OECD/CERI CIT Program

A Case Study of ICT and School Improvement at
Santa Maria Tlahuitoltepec School, Oaxaca, Mexico

October 2001

Marcela Santillán, Team Leader
Carlos Domínguez
Diana Domínguez
Adriana Gutiérrez
Universidad Pedagógica Nacional
Instituto Latinoamericano de la Comunicación Educativa

INTRODUCTION

This work is part of the ICT and the *Learning Quality* program of the *Education for the Future* project which the Centre for Educational Research and Innovation-CERI of the Organisation for Economic Co-operation and Development-OECD, is developing in order to obtain empirical evidence that may offer orientation as to the options concerning educational policy for the 21st Century.

The case study of the Santa María Tlahitoltepec High School is one of the four case studies selected to represent Mexico, was elaborated according to the lineaments designed by CERI experts which, at an international level, seek to identify the conditions in which the ICT have been a catalyst for the innovation and improvement of schools.

Overview

We are trying to drive non-traditional practices forward, to use technologies, to consider our own context and improve the learning of our community, of our people.

Mauricio Martinez (School Teacher)

The computer center has been equipped since 1998, at the beginning, it had only 10 computers sent by the DGETA. Afterwards, the Latin-American Institute of Educational Communications (Instituto Latinoamericano de la Comunicación Educativa - ILCE) made a donation which completes the number of 26 computers currently serving at the computer room. These computers are connected to the BICAP web, and also have Internet service. The total number of computers in the BICAP is 49, 3 of which are servers; 47 are web

connected and have Internet access, and only 2 are not in the web.

All though the academic program does not formally take into account ICT usage in all of the subjects, most BICAP students recur to them for school work. As the school is located in a rural area, at a considerable distance from the capital city, Internet has become an unavoidable tool for accessing information and to improve the quality of academic work. Next in importance are the word processors, graphic editors and programs to make presentations (Power Point). The school has a canon that is used by students and campus supervisors in order to expose diverse themes and in the presentation of projects.

Electronic mail is a useful application amongst the academic community of the BICAP. On average, Teachers send from 5 to 10 mails weekly. The addressees are of diverse orders, ranging from students in the same community and their long-distance-education teachers to teachers of other regions and other states. Concerning the students, 70% have an e-mail account, but their communication is mostly with ex-students now attending other schools outside their own state.

The use of simulators and algebraic calculators is beginning to generate curiosity. Digital videos are another resource employed by the students to review themes that have already been covered. All though such material is not specially designed for senior high school, they exchange these resources with junior high school consultants.

The computer web at the BICAP is used so that managerial personnel, technical staff, craftsmen and academic staff may have the opportunity to connect to the web shared resources and to Internet from their own offices. In such a way it is expected that administrative procedures will be more agile and that the academic staff will enrich their teaching by means of actualized information. The web computer section installed at BICAP is completely cabled. A segment of the web is supported by optical fiber.

Parents show enthusiasm concerning the opportunity given to their children with ICT access; they believe schools are better now than when they used to go, and, according to their own possibilities, they are willing to cooperate for the school to become each time a better place in which to learn. According to directives, teachers and parents, one of the major achievements of the school has been the incorporation of its graduates into institutions of higher education which have a very great demand and, consequently, very selective accessing procedures.

One of the most important activities at the BICAP is its commitment to technological support, aid, maintenance and development in elementary education schools in its own community. Such is the case of the Pablo L. Sidar and La Xaam grade schools, the Federal Junior High School (Secundaria Federal) and the Center for Musical Training and Development of the Mixe Culture (Centro de Capacitación Musical y Desarrollo de la Cultura Mixe - CECAM).

It also offers its support to the Community Interaction project (Interacción Comunitaria), which is dedicated to the productive community development of region producers. At present, they have began working with the Technological Institute for the Mixe Region (Instituto Tecnológico de la Región Mixe - ITRM) , widely supported by the BICAP.

The BICAP project promotes crafts workshops, amongst which the following stand out: the Spinning and Weaving workshop, the Jewelry workshop, and lastly the Amber workshop which is currently being developed. Access to the computer center is equal for all members of the community, from craftsmen to parents, they must only take into consideration the established schedules for academic activities.

2. The past
One of the main concerns of the community is to have a language laboratory, a computer center, and to

encourage a series of workshops for community development assisted by technology. In 1995 while the Ministry of Public Education, and the Oaxaca State Governor, visited the Mixe community of Santa Maria Tlahuitoltepec, help was requested to develop an Integral Educational Project for their community. The latter had to be congruent with their cosmogony, costumes, language, culture and with a stress in the reality of the indigenous community and with its particular development needs. It also had to encourage their integration to the region, as well as to the world and national contexts.

The Mixe Community Integral Education Project was launched by four members of the community: Engineer Mario Lopez, Physician Crisoforo Gallardo, Mr. Palemon Vargas, and Architect Santiago.

"It was actually all the community, but mainly four companions dedicated themselves to develop the project full time ? Afterwards some other persons were incorporated, but in the end this process of searching, innovating, creating and all this crazy battle as a whole, was carried out by these four people"[1]

Backed up by Federal Government Advisory, economical resources were gathered for the acquisition of computers destined to the Municipal Direction of Education (Regiduría Municipal de Educación). By 1997 the number of computers was increased considerably with the aid of the Latin American Institute for Educative Communication (ILCE). The community had already seen the need to expand their technological project:

"Engineer Marino and myself went to the SEP Coordination , and while discussing the project with other people, that need was stated; the need to experiment with these technologies and we saw up to what point it was possible to have a web within the community. That's where it all started; we were not talking only about the center of the community but also about the surrounding branches. This was obviously not possible in the end for technical and economical reasons".[2]

In the operative part of the project help was requested from the General Direction of Indigenous Education so that by means of a computer specialist update courses could be given to the community teachers.

The High School Project (BICAP) is the most polished vision of an Integral Community Education with the advantage of continuity carried out by the community itself. It is outstanding that an indigenous community which is far away from the big cities no longer depends on qualified staff for the technological project to keep on developing, as a group of professionals from the community has been brought up, thanks to their number, maturity and enthusiasm; constitute a critical mass guarantee continuity and efficient and endogenous growth of their own project. There also exists strategic plan to finish the project as well as a self determined vision of the path to follow to complement it.

The Santa Maria Tlahuitoltepec community is found in the Mixe part of Oaxaca State, at a distance of approximately 3-4 hours of the state capital, thus speaking of school improvement should imply different dimensions with respect to any other urban or suburban school. As a matter of fact to the question "which problems were faced?" the constant answer of the interviewed ones was centered on logistic problems; as told by the biology teacher:

"The implementation of the project was expensive and required a lot of hard work; well, you can imagine what it is like with a rocky road 4 hours long to Tlahuitoltepec. But all the problems were surpassed; that is why I say it is not a person's job but of many and with determination".[3]

Resistance to new technologies was one of the major obstacles, but it can be said that this resistance was mainly based on a big amount of fear to the unknown; a break with the traditional educational systems:

"Some people didn't accept this model, they considered it as abnormal because teaching was not carried out traditionally, they felt that the students weren't learning and that something very important was being dealt with: education. Therefore it was unacceptable for them ? By now people are beginning to see the elementary results such as students being accepted in higher education institutions and developing an acceptable

academic level. I believe that these are the main achievements and the main problems of the beginning." [4]

Ignorance was another factor, of no less importance, that had to be dealt with when the project was launched. This together with the cultural and linguistic problems of the community due to the fact that most of the population has Ayuuk as their first language.

The main factor that has enabled the school's success, is the way in which teachers have approached to ICT as a tool to access knowledge, to develop abilities and to balance social inequities:

"*Frequently the information found in the library is not enough; now we have the option, through Internet, to communicate with other institutions in a matter of seconds, which in one way or another keeps us up-to-date. We also have access to the news as written press was not available in the community before Internet"*[5].

Student's restlessness is fundamental as it is them who take more advantage of ICT. The achievements become something tangible:

"*I consider that the fact that this interest exists is already a success. If the computing center were empty we would be speaking of failure. In elementary and junior high schools there is a great amount of curiosity.*[6]

3. The present

The BICAP is a didactic indigenous model proposed from within the community in accordance to the needs of the Mixe people which offers high school education, communitary development and craftsmen training and is based on a pedagogic model with the following characteristics:

- teaching-learning process backed up with innovative tutors-facilitators which rely on information and communication systems.
- global view of knowledge.
- of cultural values.
- polyvalent education.

The school counts with approximately 300 pupils distributed in three grades and 10 groups. In the teaching staff 27% have a masters degree and the rest a college degree. There also exists a pedagogic training program.

The computing center has a total of 28 PCs distributed in 4 rows with 7 computers each and it is available from 8am to 11pm. Throughout this time a computing specialist and a web manager are available to help the students and supervise the equipment's performance. The equipment can be used seven days a week, outside the schedule established for classes, without a time limit.

Out of the interviewed pupils, 80% have an email account and check it at least three times a week, they also have regular information exchange through Internet with most of their tutors who answer their messages within one or two days. They also use Internet regularly and most of them have been engaged in forums or chats although they do not work with other students through the web. Some of them are more interested in ICT and form small groups in which they learn programming, web site building or help less advanced students in the use of this technology on weekends or during vacations just as described by student Hugo Dominguez: "I use it regularly, especially on Saturdays and Sundays where we have the computing center for ourselves from 4 to 6pm. We also receive messages from teachers from time to time ? Basically, with my teachers.

According to the monitoring of ICT practices for teachers most of them are comfortable looking for

information in the www, type emails constantly (between one and five daily) and take part in long-distance actualization forums or courses. Ninety percent of the interviewed ones have an email account, assigned students working on the Internet, use computer made slides for their classes and divulge rules for student behavior as well as for the use of the technological media.

During class observation the most commonly use of the new technology were Power Point presentations, the use of the www was not so common and students have a relative freedom to browse the web while discretely being monitored by the teacher. Teachers use multimedia CDs in their classes as a complement to internet search; the most commonly used applications are: word processors, image editors and Power Point.

At the staff room there are two computers which are part of the LAN, a TV which receives the TV Educational Network signal and several videos with a variety of themes. They have an assigned area for meetings and three offices where downloaded newspaper fragments can be seen.

Interaction of students with ICT at school is not reduced to the computing center: by means of shared files the pupils exchange information and even involve students from other levels as the MAN includes the Music School, elementary school, junior high, the municipal head and BICAP itself. The school's efforts to improve the academic programs and make it a better place to learn have not passed unnoticed:

"*More computers have arrived, that's what I see. The classrooms have also been improved; they were in a very bad state, but now they are in better conditions ?"*[7].

However, there are many things still to be done:

"*In my opinion I'd say we need more computers"*.[8]

They are convinced that the impact generated by ICT has brought benefits that are already quantifiable:

"*Guys are now able to compete with other schools and can be more self-confident ? Because at this level they are already getting familiar with this new technology, this was impossible before. I remember when I arrived at Oaxaca city without knowing the computer, it was a quite shocking experience; one has to be up-to-date, that's the only way to succeed. This transition will be a lot easier for our students"*.[9]

4. Hypotheses
Hypothesis 1
Technology is a strong catalyzer for innovation and educational improvement, specially when the www is involved. The opposite hypothesis is that when true improvement in the educational field is achieved, technology only serves as an additional resource and not as a catalyzer in itself, that is to say, that the forces which headed the improvements also head technological application towards specific educational problems.

Evidence which supports the main hypothesis

Since the incorporation of Information and Communication Technologies, the educational process of the Santa Maria Tlahuitoltepec community, specifically of the BICAP, has had radical changes concerning the way in which education is received: students have taken an active part in the construction and development of knowledge. Internet has propelled collective work, information exchange and a variety of different perspectives and ways of understanding the same theme. Teachers recognize themselves as an important part of the educational process, but they are also aware of their own limitations, they assume their equality of

conditions regarding students and encourage a thoughtful attitude and a constant quest for knowledge.

The daily use of computers, the logistic conditions in the community and the conviction that ICT has improved the teaching quality, are factors which have contributed to increase the students' computer abilities, as well as those of the directives and the teaching staff. But the most important thing is that ICT now occupies a central place in the teaching and learning process.

Hypothesis 2

The spreading of the innovation / improvement (and therefore of ICT) followed the traditional spreading patterns for innovations, as outlined by Rogers (1995). The opposite hypothesis states that technology functions in a different way from traditional innovations and, therefore, presents different spreading patterns.

Evidence supporting the main hypothesis

The initial implementation was carried out by the initiative of a group of five people who were members of the Santa María Tlahuitoltepec community. It began towards the end of 1995, when they stated the need of receiving support for the Community Integral Education project (Educación Integral Comunitaria). By 1998 the project was being consolidated with the resources handed out by the ILCE and this allowed for a grater number of people to be reached. In that same year, the BICAP had around 50 computers, facilitating access to new ways of learning for a great number of young people in the Mixe region. Despite these facts, some teachers and parents support this hypothesis owing to the ideas they have about technological usage. Thinking about the negative aspects brought by the ICT introduction, more than in the positive ones has made a sector of the school community show resistance towards the constant use of technology. The idea that financial aid and resources should be given to other sectors such as health, feeding, productive projects and community development rather than ICTs, has not allowed for a more efficient development and for a more adequate and innovative ICT usage. While it is true that a group of students stands out because of they have gone deep into the knowledge of computer science, the community average is that of any habitual technology user.

Hypothesis 3

The successful implementation of ICT depends particularly on the competence of the personnel for integrating it into teaching and learning processes. This hypothesis assumes that teachers mediate ICT applications when they are successful, and that its academic value withholds a positive relationship with the competence of the teacher. The rival hypothesis is that technological educational infrastructure and the student's competence in ICTs determine the results in ICT implementation, while the teacher's competence does not.

Evidence which supports the main hypothesis
From the moment the project is given birth by and for the community, the adequate development of the project is practically guaranteed. Furthermore, the group responsible for ICT implementation showed great willingness for the adoption of these new technologies in their teaching.

The teachers' participation becomes significant if we take into account that, in order to obtain training in technological usage, they started from the very basics, and that this process implied constant travelling to the capital city in days outside their schedule, as well as additional investment in resources to improve their ICT knowledge.

Owing to the compromise of the academic body, the educational project at the BICAP has allowed an adequate use of ICTs to be consolidated, stimulating a responsible attitude towards ICTs and establishing a ground basis to ensure the expansion and growth of the project.

The participation of people who do not belong to the community is also of great importance as they encouraged amongst those involved in the project, and particularly amongst teachers, a constant training in the usage of technology and in their professional development.

Hypothesis 4

The gaps in the academic performance between students with high degrees of poverty and those with better economic levels will not increase when all students have equal access to ICT. The opposite hypothesis is that equal access to ICT will make more advantaged students increase the gap in performance in relationship to students with lower economic levels.

Evidence which supports the main hypothesis
ICT access for students of high and low economic levels has allowed for students with high poverty levels to improve their academic situation in relationship to other students in a better economic situation. From the start the idiosyncrasy of he or she who has nothing reduces him/her to an attitude of rejection, fear and distrust towards ICT. But as such students begin to discover the advantages and benefits of technology, they appropriate (always more and in a better way) the tool which they never thought they would have access to.

Hypothesis 5

The successful implementation of ICT will lead to either keeping up with the same academic standards or improving them, despite the low quality of much of the ICT material. Academic standards are a function of the expectations of both the teacher in question and the school as a whole, and not a function of textbooks or ICT material or other similar resources. The alternative hypothesis is that ICT usage will eventually lead to a decrease in the academic standards as students spend a lot of time on searches which are only marginally beneficent, as well as wasting time in reviewing Web contents and educational programs of a poor quality.

Evidence which supports the main hypothesis
The successful implementation of ICT has allowed a considerable number of the first graduated class of the BICAP to be accepted in their first options for entry at higher education institutions. This fact goes beyond the expectations of the school's headship, the teachers and the parents regarding the academic achievements of the school's students. Each school year the demand for entry to the BICAP increases, including demand by students in other districts or regions, and even in states sharing a frontier with Oaxaca. This is due to the fact that, in the rural area, the school's prestige is not only great, but also increasing.

5. Future projection
Mexico is a multi-ethnical and multicultural country with many diverse ways to understand reality. Oaxaca State, to which the present community belongs, is one of the states with bigger indigenous population in the country where social-cultural diversity can be best appreciated. For a very long time, this social groups have organized themselves in a strictly collective way. It is due to this fact that the project has high possibilities to carry on and develop even further. Another important factor is the conviction in most of the involved actors whom are convinced of the positive results since the implementation of ICT:

"*We now have students who study outside the community and don't have problems doing so nor need to take special regularization programs in order to be admitted at other institutions. We and themselves (students) can see the benefits ? we think that, in the future, elementary school children wont be surprised by these technologies when they get to high school ? we want a village with an important technological development*".[10]

Fidel Diaz, native of this community, is studying a Master Degree on Educational Technology; he imagines the school five years from now:

"*We want to preserve our culture, customs, traditions and think collectively while having respect for individual differentiation. We don't want to be immerse in ignorance and uninformed. Our community has already paid the fee for several centuries of underdevelopment. We want to be up-to-date concerning communication and media? this is how I see the school in the future".* [11]

Students from different regions of Oaxaca are actually attending to BICAP. The school's admission demand is increasing and it is common to hear of students from Oaxacan center, coast and isthmus.

Economic resources play a central role when trying to expand technology to schools of other communities, municipal heads and regions. This is a dream more than a tangible possibility. Conviction on the viability of this kind of schools is strong, and there is no doubt about their pertinence. For this project to be able to carry on it is fundamental to inform of the existence and results of this school: to keep growing within the needs and characteristics of the scholar entity.

6. Appendix A

The research team was integrated by: Carlos Domínguez, Diana Domínguez and Adriana Gutierrez whom where coordinated by Marcela Santillán. The instruments with which the interviews were carried out were two video cameras and three audio tape recorders.

A total of eighteen interviews were carried out in five days of work. The work journal spanned from 8am to 3pm with the following distribution:

Day 1	Day 2
Director Fidel Díaz Pérez	Teacher Margarita López
Ex-Director Marino López Vázquez	Teacher Rubén Gallardo
Teacher Ranulfo Vázquez	Student Hugo Domínguez
Student Martha Hernández	Class observation
Day 3	Day 4
Teacher Mauricio Martínez	Technician Miguel Ángel M.
Teacher Juan Pacheco	Computing teacher Jorge Hernández
Teacher Rubén Dario Hernández	Ex-coordinator Crisóforo Gallardo
Class observation	Student Marcelo
Outside class observation	Class observation
	Outside class observation

Day 5
Parent Valentín Díaz Cruz
Parent N.
Students' work recollection
Teachers' work recollection
Work recollection

Appendix B
How confident do you feel using a computer for each of the following activities?

	Very confident	Confident	Unconfident	Not confident at all

1. Writing a paper	7	1		
2. Search for information on the WWW	5	3		
3. Create and maintain web pages	2	6		
4. Use a data base	3		3	2
5. Develop a data base	1	1		6
6. Send and receive e-mail	5	2	1	
7. Write a program	1	1		6
8. Draw a picture or diagram	4	1	1	2
9. Present information	7	1		

How important are each of the following computer related abilities in your class?

	Very important	Important	relatively important	unimportant
10. Write a paper with a word processor	8			
11. Search for information on the WWW	7	1		
12. Create web pages	2		5	1
13. Use a data base	1	1	3	3
14. Develop a data base	1	1		6
15. Send and receive e-mail	8			
16. Write a program	1	1	2	4
17. Draw a picture or diagram with a graphing/drawing application	6	2		
18. Present information on Power Point or equivalent	7	1		

During the last year, how frequently did you ask your students, on average, to accomplish a task involving the following activities?

	Very frequently	Frequently	Once in a while	Scarcely
19. Use the WWW	7	1		
20. Create web pages	2	1	3	2
21. Send or receive e-mail	6	2		
22. Use a word processing program	8			
23. Use a computer to play a game.	2	2		4
24. Use a spreadsheet	1	1	1	5
25. Use a graphics program	1	1	1	5

26. Join in an on-line forum or chat room	5	2	1	
27.Use a presentation program (Power Point)	8			
28. Use an instructional program (including simulations)	3	3	1	1
29. Other computer uses	1	1		6

30. How would you grade your ability to use a computer

good	fair	poor
3	4	1

Answer questions 31-38 based on last year's politics or experiences in your school.
31. Was student computer use ever evaluated for grading?

yes	no
4	4

32. If you assigned a www searching, how freedom did you allow students in locating sites to visit?

No restrictions	Some restrictions	Designated sites only
2	3	3

33. Did you create or modify a Web site with any of the classes that you taught?

yes	no
2	6

34. What portin of the computer use in your classes was directly directed with the course content?

All	Most	Some	Very little
4	4		

35. What portion of the computer use that you assigned was done by students individually?

All	Most	Some	Very little
	1	2	5

36. If you have a computer at home, how often did you use it for preparing for teaching?

Several times a week	Several times a month	A few times	Never	No computer
1	1			6

37. Did you participate as student or instructor in a virtual course through the Internet/WWW?

yes	no
3	5

38. Did you involve your students in collaborative learning over the Internet/WWW with students from other classes?

yes	no
5	3

39. Are you currently using technology to collaborate with other teachers (professional chat rooms, forums or others)?

yes	no
3	5

40. How many e-mail messages do you send each week on average?

More than 12	6-11	1-5	None
1	1	5	1

How many of the following have you ever done

	yes	no
41. Make changes to a computer's hardware	2	6
42. Update an application program (word processor, graphics program, etc.)	4	4
43. Recovered a damaged file	3	5
44. Created a web site	2	6
45. Developed a data base	1	7

Appendix C
Below is a diagram of the distribution of computers in the computer center.

Out of the 26 computers in existence at the computer center, only 16 have multimedia capacity, that is to say, they have audio-phones, CD-ROM unit, audio entry and entries for other multimedia such as LCD cameras.

The computer web at the BICAP.

The computers at the BICAP and in the computer web are distributed as follows:

Area	Total web services	Total number of PCs	Available services	Web-connected PCs
Web office	5	5 (3 servers)		5
Computer center	35	26	9	26
Spinning and weaving	1	1		1
Store	1		1	
Community interaction	1	3		3 (Hub 8 ports)
Chemistry laboratories	2	1	1	1
Class rooms	1		1	
School services	2	3		2

Supervisors	4	2	2	2
Audio	2		2	
Headmaster's office	6	5	1	5
Auditorium	1	1		1
Library	1	1		1
Jewelry		1		
Total	**62**	**49**	**17**	**47**

As may be observed in the diagram above, the BICAP has, at the present day, a total of 49 computers, of which 3 are servers.

Out of the total number of computers:

- are web connected and have access to the Internet.
- are not web connected.

In the BICAP computer web there are 17 services at disposal for a computer to be connected to the web.

---

[1] Teacher Arnulfo Vargas

[2] Crisóforo Gallardo

[3] Teacher Margarita López

[4] Teacher Arnulfo Vargas

[5] Administrator Ing. Marino López

[6] Crisóforo Gallardo Vargas

[7] Student Martha Hernández

[8] Ibid

[9] Teacher Juan Pacheco

[10] Crisóforo Gallardo Vargas

[11] Director Fidel Díaz Pérez