THE UNWAKENED POTENTIAL

The transformation of education that generates a social and economic impact on a country and the contribution of technology to the process

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The basic ingredients for the sustainable economic growth of a company are its productivity and its capacity for innovation. Human capital is the basic contributor to this process, and technology is of equal importance. Technology allows human capital to be more productive and effective; an effect we have observed since the transition from manual labor (agriculture) to industrial labor.

For private companies, the identification and attraction of talent is as important as selling their goods and services. The challenge is similar for the country's growth, with the difference being that it has the responsibility of preparing talent from the initial years of life and throughout the academic development. In the 20th Century, access to education became a human right included in several constitutions and in the Universal Declaration of Human Rights (United Nations, 1948). Several countries have successfully offered education to most of its citizens.

After having reached this goal, these same countries are now concerned with offering higher-quality education, having better prepared educators, better infrastructure, educational resources and content, and appropriate learning methodologies. The introduction of technology as a learning tool increases the possibility of accessing meaningful content and developing competencies that will lead to better quality of education – the fundamental ingredient for promoting growth. Today, there is a transformation underway from an industrial society to a knowledge-based 21st century. And, Education is the center of this knowledge society.

To face requirements of the 21st Century, it is necessary to provide an innovative educational system that promotes the individual and group potential of each student. This allows the student to acquire and share knowledge based on his/her personal and collective interest, while developing self-confidence. A child's innate curiosity, when encouraged, will be motivated to seek out knowledge necessary to learn and to generate results that will benefit him/her and the rest of society.

Every human being is born with unrealized potential and should be encouraged to develop it. An individual in a small or isolated town in any country in the world may produce a great innovative idea and propose an important change in the society. The next big challenge of the education system is to awaken the individual potential of each student and connect it to other students. This creates collaboration networks and the building of knowledge. Thus, countries will be creating an ideal environment so that society may be self-sustainable, generating real economic and social opportunities for all citizens.

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This document discusses the economic and social benefits of developing human capital through an educational system that explores the potential of each citizen and connects one another to share surroundings, interests and needs, anywhere in the world. Additionally, we provide an option for transforming education and we discuss the most important aspects to consider when implementing technology as a learning tool.

THE IMPACT OF EDUCATION ON A COUNTRY'S SOCIAL DEVELOPMENT AND ECONOMIC GROWTH

When discussing the impact of education on the economy, we talk about human capital developed by a country through its educational system. To understand this impact, economists compare completed school years with GDP (Gross Domestic Product) growth. For every additional year in school, GDP grows approximately 0.4% in 40 years (Barro, 2001). This is the main reason why education is a positive investment. Considering that Latin-American children typically attend school until the fifth grade (IADB, 2006), countries have a great opportunity for growth when they invest in education.

GDP is a macroeconomic variable of the impact of education on a country's growth. In recent studies, economists have ascertained that a child's learning experience is more important than the number of years they remained in school. The capacity to learn, together with the number of school years completed, is the true measure of economic growth. Annual growth may reach approximately 0.75% a year with a high-quality workforce, according to studies by Hanushek, Jamison, Jamison and Woessmann (2008). Learning capacity produces better possibilities for innovation and productivity, both critical aspects for the socioeconomic growth of the country.

Education is a personal experience that influences the student's future life as well as the society. The community as a whole benefits from its people when they are better educated. Economists state that we are moving from a macroeconomic to a microeconomic analysis of the educational impact of a country's economy. Therefore, attention should center on each student and his/her capability to promote innovation and productivity, as an individual and as part of a community. This presents a challenge in regards to whether the education offered today may develop the competencies required to lead, especially among developing countries, towards a sustainable economic and social growth in the 21st Century.

In the 20th Century, we observed that industrial production slowly moved away from manual labor towards the use of machinery. Human capital assigned to manual labor transformed into a new reality for which it was not prepared, as schools had not moved towards this new context. The classroom that we know today was conceived to provide the necessary knowledge for the industrial century, for a society which was evolving from agriculture towards industry.

If the main characteristic of the 20th Century was industrial development, the 21st Century is represented by the development of knowledge. Today we have the same urgency to evolve, this time from an industrial society into a knowledge society. Each country has the daily challenge of preparing its human capital with the necessary skills to live, create, produce, develop and enjoy an ever more globalized world.

Today it is possible to pay bills via the Internet without having to go to the bank. It is possible to cook a complete meal in a microwave in one-third of the time. It is possible to reach 82% of the Latin-American population through a cell phone (Pyramid Research, 2008). The 21st Century conveniences allow us to be more efficient in our actions. This provides us the opportunity to engage in other activities which were previously considered as secondary, such as reflection, creativity, innovation and an increase in productivity.

Being productive, creative, and innovative is key, because the goods and services created and offered today are transformed into commodities in a shorter period of time. The capacity for innovation is fundamental to continue moving forward, improving a country's productivity and offering more opportunities to its citizens. Investment in human capital is therefore paramount.

The main skills required in this century are (Kozma, 2008):

1. Ability to solve real world problems;

2. Critical thinking;

3. Ability to collaborate and communicate with the community, city, country and other parts of the world;

4. Technology expertise.

When a country invests more in the required 21st Century skills development, it creates the environment for innovation and creativity that reaches better conditions of life and development. A country leverages its investments when they are focused on developing the learning capabilities of its students (Hanushek, Jamison, Jamison, Woessmann, 2008).

Students have different interests, abilities and learning pace. In the traditional education model, these students are required to be in the same classroom. Negative results are related mostly to the lack of interest in the subjects taught and to the number of students in the classroom. A student's productivity, interest and creativity are limited when they are required to share a learning model. Innovation occurs when a student has the freedom to create, instead of having to follow a learning framework established by others.

The 21st Century requires qualified citizens not only in technical terms, but also to be prepared to share and contribute values, for themselves and for society. Today's learning experience must include all activities and human interactions that define the patterns of permanent learning throughout adult life. A country's growth will be measured not only by the GDP, but also by other non-monetary aspects of life

in the 21st Century. Education may contribute to the index of intellectual return, and may also impact society as a whole.

The political situation of a country has a direct influence on its economy. For example, the level of corruption, the economy's openness to foreign capital, intellectual property laws, production and consumption, among others. These characteristics are better identified, understood and solved by an educated society, committed to its citizens' wellbeing.

Today's world requires a drastic change in the traditional education system. Are classrooms really needed? How can a student receive individual attention and develop their greatest potential? Why does a student have to learn at the same pace as others? What prevents students from starting college at 14 if their intellectual, social, personal and emotional capabilities allow for it?

Countries should consider investing in education after high school for students who are capable of graduating before the established time, without affecting the taxpayer (Gingrich, 2008). The budget that is saved by the State in high school would be invested in college education for these young adults. This would be an incentive for middle and high school students to make their best efforts to graduate as soon as possible and maximize their learning process. Only exposure to real life – work brings the reward – is capable of preparing young adults responsibly to face the implicit commitments of their adult lives.

The concept that young adults must have sufficient maturity to go to college may change when the focus moves from the preparation for the labor market towards innovation and productivity. Students increase their chances of innovating when the environment is adequate. Maturity develops when these students are exposed to a community of common interests, regardless of their age.

The globalized world is demanding a transformation of the education system that trains its citizens with the competencies required for this century. Our duty in this generation is to fulfill this requirement, creating a favorable environment for such change and consequently benefitting the countries' social and economic growth.

Below we discuss two means by which to transform education: (1) the use of technology as a learning tool, and, (2) we provide an example of an educational system with an adequate pedagogical methodology for the 21st Century. These aspects do not solve the entire education problematic of a country; however they are a good starting point.

EFFECTIVE USE OF TECHNOLOGY IN EDUCATION

Humans began to develop the first physical tools to make tasks less demanding and to improve their work performance. Each time tools become part of the job, people move towards a new level where their performance and productivity requires intelligence and decision-making (less mechanical means). In the 21st Century, technology is an important component of the learning experience. It opens the

doors to a world of information, knowledge and collaboration that, when exploited correctly and guided by educators, benefits the students in the development of their abilities.

Technology is a fundamental tool for an efficient educational system. The educational system based on knowledge communication is now being replaced by knowledge acquisition and transformation. Educators and students carry out more intelligent and efficient work when using technology as a learning tool.

The pedagogies supported by technological tools allow educators to have a more significant, creative and satisfactory job that helps students discover their passion in an intellectually rich environment. The variety of educational software allows students to explore a problem in different ways, thus using their potential and improving their quality of life. One of the great challenges of introducing technology into the traditional educational system is the low capacity and response time. If we use technology as a tool of traditional education, we waste its potential because educators tend to use it simply to automate their existing work, such as putting their classes in a Powerpoint presentation.

The education system of the knowledge century demands the use of technology as long as its implementation is effective. For instance, educators may introduce sources of information on mathematics and ask their students to apply their learning to their daily lives. Educators no longer present a subject in a lecture format, but allow their students to think through its applicability. Technology becomes the tool for the acquisition, transformation and generation of knowledge. Therefore, it must be available whenever required. The four basic pillars of this implementation and the technical aspects to consider are discussed below.

THE FOUR PILLARS OF SUCCESSFUL IMPLEMENTATION OF TECHNOLOGY IN EDUCATION

Imagine more than 90,000 employees at Microsoft without Internet connection for one day, or one of the 17,000 Google employees without their computer for a week. Imagine that Elektra's sales system ceases to work for a few hours at one of its 1,900 stores distributed throughout eight countries. Or, that the Online Tax Collection system in Brazil, which receives almost 100% of taxpayers' statements, goes offline on the last day for filing.

Information Technology plays an important role in these companies and they must not fail. Infrastructure, technical support and logistics must be 100% reliable. When technology does not work, it has a significant impact on productivity levels, which cannot be ignored in today's globalized world.

The technology implemented in a national education system demands the same level of quality, sophistication and reliability. The one difference is that the number of students is significantly greater. A number of Latin-American governments and some other emerging countries in the world have become technological innovators in education. Students have been provided with laptops. The learning

level of these students will significantly impact them as individuals as well as their families and their community. While these students are accessing knowledge, they will have the potential for collaboration, they will develop critical thinking skills and they will have the opportunity to explore infinite possibilities offered by today's technology.

Technology is only one answer for a better quality education. Technology is a tool that increases the chances of more effective learning. The challenge faced by governments today is in establishing the logistics, support and infrastructure in schools to guarantee that they work as large companies. In addition, governments have another pillar, pedagogy, to guide the effective use of technology. As an additional learning tool, the technology must work consistently, guaranteeing its use anywhere and anytime.

Logistics

The performance of a successful technology project on a large scale begins with logistics. The main factors to consider in this pillar are: 1) origin of hardware; 2) installation of software; and, 3) transportation and distribution of equipment. Better-planned logistics will make a difference in the success or failure of the project.

Logistics may be handled by the government or it may be subcontracted. The manufacturer can handle it during the production stage, by installing the software, assigning a device to each student and shipping directly to the entity that will distribute the devices, i.e., the school. The most effective and recommended option is to subcontract logistics to the manufacturer, as described.

Support

Once users have received the hardware, the project's challenge is to ensure that it works continuously. To address this aspect, there are several alternatives for technical support: (1) centralized, divided into three different levels of support, depending on the problem; (2) decentralized, provided at the school. The combination of centralized and decentralized support is the most powerful solution, given that the problem may be resolved immediately, eliminating costs of telephone calls and additional technicians. The levels of support usually range from one to three, the first being the most simple to resolve up to the third level, which requires highly specialized technicians.

One of the more creative ways to provide technical support in school is through the students themselves. Technical training benefits the school and the students who are being trained for an IT profession that they can perform in the future. The "Student Help Desk" program, used in many Latin-American countries today, is an example of first-level support provided by students.

There are many companies that specialize in providing technical support. They could be hired for the short or long term. The effectiveness of the service increases with time because problems are stored in a database, helping in problem solving. Furthermore, costs may be optimized once the more frequent problems are identified. For example, if the majority of technical support calls relate to storage space, the implementation of a filing system in the server would decrease the costs related to this problem.
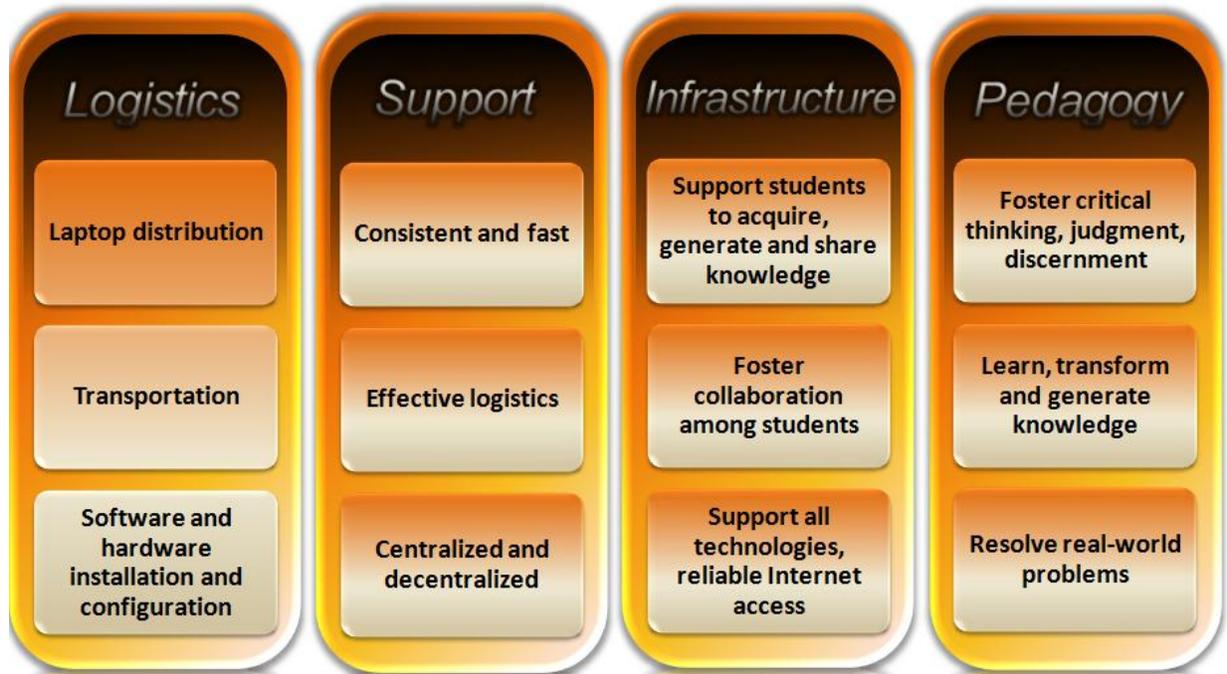
Picture 2 – Basic pillars for the implementation of technology in education

Infrastructure

Infrastructure is one of the most expensive elements in the start-up stage of any project. The configuration of servers (including hardware and software), the structure of protection and data recovery, user service, security, network services, content, collaboration services, among others, are part of the elements required for a successful infrastructure. The good news is that **infrastructure can evolve** in increments, making implementation successful until a dynamic state is reached. The basic instructions for evolving the infrastructure appears in the article: "*Paving the Way for a Dynamic and Mature ICT Infrastructure in Education: A Case for Schools in Emerging Markets*" (Morgado, Igarashi, Twani, 2008).

A dynamic infrastructure is more cost-effective than the basic infrastructure. Studies have shown that its optimization can save as much as US$670 per computer (source: IDC and GCR, 2006.) Infrastructure, together with logistics and technical support, are fixed costs that can – and will – decrease throughout the implementation of the project.

The governments' objective is to prepare the infrastructure so that new services and devices are easily added and are transparent for the end user. Today students use laptops; tomorrow they may use a cell phone or a wrist watch. There is no limit to the evolution of technology. An adequate infrastructure guarantees user-friendly access and allows teachers and students to concentrate on the greater objective, which is to learn.

Pedagogy

In addition to logistics, support and infrastructure, governments have the pillar of applied pedagogy. Technology is an additional tool available to both educators and students, benefiting the learning process. Educational reform must include educating students, parents, educators and the community, so that they understand how and why technology is incorporated in their learning experience. Successful pedagogy requires not only a model, but also adequate training of educators, adequate resources for education, system management, and finally, evaluation.

Additionally, governments must ensure the scalability of their education projects. The number of students can reach a multitude in just one country. If successful companies require an adequate infrastructure to serve a limited number of collaborators, governments require much more in order to provide a menu of adequate services to students, ensuring a successful learning experience.

There are various ways to achieve the transformation of education that causes social and economic development. One successful model, introduced 50 years ago, still has applicability for the 21st Century. This model is the Fontan Relational Education System *(SERF)*.

TRANSFORMING EDUCATION

Carlos Andres Castro[3] studied in public schools in Chia, Colombia, until he was 13 years old, when glaucoma affected 100% of his vision. He was forced to attend a school for children with vision impairment. In three years he learned Braille*,* in addition to the normal curriculum for his school age. When he finished primary school, Carlos returned to regular school even though his condition did not allow him to study as other children did. In addition, Carlos was extremely shy. However, when the school adopted a new pedagogical personalized learning model, new horizons opened before him.

The personalized learning model taught him autonomy, self-esteem, how to search for information, and how to argue effectively and discuss solutions with his classmates. Through his classmates' support and the guidance of his teacher, Carlos was elected as student representative to the Board of Directors at the *Santa Maria de Chia* School. Carlos evolved into a leader by other children of his own age who eventually ignored his vision impairment. Rather, they focused on his contributions and potential. If we are to transform education, we must concentrate on developing each student's natural talents, as well as his or her personal, social and emotional competencies. Educators guide students, allowing them to be the main drivers of their own learning process.

In 1957, this transformation began when two Spanish psychologists, Ventura Fontan and his wife Emilia Garcia, founded a psychology center in Medellin, Colombia. Their center, called the "*Centro*

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Psicotécnico" (Psycho-technical Center), was dedicated to educational investigation, development and experimentation with new teaching methodologies and tools. In 1985, as a result of their research and implementation of new methodologies, they founded the Fontan School of Medellin, which was approved by the National Ministry of Education as the first innovative school in Colombia.

With the death of Ventura in 1993, his son Julio took over the project's management, continuing the transformation of the educational process at the *Fontán School* of Bogota, Colombia. From there, the *SERF* was founded. At SERF there are no teachers lecturing in classes, there are no book transcripts or blackboards, no tests, grades, or collective vacations. Nor is there a uniform curriculum for all students or a division by courses and subjects.

By 1999, SERF received the *Orden a la Democracia en Grado de Comendador* (Democracy Order in the Degree of Commander) from the Colombian House of Representatives. This award was given due to the excellent results achieved in its application in the traditional formal education system and environments of adverse poverty and violence (neighborhoods with *sicario* [paid assassin] gangs or urban guerrilla).

Since 2005, SERF has been hired by the Colombian Ministry of Education to work directly with the State Secretary to serve school-age students in vulnerable and adverse conditions. SERF has benefited several institutions and more than 2,700 students, who have shown important advancements in performance and learning accomplishments. For example, the *Santa María del Rio* School went from having low State test scores to becoming the second best school in its region in three years. This demonstrates that education influences the social development of a community and consequently, of a country.

During 2006, the SERF model was introduced to institutions where the Telefonica Foundation's *Proniño Program* continues to make contributions. SERF was selected as the pedagogical alternative for these students due to the failure of the traditional education system. In 2008, the Santa María la Blanca school in Madrid, Spain, opened its doors to more than 1,800 students using the SERF model. More schools will open during 2009 in the Basque Country. Implementation of the SERF model, in collaboration with the Secretary of Education of Cundinamarca, Colombia, is beginning for 20,000 students in 14 public institutions. In addition, the first two universities using the SERF model, the *Autónoma de Manizales* and the *Universidad Agraria de Colombia*, open their doors in 2009.

According to the ICFES (*Instituto Colombiano de Fomento de la Educación Superior*) (Colombian Institute for the Promotion of Superior Education), the Fontan School has maintained a "very superior level" (the highest level) in State exams. SERF has self-perfected during the past 52 years, and it is living proof that education can be transformed and that each student can develop his/her dormant potential to a level of excellence. The formula for this change continues.

The Relational Education Model

SERF is a formal self-learning model to design a personal educational project based on each student's abilities that works in tune with the student's individual learning rhythm. This drives the achievement of excellence in each subject, highlights each individual's potential and develops his/her intellectual,

personal, social and emotional competencies, which are essential for integration and commitment to his/her community and his/her country.

Through academic work, students discover the importance in what they do, they learn how to research, and develop intellectual autonomy and creativity. At the same time they learn to solve problems, build knowledge, work to achieve excellence, to self-assess, and work on projects that require creativity and critical thinking. In addition, they develop work disciplines where they make decisions, are responsible, plan ahead, manage their own time, and learn how to effectively work in challenging situations.

From their emotions, students build a meaningful life, develop the capacity to effectively manage challenges, increase their self-esteem and go through a process of self-recognition, acceptance and respect. Their social environment allows them to set common goals, develop leadership, make group decisions, be responsible for their groups, learn to be supportive, and to develop an ability to transform social environments.

A student can begin his/her school activities on any day of the year, complete the course at any time, take longer or less time depending on his/her capacities (within the pre-established limits.) There is considerable flexibility in the child's home life. Whether it be vacation planning, an illness on the part of the student, or other personal activities, there is a lot of freedom to plan their schedule. Students who need extra time to dedicate to personal activities, such as sports or music, can do so without seriously impacting his/her studies.

With a clear vision of their responsibilities, the significance of their own realities and capabilities, students add value to today's society, regardless of their grade or age. Students have the skills and can collaborate to solve real world problems. Innovation and productivity, which have a direct impact on the economic and the social growth of a country, begins here.

The Relational System develops four basic competencies: Intellectual, Personal, Social and Emotional.

Intellectual Competencies

Assessing the student's ability to learn and how it occurs, the educator develops an **individual study plan.** The student's capacities, interests, expectations, and the way in which he/she learns and his/her thought processes determine the course of study. This plan also considers the legal requirements which may vary in each country.

By using their natural learning capacity, and following a normal process to **develop their autonomy**, students acquire the necessary content from each subject. Together with their educator, students seek out information and process it. They discover its logic and put it into context. The students work with the material until the level of excellence has been achieved, allowing them to continue to the next subject. When students complete all subjects in their study plan, they proceed to the next course.

Personal Competencies

Together with their educators, students learn to **make decisions and accept the consequences of their decisions.** This makes them responsible and capable of evolving as they decide how to build their daily, weekly and monthly learning plan. This corresponds to their personal goals, while collaborating with

their educators on the date to turn in projects and when the course will be completed, among others. During this process, students develop the **autonomy to plan their time.**
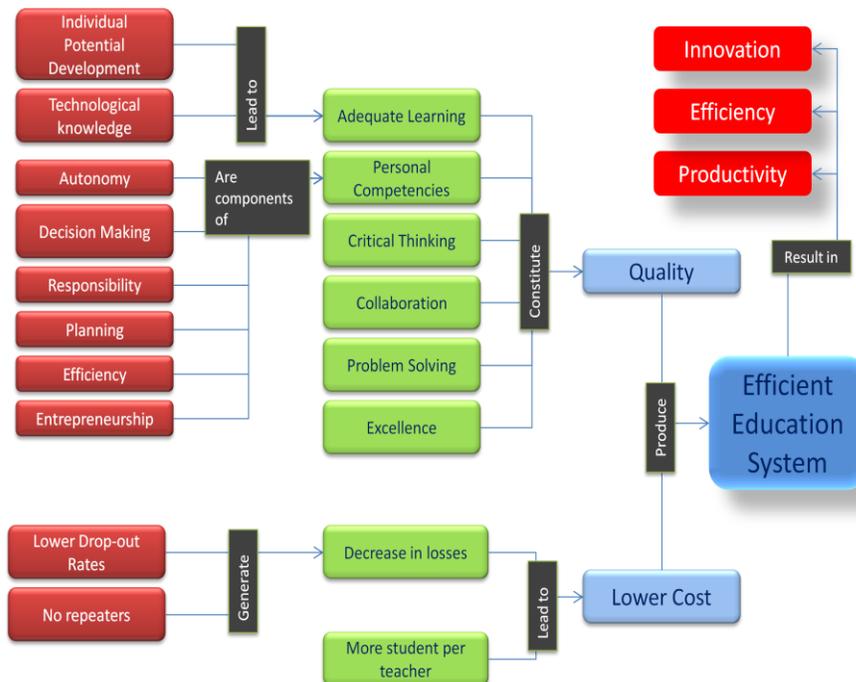
Social Competencies

The workshop is the environment in which students work as a team. They set goals, assume complementary roles, evaluate the process and transform it together with their educators. Students **learn to collaborate, develop leadership skills and solidarity**, are recognized for their strengths, and learn to be committed to their community.

Emotional Development

In this process students discover their limits, allowing them to **develop the reality principle while increasing their self-esteem**. By projecting themselves in time and adding value and meaning to their work, students discover the importance and the meaning of their own life.

Efficiency

Having a more efficient system that highlights each individual's potential allows more students to have plans with greater content and depth for addressing each subject. This system proved that the **cost per grade decreases** as students gain autonomy. The ratio of students per educator increases naturally. Having fewer educators makes it possible to increase their compensation, thus attracting higher qualified professionals.
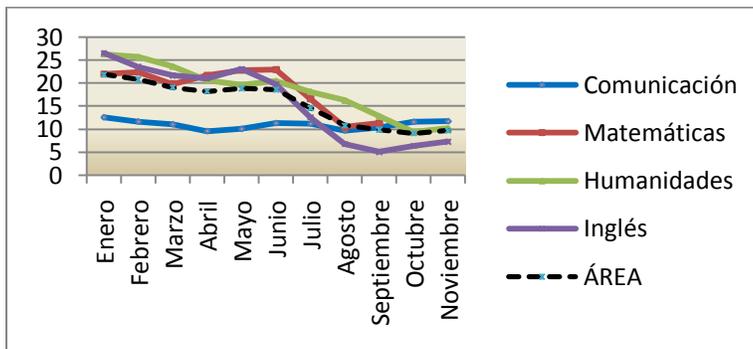
Figure 1 – The anatomy of an efficient educational system

The flexibility of the relational education system **addresses school drop-out rates**, which is a significant concern for all countries worldwide. Because of economic constraints, children from lower income families have a tendency to drop out of school to support the family. By having an individualized plan where the student is given meaning to his/her life, SERF provides an additional solution to the dropout problem.

The National Institute of Statistics, Geography and Information Systems of Spain, states: "In *2004, 1.7 students in every hundred who were registered in the basic education level had dropped out, leaving their education unfinished and, sadly, the greater the number of people dropping out, the greater the percentage. Likewise, the number of middle school students that dropped out was 7.1%; the number of high school students that dropped out was 16.3 in every hundred, and, at the technical professional level, 23.6 percent of students registered in a program, dropped out".*

In addition to lower costs and a decrease in school drop-outs, there is an increase in the level of excellence. **No student fails the year**. Students, who fail the year in a traditional system, need 1-2 more months to finish their studies in the Relational System. Given that **no year is lost**, situations like the one in Mexico would be avoided, where "*during the 2007-2008 school cycle, 50,486 primary and middle/high school students in Puebla failed the school year, representing an economic loss of approximately US$72M for the entity*" (National Institute for the Education Assessment – INEE.)

By being more efficient, the Relational System decreases the cost per grade which allows more students to complete the grade in less time, as shown in the graphic below. The average time per grade after the second year is nine months instead of ten. If the savings generated by the introduction of the Relational System is reinvested in the educational system, the return on investment can be less than five years. Figure 1 highlights important aspects of an efficient education system and its benefits.

Graphic 1 – Time in days that it takes new students of the Fontán School to complete subjects (Bogota, 2008)

A World with Open Doors for Children

Since the beginning, SERF has always used technology as a learning tool. It is currently a proven model, with tangible results.

A real transformation of education begins with a pedagogical change that makes the introduction of technology a must. In the new education system, technology is required due to the considerable amount of information to build the pedagogical project for each student, and for appropriate follow up. One of the main goals of the Relational System is the development of the student's autonomy, and technology is the best means to achieve this. SERF is a one-on-one pedagogical system which requires the use of a technological one-on-one system.

Technology allows students and educators to develop personalized plans, with an appropriate follow up of the learning process. Parents can follow up on-line with their child's learning progress, explore the status of each competency, work rhythm, compliance and estimated time for their child's completion of the course. School administrators can follow up and monitor students' and educators' progress, the workshops, and the institution in general.

The use of technology facilitates the scalability of the education system and provides equal access to education. By using technology, students plan their time, do research, access information, do exercises, work with simulators, interact with classmates and teachers, solve real world problems, develop projects in an individual and collaborative manner, receive work assessments and monitor their competency achievements. Technology is an indispensable learning tool, improving quality of life in a substantial manner, while facilitating the development of the students' autonomy.

As a result, technology provides major flexibility as it allows students to continue to learn in any location, at any time. By being responsible for completing their study plan, students break down the barrier that learning is restricted to the classroom. An example of such flexibility occurred when a chicken pox breakout occurred in late 2008 at the Fontán School of Bogota, forcing students to stay home for 15 days. Those students continued to work through electronic means, there were no delays in the learning process.

CONCLUSION

Carlos Andres Castro's experience demonstrates that it is possible to offer the same quality of education to all, regardless of social condition, physical impairment and geographic distance. His success shows that economists who are assessing the micro-economics of the results of education, are headed in the right direction.

Governments have a real opportunity to impact their societies and economies by transforming education. Equality, quality, greater cost-benefit, productivity increase and generation of innovation are possible through an effective educational system, with individual attention provided to every student, supported by technology.

Awakening a country's potential begins by investing in each citizen. It is a long term concept that only countries committed to healthy and sustainable growth can implement and achieve. In the end, even though interests go beyond the individual, governments that are truly committed to transforming education will empower their citizens to not only be productive, innovative and able to generate a self-sustainable economy, but also to achieve their real mission in life: to be happy.

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