Evaluation of technological needs and resources at five middle schools in Totonicapán, Guatemala.

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By Elias Tzoc Caniz

Abstract

In the digital age, both the Internet and computers have helped transform traditional information services into digital and enhanced services. For developing countries, however, issues such as the digital gap and socio-economic development are still barriers to creating equal opportunities for accessing electronic services. In Guatemalan rural-small schools, instructional methods are limited to listening to the teacher and copying what is written on the blackboard. Therefore, the roles of Information Centers, as source and gateway to information, have become critical. As some experts have stated, "the combination of education and technology has been considered the main key to human progress." In fact, local information centers aim to bridge the information gap by providing computer access and training to end-users. This report provides the results of a summer research -*Evaluation of technological needs and resources*- in five middle schools in Totonicapán-Guatemala.

I. Introduction

The development of *Information & Communication Technologies* (ICT), particularly the Internet and computers, has helped transform traditional information services into digital and enhanced services. For instance, libraries, regardless of their size, are adopting new functions of acquiring, storing, disseminating, and presenting information and knowledge. In developing countries, however, there are few libraries in urban areas, perhaps none, in rural areas. In fact, instructional methods in rural schools are limited to listening to the teacher and copying what is written on the blackboard. Therefore, the services and roles of *Information Centers* (IC), as source and gateway to information, have become critical, especially when dealing with digital resources in the global community. This way, these centers aim to bridge the information gap by providing computer access and training to students in places that have faced perennial limitations not only in education but also in socio-economic development. For those reasons, this report describes a research study -*Evaluation of technological needs and resources*- in five middle schools in Totonicapán-Guatemala; the findings could help decision-makers or technology advocates when dealing with issues of ICT infrastructure and users' needs in schools of this category.

II. The national context

With a population of approximately 13 million people, the Guatemalan society is multi-cultural, multi-ethnic, and multi-lingual. In fact, Guatemala has over 50% of its population coming from indigenous peoples -one of the highest rates in Latin America-. Almost a decade after the 36-year civil war ended, and though these accords constituted a national development plan and established an agenda with a number of policy actions, including areas such as economic, social and human development, public sector reforms, justice and human rights, security and reconciliation. Currently, cultural and socio-economic gaps persist in the country, especially within indigenous communities. For instance, children education is plagued by a lack of access to pertinent traditional resources -not to mention digital- insufficient teacher training, and inadequate schools

facilities. According to a report presented in 2001 by USAID, nearly 76% of rural children drop out before completing primary school. Additionally, the combination of high levels of crime, inefficient judicial systems, slow economic growth, and institutional instability are some of the elements that have blocked a more dynamic national development for all Guatemalans.

The current administration has developed a national plan which focuses on sustainable and participatory socio-economic development. The four-year (2004-2008) plan includes a Recovery Program, which is founded upon three strategic components:

- *Guate Solidaria* (Solidarity Guatemala) includes course of actions to reduce academic drop-outs and the safeguard of cultural diversity in order to develop an effective social policy;
- *Guate Crece* (Guatemala Grows) is to encourage the search for alliances between the public and private sectors in various areas of the local economy, including infrastructure (e.g. roads, school facilities), tourism, finances and the forest sector;
- G*uate Compite* (Guatemala Competes) aims to increase productivity through systems supporting technological innovation, the promotion of exports, and the creation of local business programs, which will eventually promote national and international investments.

According to the 2006 Consular Information Sheet, Guatemala has a developing economy, but it is characterized by wide income disparities. The economy of the country has been based on fundamentally three economical sectors: agricultural, industrial and commercial. Over the past several years, tourism and exports of textiles, and nontraditional agricultural products such as vegetables, fruit, and flowers have increased, while more traditional exports such as sugar, bananas, and coffee continue to represent a large share of the export market. The relative economy growth of recent years has been undermined by the fluctuations of the international markets (especially in the United States and Mexico), and by the consequences of a series of natural disasters (floods and hurricanes).

From the social point of view, poverty is still a major problem for more than half of the population, and almost 25% of the population lives in extreme poverty. Indigenous peoples suffer from strong racial, social, economic and cultural discrimination. With the return to democratic governments, indigenous leaders began to call for changes in order to create an institutional framework for the recognition and incorporation of indigenous issues in the national agenda. In this end, indigenous participation has increased in the country's political life -in the last 15 years-; although concerns have remained regarding the institutionalization of not only their representation but also their active participation in the decision-making process in the various areas of national life.

III. Description of the communities/schools visited

The research study took place in two areas: urban and rural. *Escuela Normal Rural de Occidente* (ENRO) -is a public middle and high school-, located in city of Totonicapán. In contrast to ENRO's location, the four *Institutos Básicos* (IB) -community middle schools-, are located in rural areas which are ten-twenty miles of Totonicapán. Though the establishment of these schools has been an important step toward providing access to education in rural areas, there are still remaining issues such as the development of local collections of academic resources in each school, and more time per class session. For instance, students at ENRO receive 3 hours a week of each core class (e.g. mathematics), whereas students at IBs only receive 1.5 hours a week.

Despite the differences in number of students enrolled, the physical location of each school, and time average per course, these schools also have common difficulties, such as the need for adequate facilities and the lack of ICT resources. As the findings of this research have revealed, students at ENRO are most likely to be better prepared in using computers because they have been exposed to these services which are mainly provided by private internet centers. According to the teachers, nearly 50% of the students at the IBs are both working and studying at the same time. Thus, they have more responsibilities and fewer opportunities to visit Internet centers, even if they would be able to pay for it.

The following table summarizes the main characteristics of each school.

School 1 – Instituto Básico of Barraneché
Barraneché is located approximately twenty-five miles of Totonicapán city.

Date built:	2001
Grades:	7-9 & K-6 mornings only
Students:	74
Classrooms:	4
Computer lab:	Yes (5 computers with no internet connection)
Teachers:	50% (4 of 8) have completed an MLTP program

School 2 – Instituto Básico of Chivarreto
Chivarreto is located approximately twenty miles of Totonicapán city.

Date built:	1998
Grades:	7-9
Students:	95
Classrooms:	6
Computer lab:	No
Teachers:	80% (5 of 6) have completed an MLTP program

School 3 – Instituto Básico of Vásquez
Vásquez is located approximately twenty-two miles of Totonicapán.

Date built:	1995
Grades:	7-9 & K-6 mornings only
Students:	120
Classrooms:	10
Computer lab:	Yes (6 computers with no internet connection)
Teachers:	All of them have completed an MLTP program

School 4 – Instituto Básico of Chuatroj
Chuatroj is located approximately twenty miles of Totonicapán.

Date built:	2001
Grades:	7-9 & K-6 mornings only
Students:	105
Classrooms:	10
Computer lab:	No
Teachers:	88% (7 of 8) have completed an MLTP program

School 5 – Escuela Normal Rural de Occidente ENRO
ENRO is located in Totonicapán city.

Date built:	1955
Grades:	7-12 & Bilingual programs
Students:	1300 (535 of whom are middle school students)
Classrooms:	25
Computer lab:	Yes (20 computers)
Teachers:	All of them have completed an MLTP program
Library:	Yes (2,500 books, available only for students)

An MLTP or Middle Level Teacher Preparation program provides the basis for coherence among curriculum, instruction, practical experiences, and evaluation. The program helps middle school teachers develop teaching plans in the secondary level -based upon the approved framework-, using appropriate methodological strategies and elaborating educational materials for the current and local-context. Given the inherent implications of global trends, teachers who have completed an MLTP program tend to adopt leadership roles in promoting and participating in activities designed to integrate new techniques such as critical thinking and even information technologies. For instance, in Accounting courses teachers -with an MLTP degree- often encourage students to read the economic section of local newspapers, listen to radio news, or watch television news program. These techniques not only let the students be aware of current economic issues, but also enable a new framework of learning.

A visitor to any of the five schools could see obvious signs of needs, including ICT resources, printed materials, training opportunities, and computer-literacy. That is, access to these tools is a top priority in these schools. In a next stage, acquisition and dissemination of academic resources such as encyclopedias, textbooks, tutorials, and dictionaries, would be essential. As revealed in recent ICT research studies, accurate technological resources and up-to-date training are key prerequisites for developing information societies and supporting economic and social development.

IV. Research objectives

The overall objective of the research study was to provide an accurate perspective of the ICT infrastructure available for students in five middle schools in Totonicapán. In the long-term, the findings could enable further analysis in evaluating the cost and social benefits associated with incorporating computer and digital resources in Guatemalan schools or local ICs. In the future, these networks could be essential agents, perhaps nodes, in the global community and help reduce the information disparity; a change that is necessary, especially for groups of children and youth.

In this sense, the study included three specific micro objectives:

a) to observe and evaluate current technological resources available in those schools;
b) to interview teachers, students, and community leaders in order to understand how they envision digital resources in the coming years; and
c) to gather up-to-date data and use it as support to develop future projects to incorporate new resources which would not only offer new services but also would support the goal of technology training for these communities.

It is important to mention that the proposed cross-table analysis of data -between ENRO and the four IBs- has been made possible by combining these objectives along with the research questions (which will be discussed in the result section). As schools with ICT resources have proven, any learning experience can be enhanced by the use of technology, even low technology. This way, the main difference still relies on the skills among teachers. Individual creativeness is the key to successful integrate technology into the learning opportunities of students. Teachers will always need the support of good technology planning and staff development opportunities to stimulate the application of new resources in their classrooms and to build a foundation for successful usage of technology for themselves and their students. Therefore, this research has given special attention to the teachers' interviews, as key participants in the paradigm shift from a traditional to a digital framework of resources and possibilities.

V. Research methodology and data collection obstacles

The research study employed three research techniques:

a) context-analysis and participant-observation;

b) survey with 140 students; and

c) interview with 9 teachers.

The participant observation technique aimed to gain a close understanding of the current technological resources available primarily in the participant schools, but also in some non-participant schools and internet centers. Teachers, community leaders, and students shared their experiences and expectations of current as well as potential initiatives in their schools. Two important aspects in this process were: the existing relationship with some of the teachers and the ability to communicate in the local language -K'iche'- with most of the leaders. In the end, conducting the research in the home village enabled a strong sense of confidence and a shared commitment toward technological projects and social development.

The type of questions and structure were based upon an existing instrument found in *User-Satisfaction and Knowledge* presented by William Trochim (2001). The survey was given to approximately 20% of students at both schools. At each IB, the survey was successfully completed by 15 students, making a total of 60 students from four IBs schools. At ENRO, the survey included 80 of the 535 students. Thus, there were a total of 140 student participants from the five schools. Both groups were randomly selected and the study did not include any compensation for participants. The students' survey had 10 questions -multiple choice-, which measured their awareness of current and potential digital services in their schools or elsewhere.

The semi-structured interview form was based upon a sample *Semi-Structured Interviews in the Social Sciences* developed by Russell Bernard (2000). Two teachers were interviewed in each school, except in Barraneché. On one hand, school directors provided data regarding the school strategic plans in adapting computer classes and digital resources. On the other hand, computer instructors or teachers with some experience in using computers provided data of identified needs such as type of

equipment, software, budget, and services. Most interviews lasted approximately 30 minutes.

Because misunderstandings are commonplace concerning the meaning of some terms, the data collection processes included a preliminary meeting with the five directors, so that the principal investigator explained the methodology as well as the structure of the survey and interview. All subject participants, students and teachers, were members of the five middle schools. In each location, two teachers helped the principal investigator and encouraged students to complete the survey. Notification of the survey was held during a welcoming conference where the principal investigator, in conjunction with the school teachers, explained the type of questions in the survey and the potential benefits of the study to the students.

In terms of data collection obstacles, early communication with the subdirector at ENRO and the director of education at CDRO was crucial to reduce time conflict and logistic problems. For instance, in April both teachers along with the principal investigator defined the general framework of the study and developed an initial timeline for the research activities. The communication was held by e-mail and phone calls.

Nevertheless, four obstacles could have *partially* biased the results.

a) in Chivarreto, the visits were scheduled during the mid-term evaluation week but students were free to go home right after complementing the test of the day. In this sense, it was difficult to truly select every participant using the random technique -*required to avoid bias and selection discrimination*-, because there was never a time where all students were together. After two attempts, the teachers and the principal investigator had to reach a consensus to select 15 out of 35 students.

b) though the initial sample size was 20% -a total of 185 students from the five schools-, due to a general issue of incomplete surveys, the final sample size dropped down to 15% (140 students). Some surveys had only four questions correctly answered and others were just *incongruent*. For instance, some

students who reported not having any experience with computers, they also reported being able to upload/download files from the Internet.

c) during the interview with the computer instructor at ENRO, the conversation was interrupted at least twice. Because the interview was held in the computer lab, students kept going in and out, many were in a hurry to print their homework and others needed assistance with their files. But with one instructor, only 15 computers running, and more than 1,000 students, it would be unthinkable to expect a different scenario. Given that situation and the level of engagement of the instructor in computer literary not only at ENRO but also at a private center, this interview was the longest one -nearly two hours-.

d) in Barraneché, it was not possible to interview the director because he was attending a municipal week evaluation. Therefore, the number of interviews also dropped down to 9, instead of 10.

Results

Although the three research techniques were based upon the qualitative approach, once data was stored electronically -in a database developed in Microsoft Access-, it was possible to complete the process of answer validation and categorization for open-ended questions. The new records in the database were exported into Excel files, where the combination of two features: *Dynamic Data Source* and *Data Analysis* allowed the design of tables and graphs.

These initial findings are presented in two sub-sections:

a) general overview of number of participants, and

b) discussion and possible answers for the research questions (RS).

Participants

By the end of the study, 140 students successfully completed the survey, 57% were from ENRO and 43% from IBs. *See Table 1*. The criteria of selection were based

upon two characteristics: gender and number of students at each school. Although in this study, 57% of respondents were female; at ENRO, this group represents 54% whereas at IBs is 62%. Given that the total population of students in all four IBCs is 394 and ENRO is 535. The sample was designed to include 20% of each school-population; however, after eliminating unusable surveys the final sample was 15%.

Table 1
Number and percentage of participants, grouped by gender and type of schools.

School	Female		Male		Total	
	N	%	N	%	N	%
ENRO	43	31%	37	26%	80	57%
IBCs	37	26%	23	16%	60	43%
Total	80	57%	60	43%	140	100%

Regarding the 9 successful interviews, all directors and computer instructors were males. Two unique characteristics were found: their similar experience with computer issues and their recent engagement (2-5 years) in the field. *See Table 2*. In some way, these common characteristics should stand as valid arguments that the influence of computers in education programs is relatively new. These advocates also had a general concern, the need of more ICT projects in their schools, which contrasts the statement made by Valls (1999) "the combination of education and technology has been considered the main key to human progress."

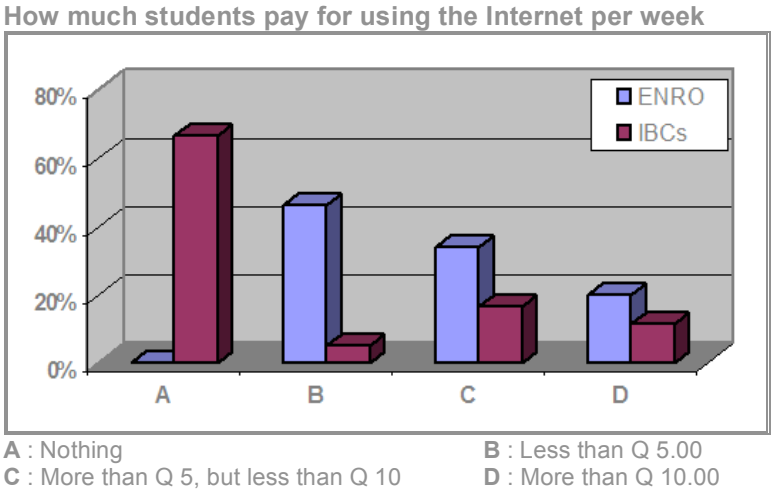
Table 2
Teachers' experience in the following tasks

Years of experience you:	zero		less than 2		between 2 & 5		more than 5		Total	
	N	%	N	%	N	%	N	%	N	%
have been using computers	0	0%	3	33%	5	56%	1	11%	9	100%
have been studying about computers	0	0%	6	67%	3	33%	0	0%	9	100%
have been teaching about computers	4	44%	3	33%	1	11%	1	11%	9	100%
have been using the Internet	0	0%	5	56%	4	44%	0	0%	9	100%
have been conducting online research	1	11%	6	67%	3	22%	0	0%	9	100%

Will an Information Center reach and benefit more users in a large-urban school or in a small-rural school?

Although selecting the appropriate technology in today's education continues to be complex, regardless of school size and location. In the business world, the success of a give service relies on the overlap of consumer's need and the provider's capability to resolve that need. In this context, students in IBs hardly have access to computers, 75% reported to be willing to pay if they had a center with Internet connection. As presented in *Graphic 1,* in IBs 67% are not spending money at all in computers, however, in talking to some of the students and teachers, they have agreed that the major problem is the overlap of work and study. Based on the business model, since there is an obvious demand of service with an existing market; then, a local center owned either by the school or by a private entity, would be part of the solution.

Graphic 1

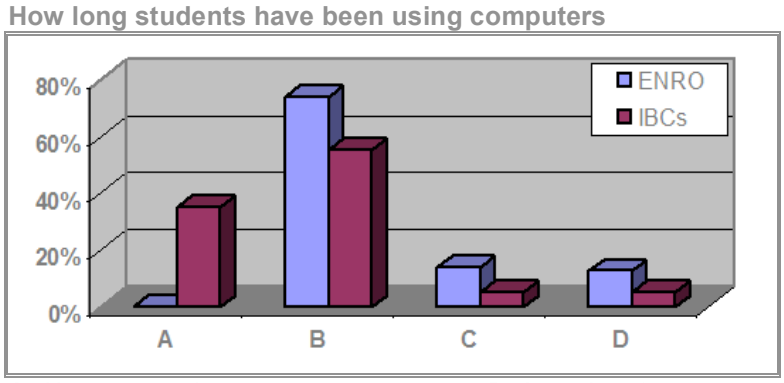


According to this graphic, as well as the inherent challenges of maintaining and integrating technology into schools, an initial answer to where an IC would reach and benefit more students; it would be in small-rural schools. However, it is imperative to underline that one IC could serve at least two schools. In that sense, there will be more users using and paying for the service, which turns out to be a key element for self-sustainability.

Is there a significant difference in terms of computer skills between middle school students at ENRO and IBs?

Yes, there is a clear difference between the two groups. Generally, students at ENRO have been using computers more than students at IBs. *See Graphic 2.* For instance, 35% of students at IBs have not ever used computers, whereas at ENRO everyone has had some tech experience, at least during the last year. In rural schools, interviews and context observations have confirmed that the lack of local ICs remain as the major key to overcome and provide technical services, nevertheless, 33% of IB students are using computers elsewhere. This finding would suggest that if there were a local IC, IB students will most likely use and pay for the service.

Graphic 2



Despite that ENRO has two computers labs -20 computers-, but with more than 1,300 students enrolled; it is practically inconceivable to schedule formal computer classes. Therefore the main factor of change with students at ENRO is the proliferation of Internet centers in Totonicapán city, rather than the computer labs at school. On the other hand, nearly 85% of students at ENRO are from rural communities (2-5 miles of the city), and yet, they are paying for the services. In this end, although a new IC in a rural setting would face more challenges -financial and human resource-, it would definitely benefit those users, who have been traditionally excluded for accessing ICT resources.

Are there common threads of interests among teachers at ENRO and at IBs in terms of digital and technological resources?

To begin with, 8 of 9 teachers have concluded that "decision makers in education programs do not see the value of technology in children and youth education." They also emphasized on the need in retraining educators to think in new and innovative ways about how today's technology can create new instructional models, even in small schools with limited budget. According to the interview results, the list of technology resources needed in implementing a digital and inclusive approach would require both *low* and *high* tech tools. For instance, overhead projectors, television, video-cassette players, and even cassette players, could be part of an immersion strategy. On a next stage, computers, scanners, printers, and internet would be necessary, they stated.

A recurrent question among teachers is whether new technology truly complements existing patterns of behavior. Five teachers have reported that students who are using the Internet tend to copy and paste their assignments. They are developing search skills, but they often lack the core competency of learning, -to read and write critically-. On the other hand, teachers have pointed out the urgent need to identify talented students and find scholarship opportunities for them in more competitive institutions. Otherwise, the gap between computers literate and illiterate would continue to grow, and the mass production of information would remain in few dominant languages.

Additionally, interviewees mentioned that an active cooperation between universities and middle schools could support the acquisition of new resources by developing joint projects. Universities can use the schools facilities, but install computers, which can minimize cost operations and broaden opportunities for a diverse group of users. Moreover, a first step toward a needed change is the identification of basic technology tools from the context of the classroom. The plan for acquiring new resources does not necessarily mean cutting-edge technology, and software could open-source. Despite the myriad concerns, in the long-term, it would be valid to think that just as TV made its way, we could expect a similar trend with computers, they concluded.

VI. Policy implications

In the last decade, some governmental initiatives have been pursuing an integrated approach to incorporate the use of ICTs in the national socio-economic development agenda. For instance, in 1998, *Guatel* the national telecommunication operator was privatized. Ever since there have been significant improvements in service and coverage. Additionally, international agencies such as USAID, World Bank, BID, along with national institutions (e.g. Rafael Landívar University and AGEXPRONT) are promoting the use of the Internet for business, social, and educational development. These programs have collaborated to create electronic centers in small villages, in which educational training and micro-business assistance have been provided. Most recently, the government started a pilot program titled *Escuelas del Futuro* (Schools of the future). This program aims to set-up a computer lab with Internet service to help students use digital resources and complement their printed-academic resources.

Nevertheless, challenges related to widespread poverty, a small private sector, and inadequate educational opportunities are limiting a better development. In fact, urban and rural disparities remain marked, which will most likely continue to block rural internet adoption and the diffusion of services. Though growth rates in cellular telephony reached more than 200% in 2002 -in small-rural villages-, this indicator remains low relative to the total population. According to the 2004-2005 Networked Readiness Index (NRI), which measures the propensity for countries to exploit the opportunities offered by ICT, Guatemalan is ranked 88th.

In July-August 2006, the Ministry of Education with the support of the Japanese embassy was able to support more than 200 middle schools with computers and few with Internet connection. Each school received from 10 to 60 computers, depending on the total of students enrolled. These projects would benefit various type of users, including students, teachers, and the community in general. Thus, ICT resources have the potential to improve the quality and efficiency of the educational system, to create structures and means that allow the development of human resource, and to promote social communication through technology for the exchange of knowledge, science and culture.

VII. Possible areas in which the research could be developed further

Under the premise that sooner or later people in developing countries will have *more* access to local and global networks; then, future ICT issues and research should include topics such as:

Digital content, the use of digital resources in schools will continue to increase. Users are, and will be, adding digital images, sounds, videos, and text files to their projects. That is, digital objects have enabled a new layer of communication from people to machines and vice versa. Nevertheless, nearly 70% of internet users communicate either in English or European languages (Global Reach, 2003), so this issue leads us into another challenge -the information gap-. Having said that, it is imperative to evaluate different techniques to acquire, perhaps produce, digital content for/in developing countries. Proyecto Enlace Quiché constitutes a good model of digital content production; they have developed at least six CDs for children and adults for learning four Mayan languages -K'iche', Ixil, Tz'utujil, and Kaqchikel.-

Preservation, once a particular piece of information has been created, often as part of a more complex entity (e.g. a manuscript), it should not only be made accessible to the public but also be preserved for future generations. Unfortunately, hardware and software change rapidly, implying automatically modifications or new digital formats. Therefore people involved in digitization and preservation processes, especially in areas with basic technological infrastructure, should be looking at the "best practices" in terms of format migrations, upgrades, and even the cost in preserving their local collections.

Copyright, under the Intellectual Property Rights (IRP) system, knowledge that is not "protected" is in the public domain. However, indigenous peoples have not used IRPs to protect their knowledge. For instance, certain ceremonial arts and medicines can only be shared for specific internal indigenous cultural and/or spiritual reasons. Thus, the integration of oral -tacit- information into written -explicit- information would also imply language constraints. This way, utilization of new technology to document and share information should be balanced with the people's right to protect their knowledge. To this end, digital information of indigenous knowledge still requires further analysis.

VIII. Community needs in terms of research

According to the majority of people interviewed and contacted -teachers, parents, and leaders- there are two pressing and complementary community needs:

a) a socio-economic evaluation to determine a payment index,
b) a feasibility plan exclusively for IC's development, and

Given that the ICT development is directly linked to household income and educational levels, both needs deserve a special attention when dealing with the near future of technology in rural communities, especially in the implementation of affordable services. Otherwise, what many visualize as gateways, in the global community, could remain as the barriers themselves. Thus, effective implementation requires the examination of cost-benefit from the viewpoint of the local and national economy. These research studies should include key indicators such as access, quality, affordability, sustainability, and applications; as well as a collaborative social dialogue, including people from the public and private sectors. As stated by Mujoo (2004) "In market economies the private sector is primarily responsible for providing ICT services, …and the public's sector main role is to provide a sound policy framework."

A good example is the growing number of users of cellular phones in Guatemala. In fact, access to cellular phone service has increased from 7.5% in early 2000, to 22% by late 2004 (WorldBank, 2004). Additionally, this case has also proved that products, designed accordingly to consumer's payment index, have the potential to merge different market segments, including rural communities. After all, a lasting change will require common agreements between consumers and producers.

Within this particular context, two preliminary actions can be drawn: *to strengthen ICs for collective access* (e.g. Internet-Centers sponsored by local governments, NGOs, and the private sector); and *to obtain affordable equipment for individual access*. In this sense, a special consideration should be given to visionary initiatives such as the *One Laptop per Child* (OLpC), initiated by faculty members at MIT Media Lab. The initiative promises to be a potent learning tool for developing countries, and it would be not only affordable but also power-efficient.

IX. Conclusions

Despite the successful actions to increase attention and support education and information technology programs from the government and foreign agencies, these efforts remain insufficient to support most schools in the country. Villages like Totonicapán, where nearly 80% of the population remain poor, -living on less than $ 2.00 a day (UNICEF, 2003)- it is difficult to consider that a family would get a computer for their children, at least not soon.

This research reveals the technological infrastructure in Guatemalan schools, specifically in Totonicapán. Indeed, much work needs to be done to transform rural middle schools and their students to ensure not only access to basic computer services but also to better prepare them for the future. Given current conditions, teachers and student have admitted that a personal computer is practically unaffordable; in that sense, the majority -85% of students and 95% of teachers- sees local computer labs as feasible channels to beginning and developing programs of computer-literacy.

Teachers along with local leaders can coordinate effort at different levels. For instance, ENRO should not only depend on the government support, if all the students are using and paying computer services at other centers; then, ENRO could consider to invest and create its own center. For the ICBs in rural communities, the strategy could be somewhat different. In fact, the Education Program at CDRO has set a five-year plan to create three *Centers of Pedagogic Resources*, which will include printed and digital materials. That is, a rural community may not have the demand/capacity to set-up and sustain its own center, but if two or three communities can work together, then the plan could be reachable.

On the other hand, decision makers could begin putting the basic technology in rural areas and the more up-to-date technology at central levels. For instance, at a middle and rural school, even a basic computer would be an asset (a PC with operating system, word processor, and datasheet can be a good start). In other settings, such as *ENRO* or a *Center of Pedagogic Resources*, where students have better understanding and other computer needs, then they may have an upgraded machine and software as well.

X. List of contacts

Key contacts -before and during the research-

- Profesor Luis Cua
  Director – Programa de Educación
  Asociación para el Desarrollo Rural de Occidente -CDRO-
  Tel. (502)7766-2175

- Profesor Aulio Amézquita
  Sub-Director de Educación Básica
  Escuela Normal Rural No. 2 de Occidente -ENRO-
  Tel. (502)7766-1258

List of teachers -interviewed or contacted-

- Profesora Sabina Menchú
  Instituto Básico en Barreneché

- Profesor Juan Jesús Chaj
  Instituto Básico en Chivarreto

- Profesor José Juan Puac
  Escuela Normal Rural de Occidente

- Profesora Verónica Tzul
  Encargada de Biblioteca ENRO

- Profesor Meiker Hernández
  Centro de Computación en Concordia

- Profesor Jorge Vásquez
  Instituto Básico en Vásquez

- Profesor Domingo García
  Instituto Básico en Chuatroj

X. References

Global Internet Statistics (2006). *Statistics by language.* Retrieved July 15, 2006 from http://www.glreach.com/globstats/index.php

Ministerio de Economía de Guatemala (2005). *Plan de Gobierno 2004-2008*. Retrieved July 20, 2006 from http://www.mineco.gob.gt/mineco/despacho/presentacionvamosguatemala.pps

Mujoo, U. (2003). Building digital resources in developing countries. *International Review of Research in Open and Distance Learning 14*(9), 281-309.

Trochim, W. (2001). *Survey model: user-satisfaction and knowledge.*

United States Agency for International Development (2001). *Report: primary schools in developing countries*.

World Bank, (2006). *Information and communication for development, global trends and policies.*

World Bank, (2005). *ICT at a glance, Guatemala*.

Valls, J. (1999). *Information services for developing countries*. 2nd ed. Thailand: Asian Institute of Technology.