K12 Enhancement Program: Engineering the Future of an Entire Young Population

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INTRODUCTION

The K12 students are growing under new and mutant paradigms of education once this is the century of big and challenging paradigm breaking standards. This is due to

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the enhancement of science and technology that is changing people's life and consequently the education field. Schools have been trying to keep up with these new education paradigms, in every level and it demands in most cases, a completely adoption of new teaching method. Proficiency in sciences is now a requirement for young people once governments have recognized that it is necessary a critical mass of scientists, researchers in engineering and mathematics among others in order to foster nations development.

The Education Research Team of COPEC – Science and Education Research Council has designed and implemented the K12 School Reform Plan for a city which challenge is to provide better and effective knowledge for young students even for those who will not enter University. The main goal is to help encourage more bright minds to pursue careers in engineering by providing K12 students of public schools, of the city the necessary knowledge about sciences and research methodology in a way that will remain as a life practice.

1 THE PROJECT

Based on a research conducted by the Education Research Team of COPEC – Science and Education Research Council for a City Hall K12 Schools Reform Plan the challenge is to provide better and effective knowledge for young students even for those who will not enter University. The course main characteristics is the possibilities to apply new and innovative approaches to provide the students the ability to develop concepts and theories to solve and understand scientific and nonscientific problems and to find solutions as well.

It is part time course delivered in two different times, in the morning and in the afternoon always after school period [1]. The students commute to the building that belongs to the City Hall and where they spend at least four hours having extra classes in the so called STEM - Science, Technology, Engineering and Mathematics fields with teachers especially hired to teach them.

The program provides classrooms with multimedia resources and a class with computers for some activities and visits to interesting sites are planned and delivered along the year.

The students are prepared to face the challenging process of university admission and even if they choose another path, one that does not include university degree, they get the tools to face labor market too.

2 THE GOAL AND MISSSION

The goal is to provide K12 students of public schools of a city the necessary knowledge about science and research methodology in a way that will remain as a life practice. The mission of the course is to impart research skills to the young students and help improve the ability of using the natural curiosity to foster their knowledge as a day-by-day life practice in order to enhance the quality of life.

The main idea is to present the engineering as a possible career choice for both boys and girls as a way to ensure a better future. Basically the course is offered to students of last year of K12 as reinforcement for acquisition of knowledge to overcome some lacks in the basic formation of young population of the city public schools. It is part of a bigger project of the City Hall and that implies in some strategies and this course is one of them [2].

3 COPEC: SCIENCE AND EDUCATION RESEARCH COUNCIL

COPEC's history started with an idea shared by some scientists of creating an organization to foster the research mainly in sciences and education. This idea seized larger proportions and after some meetings the Council became reality. This is a group of scientists, professors and professionals whose vision of future has driven them to start this work.

The main mission of COPEC is to promote the progress of science and technology for the welfare of humanity. Through its activities, COPEC maintains relations with universities, institutions of education, enterprises and the society of several countries for the discussion of sciences, technology and education directions. COPEC - Science and Education Research Council has been very active and has developed many achievements of great importance for the Country in which it is located. The Council is an organization constituted by scientists of several areas of human knowledge committed with education and the development of science and technology.

Its members believe that education is the main beam in the construction of a better society and that sciences and technology are the main agents in fostering progress to promote the welfare of human being [3].

4 APPROACH

COPEC Engineering and Technology Education team has designed the program taking into account some aspects of present educational environment. These aspects are:

Knowledge is surrounding us; it is just a matter of knowing how to get reliable knowledge. It means that people can find information not only in books or magazines but also in the Internet. People can access any information, anytime anyplace in their computers, cell phones, and tablets besides the TV.

Knowledge is the only asset that people can share and does not loose anything. Anybody, anyplace in the world can share their knowledge, it is just to take a camera, make a film and put in YouTube and there it is people sharing their knowledge for thousands of people worldwide. A class in mathematics, physics, pedagogy, gastronomy, agriculture, and the list is endless.

Knowledge does not occupy space. It does not demand huge physical space in your mind to save knowledge. So men's capability of learning is almost infinite.

Thus it is just a matter of motivate the students to look for knowledge and guide them in the construction of their acquisitions. The key element of the program is to show the students that mathematics and physics will be the tools that they can use anytime for anything in the search of problem solutions all along their lives.

As important as motivate the students is to give opportunities to the students to plan and organize, monitor their own work, direct their own learning, and to self-reflect along the way. When it is provided to students with time and space to be aware of their own knowledge and their own thinking, student ownership increases.

5 METHODOLOGY

Science, technology, engineering and mathematics knowledge have become crucial for nations once they can empower the economy and the citizens providing with tools that will help them for life long. Providing all students quality education in the so-called STEM disciplines is very important.

Thinking about this issue a town government has decided to invest in k12 education and more exactly in the last year of the K12. The project includes extra classes for the young students of last year of k12 prior university application in order to foster the science and technology interest in students who may choose careers mainly in engineering and technology.

It is a simple process that has been developed in few steps and that required commitment from both organizations involved in the project. The partners are COPEC and City Hall, which objective is to improve quality of life for the future generation of young population as a strategy to change the profile of the city population.

For a start after the agreement signed the city hall has established a place for classes and a person is in charge of the management of the courses, which in this case is the professor specially hired as the Head Director of “The Challenging Course” since the very beginning. The Head Director is responsible for keeping the course working and collecting all data for enhancement of the process throughout its development.

The project starts with school year in February providing students of public schools of the city an extra time to have classes mainly of STEM range. The classes are in the morning for students who study in the afternoon and for those who study in the morning the classes are in the afternoon.

The teachers are selected and hired specially for this program and they are paid by the city hall with federal funds especially available for education projects with the goal of fostering education.

Fig. 1. Classroom 1

The classes are in doors and special visits are planned along the program. They count with white board, media resources, and when laboratory classes are necessary they happen in the labs of universities and centers of research in the region. There are two rooms with computers as part of the pedagogic approach and they are used in shifts to provide all the students with the access to computer research.

The teachers are the key element of the program being selected based on their knowledge and pedagogical standards and teaching style. The idea is to entice the students, to be an example of success and achievements.

Fig. 2. Classroom 2

The program content is very balanced due to the basic knowledge that the students have and the knowledge they need to acquire. The topics are widely studied and the goal is to make the young students to like the subjects approached in order to pursue careers in technology and science.

As mentioned before the main idea is to present the engineering as a possible career choice for both boys and girls as a way to ensure a better future. Basically the course is offered to students of last year of K12 as reinforcement for acquisition of knowledge to overcome some lacks in the basic formation of young population of the city public schools. It is part of a bigger project of the City Hall and that implies in some strategies. It is important to have a critical mass of students interested in technological and scientific fields of knowledge in order to change the profile of the population with the goal to attract investors to the city and stop being a dormitory city [4].

6 PEDAGOGICAL ASPECTS

The course main characteristics is the approaches chosen by the teachers to provide the students the ability to develop scientific mind set to develop concepts and theories to solve and understand scientific and nonscientific problems, and to find solutions to scientific, nonscientific problems as well. This choice is up to them and basically the strategy is to provide a learning environment, in which teachers act as facilitators and not merely transmitters of information. Student learning activities include investigating, creating and solving problems.

The content of the classes are presented in a way that the students are challenged to think about possibilities to solve a problem or to search for a possible solution viewing a large picture of possibilities.

Thus, teachers must create a safe learning space where different skill levels are respected, students are directed to not fit their learning in terms of competition, and each student is encouraged to dare to take risks to learn always involves, that is takes time and demands dedication.

It is imperative to engage all of students' senses, not just their cognitive abilities and to support their learning in social groups, sometimes using peer-teaching relationships across different grade levels respecting and affirming what they already know, while inviting them to expand and deepen their knowledge and learn new things. Part of the process implies to encourage imaginative play in classroom that provides a variety of related kinds of learning opportunities.

Teaching Mathematics and Physics is very challenging once they demand a large amount of abstraction however the best way shows to be to start from concrete to abstract. The teachers use any technique that can help them to understand from videos to the construction of models, computer software, interactive activities, animated lessons and such.

Part of the program includes extra classes about culture when the students go to visit museums, art galleries, aquariums and other cultural activity just to provide them a glimpse of art and culture besides classroom walls.

The pedagogy of the program is based on some new ideas of teaching style such as:

- ✓ Enabling students to create knowledge and deploy skills to new situations, whatever they turn out to be
- ✓ Teacher works to inspire their students
- ✓ Both the students and the teachers work together to understand their progress, how they are doing (in real time) and thus learn how to improve.
- ✓ Teacher as a leader who guides the student to discover new resources, solve problems and generate new insights.

So the classes are important, but they work best as instigator environment for an expanded view of learning that is about immersing yourself in a culture where discussion and learning from the people around you matters too [5].

7 THE TEACHERS TRAINING COURSE

In order to accomplish the project it is important to point out that the teachers of public schools themselves have been in a training course with experts in the fields with a high level of knowledge and pedagogy.

These experts are retired teachers of universities mainly of engineering and technology who are willing to do some extra work doing what they do best, teaching.

The training course has 2 parts: the first one the teachers of the last 3 years of K12 are immersed in another environment; they go to another city, stay in a hotel for a fortnight, and have all the courses intensively, morning and afternoons.

The second part it happens in their city, then the experts go to the schools, in their environment where they have again one-week course as the final training course. When they finish they receive a certificate, which is very important for their careers in a solemn evening event in the City Hall.

The goal is not only to provide them the skills and knowledge but also to value their careers so that they are pleased and willing to teach, to show them that it is a life style that is important, constructive and worthies to go on. They have to have in mind that they are part of the solution of a better future for their children.

The psychological aspect of the training course is very important component of it and that is why they start with group dynamic and the entire course is designed to enhance their perception of the importance of education and teachers.

8 PRESENT STATUS OF PROJECT

The course to the students takes place in a building in downtown of the city. The classrooms are very simple with multimedia equipment and when it is necessary students have classes in computer rooms for on line math games for example and will go to laboratories elsewhere.

There is a bus available within a schedule that brings them to the places far away to museums, theaters, aquariums and other places. These activities have been added in order to show them real world far from TV. It is an intensive course that provides a good basis and that helps them in their life even if they do not go to university.

The program is possible because it is a city, which population is not so needy, what helps when it is about frequency of students once they have no transportation problems.

Visits to industries and seminars with engineers were introduced along the year as a way to motivate them to choose engineering career.

9 OUTCOMES

For the teachers it has been a rewarding opportunity in terms of career and knowledge acquisition. The training course designed for the teachers reveals to be an extra positive outcome of the project.

Although it consumes a considerable amount financial resources the city hall sees it as a path in order to bring to the community the sense of the importance to have a university in town that is the goal of the politics in charge now and for the next eight or ten years.

Due to the population (around 17.649 inhabitants) profile, simple people from hinterlands, the majority of the students tend to pursue careers in agricultural fields. The reason is that the city is in a place where agriculture is the strongest activity.

The program has been showing good results for just two years of implementation once some students have engaged in universities. It is a success outcome once the closest university is 198 Km of distance and the difficulties of access is rather big.

Anyway the main goal is to inspire students to pursue engineering careers and the goal has been reached because 10 students have enrolled engineering programs in public universities.

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