performance that has been showing, Porto Digital also accumulated some important national and international recognitions, such as: (i) The largest technology park in the country and a national benchmark in using public policy to promote innovation and strengthen the technology sector according to AT Kearney in 2005; (ii) Awarded as The Best Technology Park/ Habitat of Innovation in Brazil in 2007, 2011 and 2015 by ANPROTEC – Associação Nacional de Entidades Promotoras de Empreendimentos Inovadores (Association of Science Parks and Business Incubators) (Secretaria de Ciência, Tecnologia e

[324] Porto Digital. (2017). *Política Pública*. [Public Policy] Retrieved from http://www.portodigital.org/parque/o-que-e-o-porto-digital/politica-publica

[325] Porto Digital. (2017). Iniciativa Privada, Governo e Universidades [Private Initiative, Government and Universities] Retrieved form http://www.portodigital.org/parque/o-que-e-o-porto-digital/politica-publica

[326] Porto Digital. (2011). Porto Digital. Leaflet

[327] Porto Digital. (2017). 1ª Reunião Ordinária de 2017 do Conselho de Administração do NGPD. Recife: Núcleo de Gestão do Porto Digital

Inovação, 2015)[328]; (iii) One of the most innovative technology parks listed as one of the ten places in the world where the future is being created according Business Week in 2009[329]; and (iv) A project not only designed to stop the city's brain drain but also to create an economic model based on information and knowledge in the view of the Financial Times in 2014 (Pearson, 2014)[330].

The strategy, all results showed and also the recognitions highlighted above are evidences that Porto Digital is one of the cases of STPs and AOIs that are a step ahead in what concerns about the future of the sector. The park has a lot of initiatives in this regard, but this paper will only be concentrated in one that are related not only to the human capital qualification isolated, but it has connection with the market, universities and government issues.

5. THE BOTLENECK

According to researches done periodically by NGPD with its resident companies, a big issue for them, that has direct and negative impact in their productivity, quality and competitiveness, is the lack of qualified professionals. Evidences of this situation are the findings from the last research done in 2015. According to the study mentioned, 41% of companies have vacancies for hiring professionals. Additionally, the data revealed that the main difficulties faced by companies in hiring and also retaining professionals are, in this order: (i) lack of experience and qualification (20%); (ii) just lack of qualification (14%); (iii) just lack of experience (9%); (iv) inappropriate profile (4%); (v) difficulty in identifying qualified professional in the recruitment process (4%); (vi) cannot offer what big companies normally offer (3%); and (vii) market competition. In the total, 13% did not know or did not answered the question and the 31% left mentioned others reasons.[331]

The situation lived in Porto Digital environment, however, is neither unique nor different from other places around the globe. As Roshan Choxi (2015)[332] affirms, the number of job opening in computer science area in United States of America is increasing and they are being filled by people with no graduation in the area. According to the U.S. Department of Commerce's Economics and Statistics Administration, just 35% of computer and math positions are occupied by someone with the specific degree. Additionally, the opportunities for software developers is increasing at 22 percent, "much faster than average" (Choxi, 2015) and the opportunities are also competitive with proposals above market value, additional financial incentives and other benefits such as flexible work schedules. (Ibid)

[328] Secretaria de Ciência, Tecnologia e Inovação. (2015). *Porto Digital é eleito o Melhor Parque Tecnológico do Brasil.* Retrieved fromhttp://www.secti.pe.gov.br/porto-digital-e-eleito-o-melhor-parque-tecnologico-do-brasil/
[329] Porto Digital. (2017). *Méritos e Reconhecimentos.* Retrieved from http://www.portodigital.org/parque/historia/meritos-e-reconhecimento
[330] Pearson, S. (2014). *Recife: Rebirth of the Brazilian Vemice.* Retrieved from https://www.ft.com/content/ddf06324-af47-11e3-9cd1-00144feab7de
[331] Porto Digital. (2016). *Pesquisa do Porto Digital – 2015*. Recife.
[332] Choxi, R. (2015). *Coding bootcamps are making computer science degrees obsolete*. Retrieved from http://www.businessinsider.com/coding-bootcamps-are-replacing-cs-degrees-2015-11

So, based on what was exposed, Roshan Choxi (2015) did the following resume of the ICT companies conjuncture:

(i) The percentage of bachelor's degrees conferred in computer science is decreasing;
(ii) The number of software developer jobs is increasing;
(iii) The compensation for those jobs is increasing; and
(iv) Only about a third of current software developers have computer science degrees. (Ibid)

This is the scenario where de idea for the project PERNAMBUCODERS emerged in order to eliminate or reduce these bottlenecks, and also motivated to address other aspects related to the future, such as:

(i) **The schools programme:** Having a better programme and more suitable disciplines with the trends in the world, promoting integration between them and working with programming studies is important for the learning process and for the professional formation.
(ii) **The professionals training:** Teaching the basics of programming in school already contributes to the formation of a more qualified professional independent of the occupation area chosen to make a career.

So, Porto Digital developed a strategic partnership with institutions from de Government, University and Market, believing that the project would be more robust and complete, generating good results and success, but also contributing to solve a local problem that can also attack the global issue at the same time, since it generated a replicable solution in many STPs and AOIs with the proper adjustments.

6. TRIPLE HELIX PARTNERSHIP MODEL

Porto Digital is a successful experience of technology driven economic development. It has established itself as an asset for the local and regional economy base, strengthening traditional sectors of Pernambuco's economy. It is based in Gibbon's innovation 'mode 2', so it was developed to be an Information Technology cluster, closely integrated to university and research institutes but focusing the market and the demands for technology products and services. There is therefore a constant concern by the management of Porto Digital in promoting and enhancing the competitiveness of the park as a way to increase competitiveness of residents with access to new markets. So, it is common to its stakeholders that are focused in the economic development establish a partnership in order to count on its contribution in any initiative that has the objective to increase the region competitiveness.

With that, NGPD accumulated partnerships in initiatives focused on strengthening its ecosystem as a way to contribute to the economic development of the region. Over the time, by consequence, NGPD accumulated expertise that allowed it to develop a model of holistic partnership which has been ensuring robust, complete and generally-above-expectations outcomes.

This model is based on the concept of Triple Helix which, once implemented in the environment of a Technological Park, has potential to promote the development of a region. So, NGPD intervenes in the environment on order to contribute basically in the stabilisation of the network formed by government, businesses, university and institutions. The activities of the governance can be summarized in the following actions:

(v) Systematization and structuring of a large demand from the government sector, greater than the supply capacity of individual small company in the cluster;
(vi) The coordination and negotiation between the various ICT stakeholders related to the identified demand by establishing a discussion forum between representatives from government, academia and the private sector;
(vii) Addition of institutional credibility and effective safeguards for the achievement of collective and individual goals of the clients and suppliers;
(viii) Mediation and balancing the interests between client (the government) and suppliers (institutions and solution provider companies).

The confluence of environmental opportunity, competitive position of enterprises, and the performance of the governance entity of Porto Digital, results in different partnerships according to each project scope, recruiting the partner which can contribute the most for the project. In the case of the project PERNAMBUCODERS, these partners are: (i) The State Education Secretariat, representing the state Government; (ii) the Rural Federal University of Pernambuco (UFRPE), a partner from the Academy; and, (iii) from the market, an innovation centre called CESAR – Centro de Estudos e Sistemas Avançados do Recife (Centre of Advanced Studies and Systems), and Softex Recife, a local company association of technology-based firms and research and educational institution, which roles in the project will be detailed latter in this paper.

7. ABOUT PERNAMBUCODERS

7.1. How the project works

As mentioned before, the project PERNAMBUCODERS is a collaboration between the Education Secretariat of Pernambuco, the project's financer, and Porto Digital Management Unit, responsible to manage the project and its resources, with partnerships with UFRPE, C.E.S.A.R, and Softex (Figure 1). The scope is to incorporate programming content into the student's education in the state's public schools, believing that, more than reduce or eliminate the bottleneck presented before, in a short term, it will be a differential, and, in a medium and long term, it will be essential for professionals not only from the ICT sector, but also from different segments, since the skill can contribute transversally with other knowledge areas.

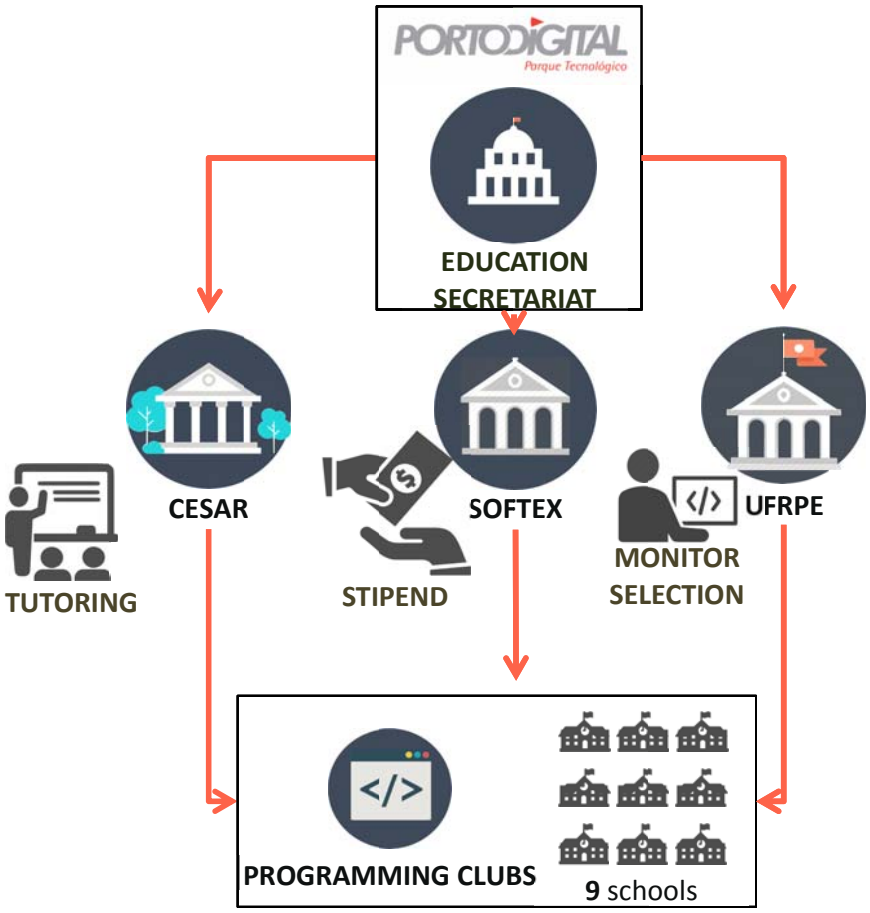

Figure 37 - PERNAMBUCODERS execution structure

The project objectives are: (i) raise students interest to the area, since it is not only about computing but can also be related to any other area; (ii) better qualified young people in matters directly related to programming, such as math and logic, that can address the gap of the market in this area that is universal; (iii) increase the performance of students in other disciplines; (iv) increase the adherence to university courses in programming and (v) increase the number of interested and active women in the area.

Besides that, the Project also aims to develop in the students the following competences: (i) logical reasoning, (ii) creativity & innovation, (iii) troubleshooting, (iv) communication & teamwork, and (v) Interdisciplinary.

For that, the methodology designed was inspired in code clubs, that are, according to Code Club International (2017)[333], groups of children aged 9-13 who periodically meet volunteers who have skills and knowledge to teach them extra-curricular content of programming. They all are supported by the institution Code Club International which contribute with advice and resources to an official local partner that, in turn, must recruit and train the volunteers and find a place to host the clubs.

With that in mind, in the PERNAMBUCODERS case, as summarized in Figure 1, a tutor network composed by experienced professionals from C.E.S.A.R., an innovation centre in Porto Digital; and professors from the partner University UFRPE, are responsible for recruit and train monitors that are students from computer science undergraduate related courses. They are responsible for guiding the students in the programming learning process and are, therefore, continuously monitored by the tutors. For that, the monitors receive from Softex, institution responsible to manage the bureaucratic documentation of them, a stipend equivalent to the Brazilian minimum wage.

After the 24 months of the project, it is expected to contemplate about 1,800 students from the nine benefited schools. Additionally, a self-sustainable, incremental and scalable strategy for creating programming clubs for computers in schools of the state of Pernambuco must be developed. Finally, a report with all medium and long term impact on learning and careers of the students involved, as well as its consequences caused throughout the state's innovation ecosystem will be made

7.2. Outcomes

From the very beginning, in August, until December of the same year, 546 students registered to participate in the project and it was possible to execute with them a complete cycle of the pedagogical program planned for the clubs. In this period, two types of content were passed, such as: (i) technical and theoretical content (good practices in the digital world, digital collaborative tools, project development, problem identification and resolution, variables, flowchart and algorithms, condition structure, repeating structure, functions, and basics of databases); and (ii) practical content for project development. The goal was therefore to pass the theoretical knowledge and develop in students the ability to program, so that they could create and develop projects on their own during the clubs' activities. Thus, the first set of content was worked in the first half of this first cycle of the clubs, therefore, the practical part was concentrated in the second half.

At the first moment of the clubs, then, the monitors conducted the traditional lectures with exercises to be performed on the computers. However, with the objective not only of executing the PERNAMBUCODERS project as contracted, but also of guaranteeing the engagement of those involved and the success of the initiative, diverse engaging and unconventional learning dynamics were also offered, motivating those involved and yielding good results. It is worth mentioning that the proposed actions have even exceeded the limits of

[333] Code Club International. (2017). *About Code Club International.* Retrieved from https://www.codeclubworld.org/about/

the clubs and the schools themselves, offering some of the possibilities and opportunities that may be revealed to the students once they master the knowledge about programming and decide by Work in the area or use, minimally, what they know about the subject in the professional choices they will make.

It is important to highlight that the activities developed in groups were extremely relevant since they generated a sense of collaboration not only among the students, but also among the educators, uniting the class and contributing to good teamwork, thus allowing those involved to identify, in a collaborative way, solutions to common club problems.

With regard to the projects developed that sought to develop logical reasoning, integration between disciplines and give meaning to the contents seen previously, it is observed that they were very varied among them and had contents of the disciplines learned in the school, but also include current issues discussed by society. There were 36 projects between games and applications that included more than eight different disciplines, sometimes used in isolation, sometimes in a coordinated way with some other, as can be seen in Table 1 below:

INTEGRATION PROJECTS	
DISCIPLINE	**QUANTITY**
Biology	2
Physical Education	4
English	2
Geography	4
History	3
Math	4
Portuguese	3
Chemistry	1
Diverse	8
Social Problems	5
TOTAL	**36**

Table 16 - Integration Projects

In addition to these activities thought and developed by the project's monitors and tutors, as previously reported, other external opportunities have arisen for students benefiting from the project, expanding their spectrum on programming. The activities to which reference is made are detailed as follows:

(i) **Positive Platforms Design Jam:** A two-day meeting promoted by the Institute for the Future (IFTF) through the initiative called Workable Futures Initiative for young people, technologists, designers and other actors to come together to prototype solutions for the work of the future. In this context, led by the NGPD that attracted the event to Recife, students of PERNAMBUCODERS and other actors were joined to discuss the impact of technologies on the job and prototype the future works, that is a little of what PERNAMBUCODERS is already provoking with the pioneering introduction of teaching programming in schools, something that there is no similar initiative in Brazil. The initiative showed students the importance of programming for the future and how they can actively participate in the construction of this future with the knowledge of programming initially given in the clubs, but that can still be deepened outside of it, as occurred in the case of the action that will be presented next.

(ii) **Hacker Apprentice (Hacker Aprendiz):** a program of the Ministry of Labour which, in Pernambuco, had a partnership with the Porto Digital Management Unit. It was the first group of a learning project focused on the area of information technology. The objective was to invest, only in Recife, in the training of 500 young apprentices between 15 and 23 years old, offering an opportunity for professional qualification, knowledge and mastery of technology, with a focus on the digital world, so that they can be more easily absorbed by ICT companies. The courses covered by the project were: (i) Systems Programmer + Database Administrator; (Ii) Mobile Device Scheduler + Database Administrator; And (iii) Web Scheduler + Database Administrator. With the Apprentice Hacker, therefore, it is intended to broaden the possibilities of high school students, or newly graduated, in the labour market, at the same time as they offer to the technology environment young learners more adherent to the companies' needs.

7.3. Evaluation

At the end of the clubs' activities in this first cycle, in order to evaluate the quality and project extension in the various dimensions of the context in which it is included, a survey was made with some stakeholders and its results can offer a variety of inputs that give the project a better internal and external vision of its performance. Besides that, the survey results will also:

(i) Assist in decision making;
(ii) Allow the project management team to detect new opportunities and investment needed to achieve them;
(iii) Help keep the focus on the project goals;
(iv) Identify strengths and weaknesses both in the project actions and in their results;
(v) Indicate needs for improvements or alert to their fragility;
(vi) Detect failures and suggest solutions;
(vii) Identify sustainability and scalability.

It is worth emphasizing that for the survey creation it was taken into account that, in order to draw a qualitative (evaluation) and quantitative (measurement) diagnosis of an educational project, it is necessary to understand education in its broadest sense. Understand its diverse actors: students, teachers, managers, monitors and project trainers and parents. In addition, it is necessary to understand its different functions: learning, development of other skills, teaching, sociability, sustainability, critical development, etc. On the other hand, there are in the educational context, as in all activities, the elements of rule that limit or expand the possibilities of the results. It is in this sense that a metric for an educational project must take into account such dimensions and be associated with evaluation instruments that bring associated qualitative elements.

With regard to the programming clubs of the PERNAMBUCODERS project, the evaluation was developed through metrics that assess and / or quantify various aspects of student and club development, providing an overvzew of the impacts on student development.

7.4. Findings

Based on the above, the metrics and their respective results are presented below:

(i) **Metric A - Perception of the students and the school managers about the project:** After the project's first semester, 96 percent of the students affirmed that the programming teaching in schools is important or very important for them. This is the same opinion for 100 percent of school's managers, who also suggested that programming should be present in all public or private schools. Additionally, according to 77,4 percent of the students, all or almost all of the activities promoted an integration with the others disciplines taught in school and they believe that this integration improves their performance in those disciplines.

(ii) **Metric B - Quantitative of students interested on participating in the clubs and active students in the clubs:** Of the students eligible to participate in the clubs, 62 percent affirmed that they had an interest in taking part in such activities and, from the participants, 85,8 percent said that they were motivated or very motivated with the project and 82 percent showed interest in continuing in the clubs after the end of the first cycle.

(iii) **Metric E - Integration of the school's teaching staff in the project:** Although their school are participating in the project, 33,3 percent of the schools' managers admitted that they did not know much about the project against 66,7 percent who knew the initiative. At the same time, just 31,5 percent of the students feel that there an integration between the clubs and the other students in school.

(iv) **Metric F - Quality of the performance of the Monitors in the Project:** For 100 percent of the students, the monitors had an excellent or good performance and about 88 percent of them think that the monitors know all themes taught in the club and encourages the participation of all in the proposed activities. In general, the students evaluated the monitors performance and their involvement with the scholar community really well, giving grades between 7 and 10.

(v) Metric G - Integration with the school managers: In this metric, 71,4 percent of the schools' managers affirmed that their relation with the monitors was excellent and the monitors showed to have a similar feeling with 100 percent agreeing that the managers were always available to handle club issues.

7.5. Discussion

The findings identified through the metrics, confirm the project relevance and potential to rich different stakeholders, influencing them positively. The results showed the importance of the project, not only for the students, but also for the school's managers who can see programming lessons taking part of all schools' programmes, what may indicate that the project correctly addresses the future according to the current needs and is also implementing the trend with success.

However, the number of eligible students interested in the project was not so impressive, what can be explained because the project was in its very beginning and the students have no idea about what it could represent to them and also provide them. Maybe that's why after a semester of activities, a great part of student was motivated and interested in continue in the clubs.

Additionally, two issues were identified with the survey and must be dealt by the project manager and the tutors as well. There is a lack of knowledge about the project and its objective not only by the students as discussed before, but also by the school's managers, what can bring about the other problem identified that is the lack of integration between the club's participants and the other students in the schools in order to multiply the knowledge learned.

Finally, the monitors and their performance seem to please students and school's managers. However, there is always space for a continuous improvement, since some students did not feel so confident with the monitors, and their relation with the school's managers was just fine in some cases.

8. CONCLUSION

Through the project and its aims, NGPD shows its speculation about the future regarding STPs and AOIs governances. The institution believes that the role of a STP or even of an AIO are to understand the environment, design an adequate strategy thinking ahead and develop project to contribute to the ecosystem competitiveness addressing future issues. So, futurism must be in these governances' agenda.

Additionally, NGPD initiatives such as PERNAMBUCODERS show the NGPD positioning regarding the geographical limits of its territory and the scope of its projects. What can be perceived by the project is that the initiatives of STPs and AOIs should not be concentrate in its own territory. The potential of a mature STP or AOI is so great that can easily exceed its geographical limits, and, for that reason, they can develop and execute projects that lead to good outcomes in other territories, as it happened in all four cities involved in the project apart from Recife.

Additionally, NGPD believes that a lot of projects executed with this mindset has great potential to be replicable in other regions and countries considering the appropriate limitations and proportions for each territory particularity.

The potential of these institutions to generate positive outcomes is so great that in the future such arrangements must contribute much more than just to their specific sectors and territories. The power of connection, flexibility, knowledge, and renewal of such governance is so great that they must serve the environment in which they are inserted more holistically. The solutions of many of these parks and areas of innovation can benefit a whole chain of production.

Additionally, as presented in this paper, since the transversal of technology is present in everything, it makes perfect sense that clusters that have as essence the development of technology are used to address so many other issues of completely different sectors. The PERNAMBUCODERS project, therefore, through not only its scope, but its model of partnership, is also an example of this vision. NGPD understands that this positioning has the potential to multiply and expand the governance actions outcomes and also allows to address different issues of the future in a unique initiative.

The PERNAMBUCODERS, therefore, addresses, among others showed before, two crucial issues for the future of the parks, such as: (i) the generation of qualified professionals for its companies in order to contribute to increasing their competitiveness, and (ii) the implementation of programming activities in schools, in order to give to the children and youth skills, confidence and opportunities to shape their future and consequently the future of the park.