

OECD/CERI CIT Program

A Case Study of ICT and School Improvement at Soledad Anaya Solórzano Middle School, Mexico City

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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 Soledad Anaya Middle 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.

1. Overview

In Math or Physics class once a week we go up to where the computers are and we study the subject. For example, in Physics we use the program which deals with the properties of heat, in Civics and Ethics class we learn about addictions and about human rights. (student Raquel)

In the Soledad Anaya Solorzano junior high school the use of new technologies includes ICT in all of the subjects and algebraic calculators specifically for math class. There is a room which is specially conditioned for ICT usage. Here, teachers come in with their groups once a week. The principal purpose of such weekly visits is to look up information in educational programs and at other times to explore interactive programs.

The school has narrow band access to Internet. Students have a limited time access to the web on a weekly basis. They make searches to carry out assignments that teachers of different subjects have set and also attend the computer room frequently to make use of the word processors and editing images software.

Parents do not have a direct access to ICT, but they do, however, feel satisfied in having their children make use of the opportunity of learning by means of this technological innovations. Their economic support, for this

new technologies to be implemented, has been given according to their financial possibilities, but always with great enthusiasm.

Regarding calculator usage, it must be mentioned that two rooms have been reconditioned for the purpose and with the support of the parents and of the school cooperative. Students make use of these rooms four times a week on average. They attend the rooms under the surveillance of their mathematics teacher. Besides such scheduled visits, students do not have the possibility of attending the rooms where the calculators are at other times.

Parents have a good opinion of their children using calculators in math class, as they consider it a new possibility to be at the vanguard in the use of this new tool.

The school was founded in February 1945. It moved constantly from one address to another until finally it established permanently in the building in which it now works. This building used to be a private school before, but now they have moved to a new establishment downtown Mexico City.

From its early days, the school has accepted girls exclusively, tradition which it has maintained to the present day, despite the fact that in the sixties most schools transformed their policies accepting both boys and girls. For many years this school was elitist, with very strict entrance procedures to choose the new students. The same high standards were required in the selection of teachers who wished to work there, all of this giving the school prestige and high academic outcomes. In the present day the situation has changed, as the selection of the girls is now carried out by the Automatic Registration and Distribution System (Sistema Automático de Inscripción y Distribución - SAID), due to which the student population is now more heterogeneous.

On the 17th of May 1968 Mr. Agustín Yáñez, who was then the Minister of Public Education (Secretario de Educación Pública) inaugurated the first mathematics lab in the school. This laboratory went on working for many years after.

2. The past

This was one of the first schools to acquire computers as part of the Computer Science for Elementary Education Program, sponsored by the Ministry of Public Education (Secretaría de Educación Pública - SEP) in 1986. A computer lab was installed at the school, one of the firsts of its kind in junior high schools: *The project was initiated because they came to the headmistress to propose it, she is a very enthusiastic person, and she accepted and encouraged its progress... I was the first teacher to get involved, I made the manuals myself, as we didn't have enough support* (teacher in charge of the computer room).

The use of ICT in this school was essentially enabled by the participation of two teachers, the one in charge of the computer room and a mathematics teacher. The teacher in charge of the computer room comments that *all the school community comes to me asking for information or data they require, or for using the equipment... Let's say that 70% of the teachers are now using computers and the Internet, and the other 30% are still a bit afraid of change... .*

The mathematics teacher began his participation in 1994, on a voluntary basis, to take part in a research about the usage of computerized algebraic systems. His involvement gave place for the National Council of Science and Technology (Consejo Nacional de Ciencia y Tecnología - CONACYT) to equip the mathematics room with algebraic calculators and textbooks specially designed for teaching with such kind of technology. Likewise, the enthusiastic participation of this teacher made the other mathematics teachers feel the need to train themselves in the usage of the technology the school has at its disposal: *... I am the most experienced at school, and this is a compromise for me to help my co-workers, because, even if you don't offer your help, they ask for it, they come and ask you how to do things, and if a teacher leaves, I am the first to establish contact with the new one coming in to replace him... .*

The interview with the headmistress points in the same direction: *...the mathematics teacher let me know that*

he was taking part in a project at the National Pedagogical University (Universidad Pedagógica Nacional - UPN), and he told me of the calculators being used there.... We started with the third grade groups - as he was in charge of them, then we worked with the second grade groups and now all the school is using those calculators. .

There was no resistance, on the teachers part, to get involved in the technology - related project: *...none of the teachers has shown any resistance, with major or minor difficulties they have all been learning... it seems that the novelty that the use of machines implies is that which has motivated the teachers to get to know them and to learn how to use them.* (Headmistress).

The one to give support and supervision to consolidate the computer science technology usage at school was the campus headmistress *... the technological project for mathematics seemed to me to be very attractive because it gave the school another incentive, a higher quality in teaching and, above all, it makes education more attractive, something different from what elementary education had been. Furthermore, it is something that cannot be found in all schools, I have given all facilities possible so that the project may develop...* (Headmistress).

Owing to an initiative of the headmistress, in 1999 the school was chosen to take part in the School Network Project (Red Escolar). The computer lab was remodeled with access to Internet and with a videocassette collection. The headship, teachers and students today join their efforts to keep up the quality and prestige that has characterized this school over more than five decades. The school is continuously taken into account to participate in different projects, like the UNESCO Schools, besides partaking in artistic and pedagogical events.

The major problems the school has had to deal with are the creation and remodeling of physical spaces to work in with the new equipment and the teacher training issue. The school has made an extraordinary effort to facilitate the construction and reconditioning of the new classrooms and labs with its own financial resources.

Considering the teacher training issue, all those interviewed believe the training they get is not enough, they also consider that the courses they get force them to work extra time outside their regular schedule. In the case of the mathematics staff, it was necessary to plan strategies to convince the parents of the advantages to be found in the use of algebraic calculators as tools for teaching and learning. A side problem, though not less important, is that most of the students are not able yet to have a computer or an algebraic calculator at home: *...that is quite a handicap in the students achievement...* (Mathematics Teacher).

3. The Present

The school has a room equipped with fifteen computers which are connected to the web and which give service to all students (500 approximately) and teachers (40 more or less). The computing center has a collection of educational programs that are available by anyone who goes there, it also has a connection to the Internet. There is a teacher in charge of supervising the equipment s well functioning, of organizing access to the room and of helping the users.

Now, the access to the use of ICT resources is organized in such a way that they may serve the teachers, as the afore mentioned teacher in charge comments:

... A schedule was designed so that all teachers of all subjects may have access to School Network (Red Escolar), and we are following that calendar; so, we cannot say that there are some who do and some who don t, here it is all the same for everyone,... (Administrative worker)

Nonetheless, and on a regular basis, about 50% of the teachers are the ones to make use of the computer room. These teachers teach different subjects: Geography, Physics, History and Biology among others. A considerable percentage of the teachers making use of the computer room do not have much experience in ICT usage, there were even some who had their first contact with them during this school project. However, even though most of them believe they have not got good computer usage abilities, they have partaken with great enthusiasm in the use of ICT.

Because of this situation, teachers have gone on their own to courses given in different institutions. Such training by their own means has given them an initial preparation. This is why they believe it necessary to have more training opportunities so that they may learn to make a better use of technology. Regarding this matter a teacher interviewed tells us:

I use the computer for investigation, for elaboration of exams, I use it as a working tool, it has helped me to learn. I didn't know anything either at first, I had to take courses, prepare myself to be able to make use of this working tool. (Ms. Ivonne - Teacher)

What this teacher says is stressed by the commentaries of the person in charge of the ICT:

By their own initiative (meaning the teachers) they have gone to take courses because here we have not yet been able to facilitate teacher training due to a lack of time. I am busy in the computer room all day long with the students, so I don't have any time left - maybe Saturdays, but then again not everyone can make it.

The regular work in the computer room consists of teachers coming in with their groups (on average 40 students) for programmed sessions. Once there, they are free to conduct the lesson as they consider best suit.

The teachers go to look up information in educational programs such as encyclopedias, maps, dictionaries and others. Their consultation is based on a previous questionnaire. It is also common for them to explore interactive programs so that the students may make searches, they use a word processor to elaborate class reports, and programs in which they may draw and edit images.

Though the Internet service is not very broad, this teachers set investigations which students may accomplish using the existing resources. In most of the cases these searches have no restrictions as to the web sites that may be entered. Some students do the searches at school, others (the least of them) at home or at their parents offices.

Students have diverse opportunities within school for ICT usage. They are even allowed to use the technological resources during their teacher's absence, though always under the supervision of the person in charge of the room. Concerning this matter, the teacher in charge of the computer room says as follows:

"Sometimes they (meaning the pupils) give up their break time and come up here to do their searches, and they are allowed to do so. When a teacher doesn't come in to work, and the group is on its own, they are also allowed in here. At other times they come in here to work along with their teachers (*Teacher in charge of the computer room*)

Access to ICT usage is not limited to the scheduled time, contrariwise, students are given the opportunity to use it at different hours and in different ways. Despite all this flexibility, it is still necessary to offer more opportunities, as is suggested in the comments of a student and of a parent:

Why is there no access in the afternoon? There should be a small workshop for the students, whether it be for the ones that are presently in school, or those who are ex-students (as is my daughter's case), as we cannot afford to buy them a computer at home. (*parent*)

They should make more workshops like the math one or the calculator workshop or the computer one. I think they are very good for learning, to adapt ourselves to the world in which we are living, because technology is always advancing. So this workshops are really good because they help us a lot. (student)

For many students, the opportunity of working with ICT is reduced to that which the school offers, otherwise, it is very difficult for them to find alternative working spaces. In this sense, it is required to broaden the computer science infrastructure at school, so that it may allow, among other things, to increase ICT contact. For this to be possible at least another equipped room would be needed.

Concerning the up keeping of the computer science equipment, we must mention the parents support. Such support, though helpful, is quite limited. Regarding official support, there is technical backing which helps in the up keeping of the resources. Regarding this matter the person in charge of the equipment comments:

We have the support of the Ministry for Public Education (Secretaría de Educación Pública - SEP). They send in specialized technicians that come when we phone them if a machine is not working. They come in and fix the equipment, so, we have a total, 100% support from them. (Administrative worker)

The school has the necessary equipment for the work to keep on going: compromised teachers willing to take the challenge of using computer science technologies, interested and enthusiastic students, family parents aware of the importance that such learning has for their children, and the necessary technical support.

Regarding the calculator usage in this school, we must say that it has consolidated in both its academic and material aspects. The school has increased physical spaced destined to math classes making use of this tool. There are two equipped classrooms, one with thirty graphic calculators, the other with fifty algebraic calculators. This has allowed the time access to this resource to expand. Concerning this issue the mathematics teacher says:

We (meaning the math teachers) already have two rooms designed to work with calculators. We have access to those rooms four times a week, so, the contents we work with in class are based on the use of calculators. Four out of five days a week they take math class using such technology.

What is quite striking about this commentary is that at the beginning of the project the teacher in question showed reserve as to incorporating technology into her daily work. Her experience, during the time she has taken up the project, includes not only an increasing in the time spent in technological usage, but also a qualitative difference between her classes before, and her classes now. She expresses this herself in the following way:

... Students generate their own knowledge (referring to when they use the calculators), in other words, they build concepts which have not been previously given. Education is no longer like it was before, then, the student was a recipient and I was all the time giving out the information which the students had only to accept. This new method promotes reflection, critical judgment ... It makes students improve their operational abilities, it makes them carry out a thorough analysis of what they are studying; in this way they may prove for themselves the theory, instead of having to accept everything I say as though it were a law. (*Mathematics Teacher*)

This commentary is complemented by the need she finds to organize her educational program, so that she may have a planning which suits the new teaching method. She describes this need as follows:

... It makes me modify all my program, because, even though it is true that there are activities which are specially designed to make use of the graphic calculator, it is not merely a simple activity disconnected to all the rest, that is to say, one activity generates a whole set of other themes which I cannot see as something apart, on the contrary, I must integrate those activities into my program, and most of the time it means that I have a lot more of work to do.... (*Math Teacher*).

Another comment stressing this points, is the one shared by one of the other teachers, in which he discusses the possibility and convenience of introducing or not this tools into his teaching:

Of course, I can leave them aside (meaning the calculators) and simply teach, and I can leave them there for ever and go on teaching, the difference lies in the way in which things are taught and in how the children learn. (*Math Teacher*)

These comments let us appreciate the changes related to the new teaching methods of the teachers. Math teachers have four sessions a week programmed in the calculator equipped rooms, with each of their groups. Each student may use a calculator and is set a series of tasks, his progress is supervised by the teacher. Generally, homework requiring a calculator are not set, as very few students have a calculator at home. The ones at school have graphic facilities, an algebraic manipulator and specialized geometric and statistics software, among others.

School organization has also been propelled, students now move from one classroom to another, from their everyday classroom to the specialized mathematics rooms and computer room, in which there is the suitable infrastructure to accomplish the set tasks, and which they attend periodically.

Parallel strategies have been developed to give maintenance to the calculators, teachers and students also do their best effort to keep it in a good state. All math teachers are responsible for seeing that the equipment be working well and well kept.

At the present moment, all of the teachers in the mathematics department in the school are partaking in calculator usage during their classes. This new tool must also be employed with the same frequency by any new mathematics teacher joining the school staff.

4. Hypotheses

Hypothesis 1

Technology is a strong catalyst for educational innovation and improvement, especially when the World Wide Web is involved. The rival hypothesis is that where true school-wide improvement is found, technology serves only as an additional resource and not as a catalyst. The forces that drive improvements also drive the application of technology to specific educational problems.

The adoption of new technologies by the school teachers has acquired different characteristics according to the resource in question, that is to say, whether it be a computer or a calculator related technology, each of these accounts for a different hypothesis.

Evidence which supports the main hypothesis

The use of calculators in the math class has caused teachers to make adjustments in their class contents and programming, due to the fact that they have observed a new and different learning process in their students. The everyday use of the tool has given students and teachers alike an acceptable level in its handling and, furthermore, it has become a central part of the teaching process. Teachers recognize differences in mathematical comprehension, now that students have, firstly, the opportunity of interacting in the mathematical sphere with the calculator and, secondly, they have been able to formalize that which they have learnt and discovered in sessions imparted by the teacher. The work accomplished by the students is carried out in both individual and collective tasks, with the support of the teacher s assessment.

The mathematics teachers involved in the project maintain a constant communication amongst each other concerning the different uses of the calculator, teaching and learning procedures, and the up keeping of the resources, always searching for ways in which these resources may be increased.

Evidence which supports the rival hypothesis

This hypothesis is supported by the way in which most of the teachers use ICT at school. The average assistance of students to the computer room is once a week, and this has not been enough for teachers who make wider use of computer resources. So they have been limited to use them as tools with which to look for information in electronic encyclopedias or for editing texts, elaborating graphics, drawings and diagrams that may complement the traditional work carried out day to day in the classrooms. All though there are already some initiatives on some of the teachers' behalf to use more dynamic software and interactive programs which involve students in a new teaching method, it is still not something concretely established.

Hypothesis 2

The promotion of the innovation and improvement (and therefore of CITs) followed the traditional promotion patterns for innovations, as outlined by Rogers (1995). The rival hypothesis is that technology functions differently for traditional innovations and that therefore different promotion patterns take place.

Evidence which supports the main hypothesis

The implementation of ICT in the school was due, at the beginning, to an official invitation made to the campus headmistress, who enthusiastically accepted, and encouraged the teachers with such an attitude.

To promote the use of ICT already installed in school a meeting was organized in which the teacher in charge of the computer room talked about her area's organization in general terms. Since then, a schedule was arranged so that as many teachers as was possible would be able to access the computer room for as long as possible. At first, many teachers chose to assist individually to specialized orientation sessions given by the person in charge of ICT. This person guided them as to the handling of the equipment and of available programs so that the teachers got an initial insight into the matter.

In the first of the working sessions, to which a teacher attended with one of his or her groups, the person in charge of the computer room was the one to take over in the guidance of the groups. Afterwards, in later sessions, the class teacher took over such a job.

The invitation to make use of the computer resources has always been opened, and though it has never been compulsory, there has been an attempt to invite teachers constantly into using them. Furthermore, the support given by those who manage the ICT spaces is permanent for teachers as well as students.

Despite the fact that there is a certain rejection towards ICT usage, it has never been a generalized situation and, due largely to the participation of enthusiastic teachers, ICT permanence in this school has been possible.

In the subject of calculator usage, at the beginning it was only one teacher who propelled the project and, gradually, other teachers joined in. Training in the use of this resource was imparted in an informal manner, during brief sessions in which different experiences were exchanged and doubts were given solution. The teacher who originated calculator use at school, has maintained a permanently open channel of communication with other teachers so that they may consult him in case they require his help. Nonetheless, as the rest of the teachers have acquired experience, this kind of support has gradually become more horizontal, that is to say, the one way dependence of teachers has decreased.

Hypothesis 3

Successful implementation of ICT depends mostly upon staff competence in the integration of ICT into instruction and learning. This hypothesis assumes that teachers mediate ICT applications when they are successful, and that ICT's academic value relates positively to teacher competence. The rival hypothesis is that the school technological infrastructure and student ICT competence rather than staff competence determine ICT implementation outcomes.

Evidence which supports the main hypothesis

The teacher's openness to adopting the use of new technologies in their teaching was a determining factor for this project to develop. Considering the average time span used up in handling the computer and related resources, and considering also the unavailability of training within the campus (they may only receive training if they attend, by their own initiative, outside), we may say that their participation is, by all means, of a major importance.

Such is also the case of the work done with the calculators: the teachers' openness, their knowledge and enthusiasm, which was encouraged in them by the pioneering teacher who started working in the project, has allowed for the present establishment of day to day calculator usage in the mathematics class.

We must also consider the important role the school's headmistress has played in the ICT usage promotion amongst teachers, and in its coordination with the person in charge of these resources.

Hypothesis 4

Gaps in academic performance between students with high and low economic resources will not increase when all students have equal access to ICT. The rival hypothesis is that equal access to ICT will lead to more advantaged students increasing the performance gap with disadvantaged (resource lacking) students.

Evidence which supports the main hypothesis

The accomplishment of students of different economic levels has not been differentiated, as all have equal access to ICT. Teachers have expressed that students who do not own a computer and who have had no previous access to ICT show a greater interest and enthusiasm regarding the use of such resources. Teachers also mentioned that these students, as they gradually acquire experience catch up easily with those that do have the resources at home. Furthermore, these students are the ones who spend the most time using the ICT at school.

Hypothesis 5

Successful implementation of ICT will lead to the same or higher academic standards in spite of the low quality of many ICT materials. Academic standards are a function of teacher and school expectations and not of the standards of textbooks, ICT materials, and the like. The alternative hypothesis is that ICT use will lead to a lowering of academic standards as students spend more time on marginally beneficial searches and in browsing poor quality Web and courseware content.

Evidence which support the main hypothesis

Work with calculators has covered teachers' expectations regarding academic achievements in daily school work. Such a situation has allowed them to identify positive differences with respect to the students' previous standards and progress rates.

As far as the school is concerned, this has allowed them to maintain very acceptable standards in mathematics, in relationship to other schools in the same zone. This fact keeps the school authorities very pleased.

5. Projection to the future

who are already partaking in the project, as well as expanding the project to include those teachers who are willing, but still somehow afraid of incorporating the new tools into their work, are possible, given the presence of two conditions.

The first of these is a more specialized training regarding the ways in which these resources may be best exploited for teaching purposes. Up until the present moment, there has been no formal training for the school's teachers, which makes the need of such courses all the more urgent.

The second of these is having enough financial resources to expand areas destined for computing technology usage, so as to give teachers and students the opportunity of a broader accessing schedule. Having training programs and longer accessing time would very probably help much in the reinforcement of ICT usage.

The possibility to expand this experience into other schools is large. The schools have always capable and good-willed personnel who welcome changes. Such a profile amongst some teachers and the headship is very useful when a new project sets out, like in the case of implementing ICT in schools. The incorporation of other teachers into the project will be gradual, this also depends on how successful the first teachers are, as well as on how much of this success may be appreciated by the teachers who show an initial resistance to the project.

As far as infrastructure is concerned, there are presently diverse instances, both internal and external, to which the school may ask for collaboration. One of these instances is the Parents Society, who are generally interested in helping, taking into account that their children will be the benefited party once the introduction of technology into their school is accomplished. Another instance is the School Cooperative, that is, those which only depend on the school community's approval to be able to offer its help. And then, there are the government instances, which, provided the school authorities plan and negotiate intelligently, and given a solid backing of the teaching staff, can help the school in the acquirement of resources to equip the school and train its teachers.

We must stress the need for training, at least as a start off, to offer the teachers the possibility to learn the basics of ICT, so that they may apply it confidently in their teaching areas.

6. Appendix A

The research team was integrated by: Valentín Cruz, Carlos Domínguez, Ximena Uribe, whom were coordinated by Tenoch Cedillo and 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:

An interview was carried out with the following persons:

- The headmistress
- The responsible of the Computer Lab
- The Mathematics Inspector
- Three teachers
- Three first grade students
- Three second grade students
- Three third grade students
- Nine parents (of the interviewed students)

The interview with the headmistress lasted about one hour. The interview with the teachers, the Math Inspector and the responsible of the computer lab lasted 45 minutes. The interview with the students and the parents lasted approximately 30 minutes.

The interviews were carried out following the protocol developed in the *Workbook for Case Studies of Organisational Change*:

- Administer Interview
- Teacher Interview

- Student Interview
- Parent/Guardian Interview

All interviews were videotaped and transcribed. Nine teachers were asked to fill in the questionnaire of the *ICT Practices Survey for Teachers* given in the *Workbook*. The questionnaire was completed in approximately 20 minutes by each teacher. A summary of responses is given in Appendix B..

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	1	0
2. Search for information on the WWW	3	3	2	0
3. Create and maintain web pages	1	1	1	3
4. Use a data base	3	2	3	1
5. Develop a data base	2	2	2	1
6. Send and receive e-mail	6	0	0	1
7. Write a program	2	3	1	1
8. Draw a picture or diagram	3	4	2	0
9. Present information	3	1	0	2

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	5	2	0	2
11. Search for information on the WWW	4	2	3	0
12. Create web pages	3	2	0	3
13. Use a data base	3	3	1	2
14. Develop a data base	5	1	0	3
15. Send and receive e-mail	2	2	2	2
16. Write a program	3	3	0	2
17. Draw a picture or diagram with a graphing/drawing application	4	3	1	1
18. Present information on Power Point or equivalent	3	2	2	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	3	0	4	1
20. Create web pages	1	1	1	4

21. Send or receive e-mail	1	0	2	4
22. Use a word processing program	4	1	2	1
23. Use a computer to play a game.	1	1	1	4
24. Use a spreadsheet	4	0	3	1
25. Use a graphics program	3	2	2	1
26. Join in an on-line forum or chat room	1	0	2	4
27. Use a presentation program (Power Point)	2	1	2	1
28. Use an instructional program (including simulations)	3	1	0	2
29. Other computer uses	0	0	0	0

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

good	fair	poor
3	3	3

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
1	8

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
5	2	1

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

yes	no
1	8

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

All	Most	Some	Very little
1	2	2	3

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

All	Most	Some	Very little
1	2	2	3

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
5	1	2	0	0

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

yes	no
1	7

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

yes	no
0	8

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

yes	no
1	7

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

More than 12	6-11	1-5	None
0	1	2	4

How many of the following have you ever done

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