

# ***Enlaces: The Chilean ICT Experience in Education***

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## **Abstract**

This paper presents a concise overview of *Enlaces*, which is the ICT in Education initiative of the Chilean Educational Reform. *Enlaces* long term goal is to achieve the harmonic and widespread insertion and use of information and communication technologies into the Chilean educational system, and particularly, into every school's culture. At the core of the program's strategy to successfully integrate these technologies to improve teaching and learning opportunities for children in the public school system, lies the training and support offered to classroom teachers as well as the national infrastructure that supports these processes. After successfully incorporating more than five thousand schools over a period of seven years, the new challenges that *Enlaces* is facing are to increase rural coverage, to train all of the country's teachers, to improve and expand the technological infrastructure, to increase and update the educational content and services provided over the Internet and to incorporate information technology more fully into educational activities.

## **Introduction**

In 1990 Chile started a major educational reform; a new curriculum for both primary and secondary education has been proposed to the country, and new teaching and learning methodologies are being implemented in order to achieve a higher quality and greater equity in public educational services. More resources, such as textbooks, infrastructure and better teacher salaries are all part of this comprehensive effort. Education has been consistently promoted as the nation's number one priority during the last decade, in an unprecedented effort to overcome poverty and to place Chile as a stable and modern country in the current millennium (see: García-Huidobro, 1999).

The information and communication technology (ICT) initiative of the Chilean government, better known as “*Enlaces*”, is also an important component of the reform. Its aim is to integrate these technologies as learning and teaching resources for all students and teachers in Chilean public schools. *Enlaces* began as a pilot project in 1992, with the intention to interconnect one hundred schools in an educational network, this was to serve as an arena to study the benefits, contents, costs and replicability of this initiative in a wider range of public schools. In 1995 *Enlaces* became the ‘official’ nation-wide initiative for the introduction of ICT to the Chilean Educational System (see: Hepp, 1998; Hepp et al., 1994; Potashnik, 1996).

This paper presents an overview of *Enlaces*, its current status and its projection after the year 2000; time when the Ministry of Education will have all secondary schools and half of the primary schools, taking part in this program (Hepp, 1995).

## **Goals of the *Enlaces* Program**

One of the fundamental premises of the *Enlaces* program was that merely supplying information technology to schools is not enough to bring about significant changes in the quality of education. Although ICT can potentially simplify and enhance the learning process in all subject areas and in some cases acts as a catalyst for innovation (Hawkrige, Joworosky, & McMahan, 1990; McDonald & Ingvarson, 1997), additional efforts –such as teacher training and support- must be carried out in order to produce sustainable changes in pedagogical practices and student learning outcomes (Fullan, 1993; Osin, 1998).

In this framework, one of the long terms objectives of the *Enlaces* project is to effectively integrate ICT into the educational process (Fullan, 1992; Grunberg & Summers, 1992; Hurst, 1983; Olson, 1988). In order to achieve this goal, the following principles guided the definition of overall strategies:

- Information and communications technologies are tools to be used by all participants in the educational process: students, teachers, school administrators, parents and sponsors. Thus, great emphasis was placed on teacher training and the development of a technical assistance network. The views that learning computer skills is an end in itself and that information technology can only be used by experts were rejected.
- Setting out not only to equip schools with computers, but also to connect them with each other and the world through an educational network, thus enabling schools to exchange ideas and experiences regardless of their location. This goal also addresses one of the Chilean Educational Reform's key objectives: increasing equity in educational opportunity for all Chilean students.
- No single formula can be applied uniformly to all schools and the uses to which computers and networks are put to will depend upon each school's educational projects, needs and its social, cultural and geographical environment.

These considerations, combined with the enthusiasm and initiative of teachers, administrators and students across the country, have often led to surprising results, with broader and deeper implications than those foreseen by the program (for an account of the results see: Hepp, Laval, Moëne, & Ripoll, 1996; Potashnik, 1996; Potashnik et al., 1998).

## ***Enlaces'* Achievements from 1993 to 2000**

By the year 2000 more than 5,300 primary and secondary schools have been incorporated to *Enlaces*. Each of these schools received computers, local networks, educational and productivity software and free and unlimited Internet access. Additionally, the Ministry of Education, in a partnership with 24 universities, provided technical and pedagogical support to each school.

In summary, the implementation of the *Enlaces* educational network has involved:

- Providing three years of training to twenty teachers per school, for an approximate total of 70,000 teachers (50% of all teachers) trained by a technical assistance network operated by universities throughout the country.

- Reaching 100% of secondary schools and 50% of primary schools, thus covering 90% of the student population attending State-subsidized institutions. It should be noted that the primary schools not yet covered by the program are those in outlying rural areas, which still lack adequate electrical power and/or telephone infrastructure.

| <b>Educational level</b> | <b>Students with access to<br/><i>Enlaces</i></b> | <b>Students in State-subsidized schools</b> |
|--------------------------|---|---|
| Primary                  | 1,900,000   | 2,124,903                                   |
| Secondary                | 671,132   | 671,132                                     |
| <b>Total</b>             | <b>2,571,132</b>                                  | <b>2,796,035</b>                            |

**Table 2.** *Enlaces* Program Coverage

- Supplying 38,000 computers to schools, allocated according to the number of students in each school. The equipment – chosen according to annually updated technical standards – includes multimedia computers, printers, modems and a local area network.
- Equipping schools with educational software to support their study programs. Annual bidding is held to supply schools with this material. The software includes productivity applications such as word processing, spreadsheets and graphics programs, along with educational software on topics such as the human body, space, science, math, geometry, scientific experimentation, Chilean history, world history, geography, literature, music, art, drama, physics, chemistry, the environment, etc.
- Creating a Web site ([www.enlaces.cl](http://www.enlaces.cl)) that offers a wide range of useful educational content and services for teachers and students. This site was conceived as an educational portal where teachers can find relevant and useful curriculum-oriented content (digital educational resources), forums on relevant issues and up-to-date education information (news, events, etc.).
- Introducing ICT as a built-in part of the new curriculum; its use has become a regular part of the school day for Chilean students.

Additionally, *Enlaces* provides special support to the schools of the Ministry of Education's Montegrando program. This project involves a total of 51 schools from different areas of the country, which apply advanced educational innovations at the high school level. The initiative views these schools as pilot programs for improvements in educational quality aimed at by the reform. Their participation in the *Enlaces* network helps them showcase their successful experiences, which can then be spread to the rest of the country's secondary schools. For this purpose, Montegrando participants have been equipped with three times as many computers as regular schools, along with a higher level of technical support and pedagogical assistance.

## ***Enlaces's* Key Strategies**

### ▪ **Teacher Training and Support**

The teacher training strategy in *Enlaces* includes three different initiatives:

- Initial training
- Follow-up technical assistance
- Educational Information Technology Encounters

Initial teacher training in the *Enlaces* program lasts two years. Its aim is to help educators incorporate educational information technology into their teaching. Teachers learn to use e-mail, the Internet, and educational and productivity software in their work, and to use information technology to create teaching materials. They also learn to use these technologies for administrative tasks, such as maintaining student attendance, grade charts and lesson plans. In addition, teachers acquire basic skills for operating and maintaining the equipment and for selecting, acquiring and installing educational software.

After the second year of training, teachers are offered a follow-up technical assistance program for one year, which can be extended if necessary. This allows the schools to continue the active incorporation of educational technology into their educational projects and to develop greater autonomy in this area.

Within each school, one or more teachers are specially trained to serve as *Enlaces* coordinators. Coordinators oversee the proper use of ICT and help students and teachers put it to optimal educational use.

As a strategy to support schools' ICT-related activities, "Educational Information Technology Encounters" are held each year in several zones of the country (34 encounters were held in 1999). After selecting the 'best practices' in each of these local events, a Regional Encounter is held. These events encourage teachers to exchange experiences and to keep abreast of each other's practices. In addition, students can observe the achievements of their peers in other schools, and the community gains a greater appreciation for the use of technological resources in its schools.

### ▪ **National Support Infrastructure**

An important element of *Enlaces's* strategy was the creation of the Technical Assistance Network. This network was built upon a strategic alliance between the Ministry of Education and universities across the country. The Technical Assistance Network's mission is to train teachers and provide them with technical and educational support. Twenty-four universities, from Arica to Punta Arenas, currently participate on two levels (see Box 1):

- a) Six universities, designated as Regional Centers, serve as coordinators, managing *Enlaces* activities and teacher training in a particular geographical area of the country. They also carry out applied research in the field of educational ICT.
- b) Eighteen universities, called Implementing Units, provide training within sub-zones under the supervision of a Regional Center.

To carry out the massive training activities required by *Enlaces*, the universities put together a network of trainers: nearly 1,000 primary and secondary school teachers specializing in educational information technology. These trainers are in constant contact with schools, working with local teachers in the computer rooms provided by *Enlaces*.

The *Instituto de Informática Educativa* of the Universidad de La Frontera, where the project was conceived, has played a central role in the development of the *Enlaces* program since 1993. In conjunction with the Ministry of Education, it is responsible for the national coordination of the *Enlaces* Educational Network. The Institute also carries out research and development activities to support the use of information and communication technology in the network's schools.

**Box 1. Chilean Universities Participating in the *Enlaces* Program**

**Regional Centers**

Universidad Católica de Valparaíso  
 Pontificia Universidad Católica de Chile  
 Universidad de Santiago de Chile  
 Universidad de Chile  
 Universidad de Concepción  
 Universidad de La Frontera

Universidad de La Serena  
 Universidad Metropolitana de Ciencias de la Educación  
 Universidad Central  
 Universidad Diego Portales  
 Universidad de Las Américas  
 Universidad de Talca  
 Universidad Católica del Maule  
 Universidad del Bío Bío  
 Universidad Católica de Temuco  
 Universidad Católica de Villarrica  
 Universidad Austral  
 Universidad de Los Lagos  
 Universidad de Magallanes

**Implementing Units**

Universidad de Tarapacá  
 Universidad Arturo Prat  
 Universidad de Antofagasta  
 Universidad Católica del Norte  
 Universidad de Atacama

▪ ***La Plaza: A Non intimidating Computer-User Interface***

Consistent with its emphasis on empowering teachers and students through the use of computers and telecommunications, during the first decade of its implementation, the professional team in charge of *Enlaces* developed *La Plaza* (“The Town Square,” see Box 2). *La Plaza* is a user friendly application that allows easy access to computers, either for exploring educational software (mostly multimedia-based applications), taking advantage of electronic mail facilities (to participate in regional, national and international educational projects), or simply for sending and receiving information of personal interest by means of the network. The software was used as a “Trojan Horse” for a friendly and non-intimidating first encounter with ICT technology. It was particularly successful in helping to reduce teachers’ anxiety towards a technology that was perceived as difficult, meant only for experts, and that required long hours of technical training in order to start using it effectively. With *La Plaza*, teachers could avoid the burden of learning the use of the operating system from the beginning, and they could start familiarizing themselves with computers and e-mail in just a few hours. As ICT evolved, this software was replaced by the use of Web-based interfaces. In some schools, *La Plaza* is still used as an e-mail communication software.

## Box 2. Description of “La Plaza”

As it is suggested by its name, this application consists of graphic metaphor of a town’s main square. Through icons of buildings that are a familiar sight in most Chilean cities and towns, the software provides four different work environments: a Post Office, a Kiosk, a Cultural Center and a Museum.



Figure 1. *La Plaza* Interface



Figure 2. Interface: The Post Office, The Kiosk and the Cultural Center.

*The Post Office.* The post office is a user-friendly e-mail system, specially designed for students and teachers. The goal was to have an informal mechanism for users to establish first contact, and then to form a work group around a discussion topic of common interest in the Cultural Center; or simply, to exchange ideas and opinions on subjects of personal interest.

*The Kiosk.* The Kiosk offers a window to a space of dynamic information. Electronic newspapers for students and teachers are available at the Kiosk. These documents are in constant, non-centralized production and distribution by the teachers and students themselves. The Kiosk also offers short multimedia-based educational stories and vignettes as a stimulus for reading and writing.

*The Cultural Center.* The Cultural Center is a meeting place for developing collaborative projects among the students and teachers at different schools. It is also a place to establish communication among teachers with common concerns, and for them to exchange experiences, written work, opinions, etc. (groups with a common interest in physical education, mathematics, English, literary workshops, communication with other countries). It is basically an easy-to-use bulletin board system.

*The Museum.* The Museum is an information center with a greater permanence in time than that contained in the Kiosk. Essentially, it is a database from which one can access information, experiences, demonstrations and uses of educational software along with the software itself.

### ▪ Private Sector Support

The development of the *Enlaces* network has required support from the school communities themselves and from the private sector. Expanding computer rooms, acquiring new educational software, servicing equipment, buying necessary supplies and providing

Internet connections are ongoing challenges demanding hard work and commitment from the whole community.

Some of the most notable contributions in this area are as follows:

- *Telefónica CTC Chile* has donated telephone lines and unlimited Internet connections to the great majority of the country's primary and secondary schools. In addition, the company has provided free e-mail accounts to all Chilean teachers and students.
- Other telecommunications companies, such as *Entel* and *Telefónica del Sur*, have also provided support, allowing the expansion of Internet connections to a number of additional schools.
- Numerous primary and secondary schools would not have been able to construct computer rooms or upgrade existing computer infrastructure to join the *Enlaces* program without donations from private companies and contributions from the school communities themselves. This support adds up to nearly US\$ 2 million in hardware and software for more than 100 primary and secondary schools throughout the country.

## Evaluation Results

In general terms, the results of the different evaluations of the impact of the introduction of ICT into the educational system conducted in the framework of the *Enlaces* program between 1993 and 1999 coincide to show that there was growth in students' creativity, capacity for gaining knowledge about the world and reading comprehension levels. However, changes in learning levels in the area of mathematics could not be established.

These results are congruous with the results of qualitative evaluations conducted by the Program that enable a better understanding of these effects. Such results indicate that technology produces a high level of motivation among students, produces a more horizontal social organization within the classroom, and enables students to feel proud of their participation in projects, with a corresponding increase in self-esteem.

From the point of view of **teachers**, the evaluations indicated an increase in teachers' managerial roles and improvements in the internal climate at schools. Furthermore, external evaluations show that a high number of teachers believe that communications via computers in their classes have improved the quality of the teaching-learning process. Complementary to this, the comparative evaluation made of programs introducing computers into the educational systems in Costa Rica and Chile (Potashnik et al., 1998) showed that *Enlaces* is a source of pride that opens doors for professional development, especially among teachers.

Looking at a school level, evaluations show that the economic factor –in terms of the project's sustainability- is a very important element. Although the associated operating and maintenance costs are significant, participating schools gain greater prestige in their communities, which translates into increases in enrollment (increased income via larger subsidies).

School officials also valued the increase in equity that the project provides by outfitting schools with equipment that they otherwise would not have been able to acquire. Worthy of note in this regard is the country wide spread access to Internet resources provided by *Enlaces* due to the fact that the schools currently have free Internet access.

The evaluations show that the program produces improvements in parents' perception of their schools' performances. This produces a positive disposition among parents towards their children's schools and facilitates the learning-teaching process.

One of the major challenges underlined by these evaluations is the need to supply schools with more computers and a greater variety of educational software so as to increase possibilities for both teachers and students to access these technologies. Additionally, and despite the fact that it is decreasing, a main concern among teachers is the heavy unpaid workload resulting from their participation in the Program. This situation could be an interesting indicator, not only for this project but also for the Educational Reform process in general, and brings up an interesting challenge in terms of coordinating and strengthening joint initiatives.

From a more global perspective, the evaluations made by the World Bank (Potashnik et al., 1998), UNESCO (Nuñez, 1995) and the Agency for International Development (Rusten et al., 1999) all highlight the *Enlaces* project as one of the successful programs in the Chilean educational reform. An important point in this positive evaluation is that the project has expanded its coverage to the national level without sacrificing quality or equity. Among the factors in this success, the evaluations mention the program's focus on teachers, the construction of a social network of educators and pupils facilitated by user-friendly technology and decentralized support, and respect for participating schools' autonomy and their decisions in the use of the program's technologies. The evaluations also emphasize the high quality of the project's technical and administrative team, which has maintained a balanced mix of a clear vision of the project, flexibility and creativity in the face of new educational challenges and fast-changing technology.

## **Discussion**

An important conclusion that has emerged through observations of the schools is that innovation must arise out of current pedagogical practices. Huberman (1992) describes it as a process of grafting the new on the old, and he comments that every 'old' is a distinctive, local context with its own history and configuration. Olson (1988) also defines the process of change as not one of substituting one practice for another, but one of subjecting existing practices to challenge posed by another well conceived practice. Both definitions have an evolutionary approach to change, rather than a revolutionary one. In other words, teachers are more inclined to use technology if they can relate it simply and directly to their classwork, that is with the materials and the teaching model they themselves use.

To this end, *Enlaces* seeks to show teachers more clearly the multiple ways in which the technology can be used, as much in the classroom as in extracurricular activities. The point is not to merely "do the same thing, only with computers," although in the beginning it may seem that way. The teacher invariably perceives changes in his or her class, at a minimum in the organisation and motivation of the students. On the basis of these small initial



changes and on clear evidence of the students' improved motivation, the teacher may try out more effective strategies or adapt those of other teachers in schools.

This strategy of placing technology in a supportive role implies first, understanding the ongoing process of change; and second, it implies the need of choosing an appropriate technology (for example, the software). This view is coherent with the reflexive concept of change stated by Olson (1988). This author defines a teacher's behavior as 'reflect on action'; a research activity as 'understand teacher intentions'; and an innovative activity, as 'engage in critical analysis of practice'.

This issue was also addressed by Grunberg & Summers (1992) who in a review of the literature on innovation and computers in education concluded that: "the previous emphasis on the technical characteristics of the proposed innovation has evolved into a more context-sensitive approach focusing on how the proposed innovation fits the teachers' working conditions and value systems" (p. 272).

Another interesting observation is that, due to the comprehensive initiative of the Chilean educational reform, computers are acting as catalysts for other initiatives that are not directly related to ICT. That is to say that many times, in the midst of many other programs intervening to induce changes in a given school, it is the introduction of computers and communication into the classrooms what ends up provoking change. This is not to say that computers by themselves are capable of causing innovation and change; but, they certainly contribute in a substantial way to make many of the changes other programs proclaim, possible. This observation is also consistent with Hawkrige et al. (1990), who found that the catalytic rationale was one of the four most used rationales for introducing information technology into schools.

## **The Future**

The *Enlaces* program's achievements, combined with continuing advances in information and communications technology on a global level, have generated new challenges for further expansion of educational information technology in Chile after 2000:

- Increasing rural coverage
- Training all of the country's teachers
- Improving and expanding technological infrastructure
- Increasing and updating the educational content and services provided over the Internet
- Incorporating information technology more fully into pedagogical activities

### **Increasing rural coverage**

Until now, *Enlaces* has focused on schools that were in -or near- urban areas, incorporating 50% of primary schools. The remaining primary schools are located in rural areas, have enrollments within an average of 24 students each and the great majority has just one teacher. Due to their rural context, these students have different educational requirements, as compared to students attending urban schools. And the Ministry of Education has developed since 1992 a special program for rural education with emphasis on appropriate pedagogy for mixed-level classrooms. Therefore, a special program is being designed which takes into consideration not only the precarious infrastructure but also the differentiated

needs of these schools. In 2000, a pilot phase of the program will be implemented and in 2001 national expansion will start.

### **Training all of the country's teachers**

The strategy of the *Enlaces* program was to train only 20 teachers per school, covering 50% of the teacher population. The remaining teachers need to be trained so that they could also make the explicit choice of using or not using ICT in their teaching. Because of the current context of widespread use of the Internet in the educational system and the effort already made by *Enlaces*, a new training strategy is being designed. This strategy will use both face to face and distance education training methods and will encourage universities as well as private industry-based institutions to provide basic ICT training. Thus, the National Technical Assistance Network will focus on the provision and support of the more specialized training courses (i.e. advanced uses of ICT in the curriculum).

### **Improving and expanding technological infrastructure**

Through the *Enlaces* program, the Ministry of Education has provided a limited number of computers and software to each school. It is recognized that the number of computers is still not sufficient and due to their technological obsolescence, some of these computers are no longer useful. Therefore, a strategy to complement and/or replace computers is being designed. The Ministry of Education will allocate funds that will be bid for by schools that show a trajectory of good use of technology and that demonstrate a coherent plan for the further integration of ICT in their educational projects.

### **Increasing and updating the educational content and services provided over the Internet**

The current international provision of educational resources on the Internet is highly heterogeneous, showing a limited amount of good resources in Spanish that can easily be used in Chilean classrooms and even less resources that are coherent with the national curriculum. Therefore, the Ministry of Education is encouraging the local production of Internet based resources and services that show clear links and usefulness to Chilean educational goals and content.

### **Incorporating information technology more fully into educational activities**

*Enlaces* has been successful at introducing ICT to the educational system and today it is possible to say that half of the Chilean teachers have an understanding of the basic use and potentials of ICT in education. The next step is **the introduction of ICT in the classroom**, aiming at the effective integration of these technologies to the set of teaching resources that teachers know, use and appreciate because they help to improve their own teaching as well as students' learning. The strategy to implement this initiative considers three dimensions, first to develop an understanding of what it is –and how to do- 'effective use of ICT in the classroom' through the study of current innovative pedagogical practices using ICT. Second, the implementation of innovations at a classroom level, which will foster a change (evolution) of the pedagogical practices, so that they can take full advantage of ICT. And finally, a strategy for the sustainability of the above mentioned innovations.

## References

- Fullan, M. (1992). Successful school improvement: the implementation perspective and beyond. Buckingham: Open University Press.
- Fullan, M. (1993). Change forces: probing the depth of educational reform. London: The Falmer Press.
- García-Huidobro, J. E. (Ed.). (1999). La reforma educacional Chilena. Madrid: Editorial Popular.
- Grunberg, J., & Summers, M. (1992). Computer innovation in schools: a review of selected research literature. Journal of Information Technology for Teacher Education, 1(2), 255-276.
- Hawkrige, D., Joworosky, J., & McMahan, H. (1990). Computers into third-world schools: Examples, experiences and issues. London: McMillan.
- Hepp, P. (1998). Chilean experiences in computer education systems. In C. de Moura Castro (Ed.), Education in the Information Age (pp. 116-130). New York: Inter-American Development Bank.
- Hepp, P., Laval, E., Moëne, G., & Ripoll, M. (1996). Monitoring the ' *Enlaces*' educational computer network. Education and Information Technologies, 1(1), 5-20.
- Hepp, P., Rehbein, L., Hinostroza, E., Laval, E., Dreves, C., & Ripoll, M. (1994). Enlaces' A hypermedia based educational network. Paper presented at the ACM Multimedia: The Second International Conference on Multimedia, San Francisco, California, USA.
- Huberman, M. (1992). Critical introduction, Successful school improvement: the implementation perspective and beyond (first ed., ). Buckingham: Open University Press.
- Hurst, P. (1983). Implementing educational change: a critical review of the literature (EDC Occasional Papers 5): University of London, Institute of Education.
- McDonald, H., & Ingvarson, L. (1997). Technology: A catalyst for educational change. Journal of Curriculum Studies, 29(5), 513-527.
- Núñez, Ivan (1995) "El Proyecto *Enlaces* (Chile), un estudio de caso", UNESCO.
- Olson, J. (1988). Schoolworlds/microworlds: Computers and the culture of the classroom. Oxford: Pergamon Press.
- Osin, L. (1998). Computers in education in developing countries: Why and how ? (Education and Technology Series Vol. 3 1): Washington, D.C.: The World Bank.
- Potashnik, M. (1996). Chile's learning network (Education and Technology Series Vol. 1 2): Washington, D.C.: The World Bank.
- Potashnik, M., Rawlings, L., Means, B., Alvarez, M. I., Roman, F., Dobles, M. C., Umaña, J., Zúñiga, M., & García, J. (1998). Computers in Schools: A qualitative study of Chile and Costa Rica (Education and Technology Series Special Issue): World Bank Human Development Network.
- Rusten, E., Contreras-Budge, E., Tolentino, D. (1999) in Learnlink Case Study Summary. "Enlaces: Building a National Learning Network". Global Communication & Learning Systems. US Agency for International Development. Available in: <http://www.aed.org/learnlink>.

