One to One Connections:
Building a Community Learning Culture

by

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1 Introduction

> *"When we talk about computers in education, we should not think about a machine having an effect. We should be talking about the opportunity offered us, by this computer presence, to rethink what learning is all about, to rethink education."*
>
> *Technocentrism*
> *(Papert and E. & L. Group. 1990)*

The ways in which computers have entered the world of education have been very superficial. Even today, as computers populate the classroom in large numbers, the role of the computer in relation to learning is not very powerful. For some people, the computer is the ultimate goal, and so they advocate students learning computer skills. As a result, computer classes have been added to the long list of classes that the students should take, and computer skills are now part of countries' national standards and tests. Other people see the computer as the object that replaces the teacher, or in the best scenario that supports the teacher's instruction methods. Computer-Assisted Instruction has been a major trend in the use of the computer in Education. In recent years, as the Internet has become more accessible for some people, the computer is considered a "tool to help students access information, communicate information and collaborate with others" (Fullan and Smith 1999). At least in America, it has been reported to be the most pervasive practice in schools (Vaikakul 2005).

The reality is that the complexity of the school, society and policy, and dominant cultural beliefs about teaching, learning, and knowledge constrain people's mindsets, paradoxically preventing the fundamental changes that can take advantage of new technologies and address the inadequacies of current educational systems. The same mindset permeates reform efforts as most often the educational establishment tests the alteration of one element at a time, attempting to hold all other elements constant, thereby inhibiting more profound changes.

This thesis takes the idea of "One Computer Per Child" as a real opportunity to rethink education in the new century. The aim of this thesis is to study the potential of the one-to-

one computer infrastructure as a catalyst for change. I chose to use the rural one-teacher school environment as the basis for this research not merely because such schools are numerous in developing countries and typically associated with poor quality of teaching and learning, but primarily because they do not fit traditional models of education. At the same time, they provide a fertile ground where technology can be present in sufficient quantity to constitute a computationally-rich environment; can be experienced as socially and personally relevant; and, can be linked to sources of social and cultural knowledge as well as powerful ideas.

This thesis proposes a holistic model for learning environments that builds on a rich body of Constructionist learning research. Key components of the holistic model are: sufficient amount of student-owned technology which can accompany them as they interact in school, at home and in the broader community; rich educational activities that draw on the Constructionist learning approach; and, teacher engagement in activity design with simultaneous support from a knowledge network of local and international colleagues and mentors. I introduce the concept of "whole-project" learning, which strategically integrates the elements of the model, and introduces a learning approach that is different from the existent methodology of work in that it invites deep multidisciplinary learning and can involve learners of all ages, hence challenging the need for segmentation of the school day into age groups and class periods.

Costa Rica's educational system presents an appealing case for the study and implementation of the model proposed in this thesis. Costa Rica has a history of successful implementation and on-going support for computers in education. In 1988, Costa Rica, with the support and advice of the MIT Media Lab, took a bold step toward using computer technology to enhance its schools. The Omar Dengo Foundation, the institution that has implemented the computer initiative in Costa Rica, has created a number of programs, such as in-service and computer-based training, student mentors, and computers in the classroom, among others, which are conceived within a Constructionist philosophy (Anfossi and Fonseca 1999). In addition, the Foundation has established a support network of tutors who are teachers participating in the program, and a nationwide conference for children. Through these initiatives, Costa Rica has shown

how to introduce a nationwide change that is both radical and sustainable, which gives the country a culture of educational innovation.

Building on the foundation of Constructionist learning culture and experience in Costa Rica, I decided to work with one one-teacher school, called El Silencio, over the course of one year. In the rest of the thesis, I will describe the longitudinal study of the transformation of the school by the holistic model, and of the appropriation that took place. Although this thesis takes into account the dimension of students, parents, and teacher, it focuses on students' appropriation of technological tools in the context of their learning, and how parents and teacher participation influenced how that happened.

The name "One to One Connections: building a community learning culture" was inspired by the concept of *family learning culture* introduced by Seymour Papert in his book The Connected Family (1996). As I worked with students, teacher, and the families at El Silencio, I observed an emerging computer culture as the digital technologies became part of people's "beliefs, preferred activities and traditions associated with learning." Papert tells us that a learning culture that takes into account new digital technologies is a necessary step towards changing education. This is needed even more when the learning culture of the school environment is going through a major transformation, and when technology plays such an important role. Families and community members not only need to participate and support the new learning that happens at the school, they also need to engage in it. They need to change their mind-sets about what learning is, different from what they learned at school. This thesis takes a participatory approach to involve all stakeholders not only in the design of the holistic model proposed in this thesis, but also in the development of the practical experience at the one-teacher school in Costa Rica.

1.1   Motivation and background

I have always been fascinated with rural schooling, one-teacher schools, in particular. I found the idea of a small school, where learners of different ages share the same physical space, family and community members are physically close, teachers are sensitive to what students know and are interested in (and even parents), and the organization of

physical space and time are flexible, ideal for learning. As I visited this type of school in several countries (mostly in Latin America), I found myself amazed to meet sensitive and caring teachers, and sweet students, and I also found the most extreme conditions. Students walked daily a great distance to a school in poor condition, often without furniture, learning materials, drinking water, and sometimes even without a teacher. The idea of working with this type of school always stayed in my mind, and my plans!

Even though I had read about Constructionism, it wasn't until I started working at the Media Laboratory that I became familiar with the ideas. I participated in a number of projects and initiatives that involved students creating their own scientific instruments and becoming engaged in scientific inquiry (Resnick, Berg et al. 2000) to develop tools and methodologies to help both children and parents learn together about technology and explore their values (Bers and Urrea 2000), using a variety of Constructionist toolkits (Mikhak, Berg et al. 2000) (Sipitakiat, Blikstein et al. 2002). The more acquainted I became with Constructionism, the more interested I became in bringing my experience and knowledge to the one-teacher school environment.

"Learning for rural communities" program was the first initiative that I developed with a one-teacher school in developing countries. The goal was to study how digital technologies can enhance student learning and at the same time strengthen the relationships between rural schools and communities (Urrea 2001). I worked with several schools in Colombia and Costa Rica for several years. I ran workshops with students, parents, and teachers in which they used robotic technologies to create projects about their interests and lives.

 Although the project wasn't designed to bring change to the school as a whole, I expected the teachers to integrate the technologies and the learning that happened during the workshops to the school environment. The results of these experiences were positive, but not sustainable. There was a lot of excitement during workshops; parents worked together with students and teachers. They learned together about the technology while creating projects that incorporated concepts from different disciplines. But the teachers needed a lot of support in order to integrate these practices in the daily routine of the classroom. I realized that more support and access to resources was needed in order to

make an experience like this more sustainable. Let's review other experiences in Latina America that have integrated digital technologies into the classroom:

- The Omar Dengo Foundation started the "computer in the classroom" program (Anfossi 2007), in rural one-teacher schools in Costa Rica in 1998. As part of the program, students use Micromundos[1] and other digital technologies, and followed the project-based methodology created by the Foundation to design and build projects about different topics (Anfossi and Quesada 2005). The program has been implemented in more that 100 schools each of which receive from 2 to 5 computers depending on the number of students. Even though the methodology is oriented toward a global approach to the subjects, the design and creation of projects often become activities in themselves; project-based learning doesn't get integrated into the daily routine of the school day.

  The program also includes a student-mentor component, which had been very successful at improving the use of technology in the classroom, not only because the students push the teacher to use the technology, but also because they support the work, therefore reducing the teacher's workload.

- Escuela Virtual (Virtual School) in Colombia is a program that integrates information and communication technologies into primary school (one-teacher school) to support the teaching and learning process (Cardona, Arango et al. 2003). The program was started by the Departmental Committee of Coffee-growers in Caldas[2]. Its main component is an online community[3] for teacher, students, and parents with a number of resources, including forums, collaborative projects, teaching materials, among other things. The program is based on the Escuela Nueva model of rural education, which I will be explain in detail in Chapter 2. Unfortunately, the materials adapted to integrate the use of technology suffer from the same characteristic static materials and lack of comprehensive teacher development and support recognized among the reasons that the model has begun to deteriorate during recent years (Kline 2000).

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[1] I will be using Micromundos in the rest of the document. I want to make sure the readers understand that we used the Spanish version of the software.
[2] Caldas is a department of Colombia. It belongs to the Colombian Coffee-Growers Axis.
[3] More details about Virtual School at http://evirtual.recintodelpensamiento.com/escuelavirtual/index.htm

The most recent evaluation of the program reported the following results: i) it has allowed institutions to get familiar with and to use information and communication technologies (ICT) in the educational process; (ii) it has promoted collaborative projects as spaces for connectivity and exchange of academic activities; (iii) it has changed teachers' perception about information and communication technologies. They now consider them educative tools; and, (iv) it has strengthened the relations between public and private institutions, and the educative community (Cardona, Arango et al. 2003, pag 1).

- Enlaces Rural program is the most recent computer initiative in rural multi-grade schools[4] in Chile. It was started by the Ministry of Education in Chile as an extension of project Enlace, a national initiative to enhance learning environments and educational opportunities for Chile's students and teachers (Carrasco, Stingo et al. 2001). "Using a creative mix of computers and communication tools, Enlaces has created a virtual community of teachers and students across Chile and has linked this network to the rest of the world via the Internet" (Rusten 1999).

  Similar to the Escuela Virtual program, Enlaces Rural incorporates strong use of communication and collaboration through its virtual environment, but it is an initiative at the national level. In addition, this program has a strong teacher training and support component, that is implemented through similar organizations called Microcentros (Microcenters)(Chile 2001).

Even thought the experience described in this thesis involved a single one-teacher school, differences are critical. The most obvious difference is the quantity and quality of technology available to the students; the programs mentioned above bring only a few computers into the classrooms, depending on the students. In the thesis program, each child was given their own laptop which meant that they could take the technology with them when they left the class room. However, the deepest difference is that this thesis uses technology to rethink how learning occurs in school and studies the potential of technology to act as a catalyst for change.

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[4] Multi-grade schools include one to three teachers, depending on the number of students.

1.2 Road map to this thesis

So far, I have described the motivation behind the thesis and positioned the work amongst relevant initiatives in Latin America. I am now ready to describe in detail the thesis work using the one-to-one computer infrastructure as a catalyst for change. This work builds on a rich body of Constructionist learning research. I will reference the relevant literature when describing the design of the proposed model, the experiment at the one-teacher school in Costa Rica, the analysis of the transformation of the school, and of the appropriation of technology and learning by students, teacher, and parents. This chapter describes the motivation behind this thesis and positions the work among relevant initiatives in Latin America. The remainder of the thesis is organized as follows:

- Chapter 2 describes the holistic model as it was envisioned. This model extends existing models of rural education in Latin America by bringing 1:1 computer infrastructure and by rethinking some of its components, such as the content and methodology of work, and the teacher and family involvement.

- Chapter 3 introduces El Silencio, a one-teacher school in Costa Rica where the proposed model was implemented. In the first sections of the chapter, I highlight the changes that occurred in the school as the proposed model was implemented. In the second section of the chapter, I describe the longitudinal qualitative research methodology used. I also introduce the participants and give a brief description of the main observations.

- Chapter 4 provides a detailed study of the transformation that occurred at a one-teacher school in Costa Rica. I offer the results in the form of stories, Stories of Change, which tell the tale of the evolution of the model as a result of the transformation process at the school, and the community. The process of the analysis is explained in the following chart (see Figure 1). In the first column, I include some of the principles of the model, which are described in detail in chapter 2; in the second column, I include the four stories of change that are discussed in this chapter; and, the last column lists the relevant outcomes that I use to support and illustrate the stories.
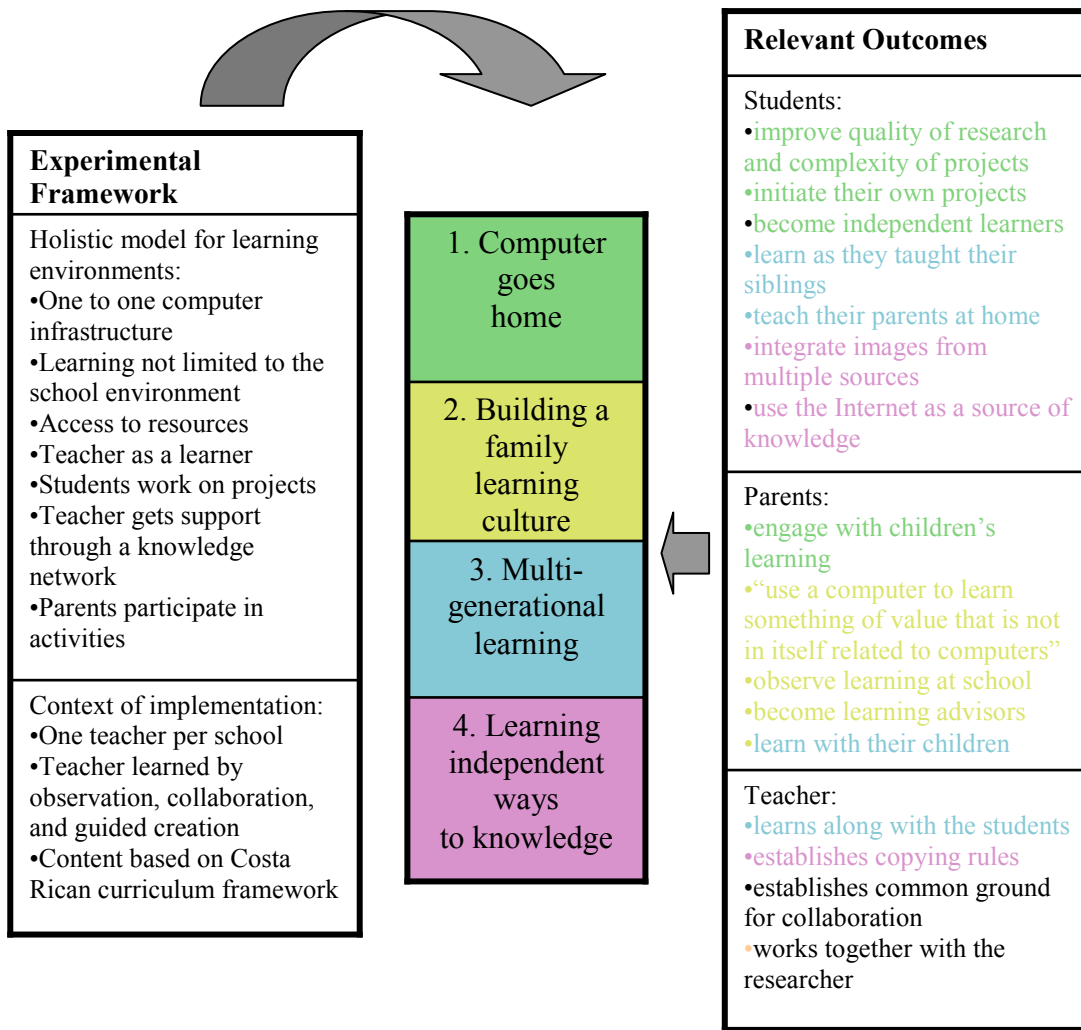
Experimental Framework

Holistic model for learning environments:
•One to one computer infrastructure
•Learning not limited to the school environment
•Access to resources
•Teacher as a learner
•Students work on projects
•Teacher gets support through a knowledge network
•Parents participate in activities

Context of implementation:
•One teacher per school
•Teacher learned by observation, collaboration, and guided creation
•Content based on Costa Rican curriculum framework

1. Computer goes home

2. Building a family learning culture

3. Multi-generational learning

4. Learning independent ways to knowledge

Relevant Outcomes

Students:
•improve quality of research and complexity of projects
•initiate their own projects
•become independent learners
•learn as they taught their siblings
•teach their parents at home
•integrate images from multiple sources
•use the Internet as a source of knowledge

Parents:
•engage with children's learning
•"use a computer to learn something of value that is not in itself related to computers"
•observe learning at school
•become learning advisors
•learn with their children

Teacher:
•learns along with the students
•establishes copying rules
•establishes common ground for collaboration
•works together with the researcher

Figure 1. Stories of Change

- Chapter 5 offers a second study of appropriation by students, teacher, and parents. In this chapter, I discuss the different levels of appropriation observed during the practical experience at the one-teacher school in Costa Rica. Although this thesis takes into account the dimension of students, parents, and teacher, it mainly concentrates on students' appropriation of technological tools in the context of the learning, and how parent and teacher participation influenced how that happened.

- The closing chapter 6 outlines the contributions and future directions.

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