ASSESSMENT

"PIZARRA DIGITAL"

PROGRAMME

IN ARAGÓN

EXECUTIVE REPORT

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ASSESSMENT OF THE “PIZARRA DIGITAL” PROGRAMME IN ARAGON
Executive Report

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1.- OVERVIEW

This report is the result of a little more than one year's worth of work by a research group at the Universidad Autónoma of Barcelona, charged with evaluating the “Pizarra Digital” programme in Aragón.

The “Pizarra Digital” is a pioneering initiative about integrating computers in classrooms, by implementing Tablet PCs (from now on, TPCs) for individual use in the 3rd Cycle of Primary Education (10- and 11-year olds). Such equipment is complemented by video projectors, broadband connections and wireless networks in the school, in order to foster new and interesting teaching scenarios. All of the above is a part of a project that includes training activities for teachers, as well as digital resources for the levels involved.

This individual use of a TPC is intended to achieve a high level of development of digital competence by the students when they reach the end of their Primary schooling, that they can apply to their progress in higher education. It also has a major social component, because it brings the Information Society closer to the students’ family environment.

After a brief experimental phase, the started in 2005. During the current year, 95-percent of public schools and 26-percent of subsidied, private schools are already applying it.

The analysis of this assessment is based on empirical evidence. Too often, the world of education gets lost in discussions lacking arguments and well-founded knowledge, beyond personal experiences or specific teaching scenarios that hardly apply to the rest of the education system. With this goal in mind, this report approaches the education reality from a dual point of view, quantitative and qualitative, trying to collect as much as possible from both of them. We have not forgotten the required bibliography review of the first-level research about education, focusing on our subject, with a major focus on its international nature.

This report is also intended to provide a plural view, by surveying every stratum of the education community involved in the daily operation of schools. Therefore, we have requested input from management, teachers, students and families, in order to find any agreements and disagreements among them, as well as common looks into the to be evaluated. We think that any assessment based on input provided by just one of the groups listed above would be partial and incomplete.

We also want to emphasize that, even if most of the report takes a diagnosis approach –as required in any assessment process of this kind--, we have not renounced to make proposals. We are aware that this aspect is sensitive, because our recommendations don't arise automatically from the conclusions of the study, and they are always subjective to a certain degree. However, we consider that our mandate also included contributing to improve the current situation of education in Aragón, so we are providing some ideas.
2. GENERAL SPECIFICATIONS OF THE STUDY

Goal: evaluating the impact of TPCs on students of 5th and 6th Primary, their schools (only public ones), their teachers and their families, with two or more years of previous experience in the year 2008/09.

Methodology: a dual strategy has been used. On one hand, quantitatively through an confidential survey taken online by students, teachers, directors and families; on the other hand, qualitatively, by visiting schools, making interviews and discussion sessions. The final sample of survey responses is as follows:

- Participating schools: 131
- Directors: 124
- Teachers: 714
- Students: 5,504
- Families: 4,801

General remarks about the study:

a) It is the first macro study covering a large part of education in Aragon (43-percent of public schools) focused on analyzing the impact of implementing TPCs on the school and family environments of the students using them. This makes a big difference from previous studies.

b) The analysis is done via an opinion poll, where not only teachers and principals are surveyed, but also students –essential players in their own learning-- and their families. This view is complemented by interviews and discussion forums with all those strata of the education community.

c) The participation of surveyed players has been very high, reaching a percentage near 100-percent of the initial population being studied.

d) This macro-assessment allows to analyze the experience globally and sets the foundation for further studies, both to follow up and to deepen into specific aspects related to TPCs, as well as other general aspects related to the students’ learning process and its relation with the family environment.
3.- OVERALL RESULTS

a) Overall assessment very positive by the surveyed groups (principals, teachers and families).

Principals and families were asked to rate on a 0 – 5 scale their level of agreement with the “Pizarra Digital”. As shown in the chart, both groups mostly agree in awarding very high scores.

**Overall satisfaction with TPCs.**

![Chart showing overall satisfaction with TPCs.](chart.png)
Using the same scale than the previous chart, principals, teachers and families were asked to rate their level of satisfaction with TPCs. The three strata gave fairly high and coincident scores. We must point out, specifically, the high degree of coincidence between professionals who work in schools (principals and teachers).

**TPCs meeting expectations.**

![Bar chart showing satisfaction levels for principals, teachers, and families.]

Obviously, the introduction of TPCs created some expectations among principals, teachers and families. It must be noted that such expectations have been met to a fairly high degree in the three strata, even considering the workload added by the “Pizarra Digital” programme.

Therefore, one can assert that principals, teachers and families, when looking at the experience of deploying TPCs at their schools, perceive it as fairly positive or very positive, which means a major success from the social and educational perspectives.

“In the end, time confirms what's obvious. Any reluctance and fear felt by everyone who was introduced to this, has been subsiding as soon as it has been integrated as a tool, as an additional resource, and we have said oh, well, it looks like it works!”

*Teachers' Forum*
b) There is a widespread demand between students and families to extend the use of TPCs to the ESO (Secondary Education).

Families and students were asked if they would continue using TPCs in high school. The answers were mostly favorable.

“The programme becomes a bit empty without continuity. It is a programme not going forward, not continuing in higher grades”

Teachers’ Forum
4.- RESULTS RELATED TO SCHOOLS

a) Deployment in rural environments is a good strategy

Usually it is pointed out that rural schools have benefited greatly from the experience, due to three main reasons: the project started there; schools usually have a TPCs per student (unlike larger schools, where two students share a TPCs); and in rural environments, students usually bring their TPCs home, which does not happen in urban areas. However, it's always the school who decides.

b) Deploying TPCs contributes to create a positive image of the school and its teachers.

According to families, the introduction of TPCs improves the quality of the school.

When families are asked if the deployment of TPCs improves the quality of the school, almost 60-percent reply that 'a lot' or 'quite', which means that this programme promotes a very positive social image of the school. It is relevant that just 8-percent of families consider that using TPCs does not improve the school.
According to teachers, the introduction of TPCs improves the quality of the school.

Same thing happens among teachers. They give a score of 3.21 points in a 0 – 5 scale, which reinforces the positive social image of deploying TPCs in schools. It would be a different issue to establish indisputably if such quality actually happens, according to existing benchmarks.

“We did not want to become outdated in the sense of the world going one way while we go the other way”

“…above all, when you work in a small neighbourhood like mine, it shows for sure and you get noticed. [...] Several teachers from private schools in my area have already asked to use the TPCs and they find that not doing it would be discriminating.”
Principals and teachers were asked how TPCs have impacted the social standing of teachers. Their replies show that such impact has been mostly medium. Principals are the ones who consider that the impact has been higher (one might say they look more optimistic than teachers), while the increased standing due to TPCs seems to be more present among students. This is very interesting, because the students' positive perception of teachers is a key element in the pedagogical relationship, in order to achieve good learning results.

Therefore, we can say that the TPC initiative is a major tool for consolidating a positive social image of schools that use them and the teachers who work there; this, added to the positive perception by students, makes a positive learning environment for school achievements.

c) Teachers’ mobility among schools impacts negatively on the programme success.

Impact of teachers’ changes in schools on the programme.
When asked if—and how—the current mobility of teachers impacts the TPCs programme, principals replied that this is a relevant issue.

One must remember that Aragón is a large territory with very low density of population. Therefore, it has groups of rural centers and very small schools with largely mobile staff.

Specifically, the principals think that this affects negatively with -1.24 points on a scale of -5 to +5. Such mobility brings that a large part of faculty is changing schools every year or two. From the perspective of the stability required to develop an innovation project—such as using TPCs in classrooms—, it is a relevant drawback that makes difficult to consolidate really innovative experiences in some schools that face this issue. This means that many schools must start over every year.
5.- TEACHERS-RELATED RESULTS

a) Teachers feel satisfied with the experience, but TPCs increase their workload.

Issues make the programme implementation difficult

![Bar chart showing issues and their impact on workload](chart.png)

It is interesting to note that, among issues that make the use of TPCs difficult, teachers stress the workload. This looks obvious, because it means entering a way to carry out teaching activities requiring more course preparation (at least, during the initial months or years) and an ongoing update of the content used in the classroom. The lack of time is another issue to be considered when evaluating the difficulties that Aragonese teachers face when implementing the TPCs programme.

Nevertheless, the above does not mean that teachers oppose TPCs. On the contrary, as shown in another chart, Aragonese teachers are satisfied with the “Pizarra Digital” programme, even if it increases their workload. This only adds to their degree of professionalism.
b) Deployment of TPCs fosters a change of methodology among teachers.

Both the principals and the teachers say that TPCs have brought a change of methodology in the classroom. Actually, principals sound more optimistic than teachers, probably due to their institutional role. Both groups agree with the statement in large percentages. The most interesting issue might be uncovering how deep and real is such change in classrooms, or if we are still at the start. Data gathered at the quantitative and qualitative stages suggest that there's still way to go.

“I believe that the tool won't be very useful if the teacher uses a traditional methodology. However, if the teacher favors cooperation or project work, then ICT is a very positive resource that provides quite good performance.

“The first change of methodology happens when you rethink the use of textbooks. When you find everything a tablet can provide, it's like 'oh my god!'. Open page 67, order exercises, when you could be working on, who knows... something nice with poetry on the computer”

Teachers’ Forum
c) Deployment of TPCs improves teachers' motivation regarding several aspects of their teaching activity.

Teachers' motivation.

![Graph showing teacher and principal responses.](image)

Asked about the impact of the TPCs deployment on teachers' motivation, both teachers and principals say that is has been quite high. It must be pointed out that, besides the influence on getting to know ICT better or wanting to work with other teachers, there’s also a motivational element to continue learning, This aspect is specially useful for successful training strategies, and shows an excellent attitude of teachers regarding continuous learning.

“I have definitely noticed a major shift, namely that there is more coordination. With TPCs there is more coordination between the teachers who are teaching the cycle now. […] There’s much more empathy.

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Teachers' Forum

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d) Teachers consider the overload in Internet connections a major problem for working with TPCs.

Even though the survey did not ask teachers about the subject, it surfaced in several visits and in the teachers’ forum as a relevant issue, affecting their teaching activities with TPCs, so it must be mentioned in our research.
e) Teachers would work again with TPCs...

¿Would you work again with TPCs?

The reply of teachers who currently work with TPCs when asked if they would work again with them, should they be able to choose, is highly significant. Most of the teachers (close to 95-percent) said 'yes', which shows how deeply new technologies have rooted in Aragonese education.
6.- STUDENTS-RELATED RESULTS

a) According to teachers, TPCs improve specific students’ competences.

Impact of TPCs in the acquisition of competences by the students.

Teachers were asked to rate, on a 0 – 5 scale, the impact of using TPCs on specific competences of the students. The findings are as follows:

First, the competences that get improved the most –as related to the others- are those linked to some automatisms, such as searching for information (as opposed to organizing or selecting it) or using ICT themselves.

In terms of TPCs impact, there’s a second group of more complex competences that are very useful for the “knowledge society”: personal autonomy, organizing and selecting information, creativity and teamwork.

Third, we can find other instrumental, more classic competences that are, undoubtedly, very important for further learning, such as reading comprehension, written expression or –last--, oral expression. Nevertheless, the latter gets a 2.09 score in a 0 – 5 scale, which breaks the myth saying that using new technologies goes against promoting this kind of learning. Obviously, using TPCs can be a relevant support to this specific kind of competences.

“They learn so many more things with computers[...]. There are things that they used to do in some way, but they have learned themselves to do faster and more efficiently”

Teachers’ Forum
“For instance, it has been useful to my son, because the computer didn't understand his bad writing. He had to learn to close his 'a's for the computer to recognize them”

Students’ Forum

“One thing's for sure: tablets put children in the spotlight. Knowing that their classmates will get to see their work, or that they will bring it home to their parents, generates a strong emotional commitment”.

Teachers’ Forum
b) Teachers say TPCs increase students' motivation.

Students' motivation.

When asked if using TPCs had any impact on the students' motivation, teachers say that such impact arises, specifically, from being more willing to learn and cooperate in work with classmates. Students' (and teachers’) motivation is a key factor in the improvement of learning.

c) Students say that they learn more and participate more in the classroom by using TPCs...

Using my TPC...

...
It is important to look into the students' feelings about using TPCs. About 90-percent of them say they learn more and also point out that activities are more fun. A large slice of students thinks that by using TPCs they participate more in the classroom and work more in teams. This perception of students towards TPC-related classroom activities creates a good learning environment.

“We have noticed highly positive results, above all in terms of motivation. We also started expecting that there would not be any substantial changes. However, some radical changes have surfaced, mostly in cultural issues, starting at methodology. Nowadays we can count on unprecedented resources.”

Teachers' Forum

“No the Internet you can see more things [than in textbooks]. You can learn more from other countries and cultures, there’s not enough room for all that in books.”

Students' Forum

“If they are in classroom, they work with the tablets, they are more motivated and listen better; therefore, they should be learning more”

Families' Forum

**d) ... but students with lower average grades are those who say they participate more and learn more since TPCs were deployed.**

<table>
<thead>
<tr>
<th>I get more involved</th>
<th>Average Score</th>
<th>Standard Deviation</th>
<th>Students' T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>3.33</td>
<td>1.19</td>
<td>0.00**</td>
</tr>
<tr>
<td>No</td>
<td>3.61</td>
<td>1.20</td>
<td></td>
</tr>
</tbody>
</table>

**Significant at level 0.01 (bilateral)**

<table>
<thead>
<tr>
<th>I'm learning more</th>
<th>Average Score</th>
<th>Standard Deviation</th>
<th>Students' T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>3.36</td>
<td>1.20</td>
<td>0.00**</td>
</tr>
<tr>
<td>No</td>
<td>3.66</td>
<td>1.16</td>
<td></td>
</tr>
</tbody>
</table>

A significant finding is that students who say they are participating more in classrooms and learning more since the TPCs were deployed are those who have lower grades (average student grades from 0 – 5). This result can be related to a higher motivation, as well as better learning absorption due to the portable device. This means there is a major action of school compensation.
On the other hand, students with higher grades are having more fun in the classroom; this result can be linked to the hypothesis that students with good grades find in the TPCs an additional element to enhance their own learning.

“Those who find it harder and those who came less motivated are liking it, and as soon as they become comfortable they feel stronger […]. Even those less apt for manipulation, those who feel insecure with paper. Tablets are soothing for them. Also for those who are curious, those who want to learn more, because it is a tool to express themselves as they want and beyond”.

Teachers’ Forum

e) Students rate very highly the TPC experience. Female students, higher than male ones...

Students rate their TPC, by genre
In line with the above results, students have given very high marks to the use of TPCs: 9.23 over 10. It is quite revealing that girls give higher scores, which can show a trend change for the future. While –according to the literature pedagogical - new technologies seem to be more appreciated by boys than girls, maybe TPCs are setting the foundation to minimize that difference. This difference in favour of 10-12 year-old girls can also be explained as a foreseeable phenomenon, because TPCs are associated to different school tasks, which usually are more valued by girls than by boys.

f) …and students not born in Spain are the ones who rate TPCs higher.

<table>
<thead>
<tr>
<th>Place of birth</th>
<th>Average Score for Tablet PC</th>
<th>Standard Deviation</th>
<th>Student</th>
<th>** Significant at level 0.01 (bilateral)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>9.20</td>
<td>1.28</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Abroad</td>
<td>9.33</td>
<td>1.21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ratings given by students born in Spain and abroad are very high. However, as it happens between boys and girls, scores given by both groups show significant differences, being higher among students not born in Spain.

These data confirms the high commitment of foreign students to school requirements. As well as the positive view that they have of information as a success-enabling tool in today’s society.

“…[Gipsy and migrant children] are improving in the sense that they are going to develop competence in computing that they would not get otherwise and is very important nowadays…”

In my case, in order to serve students coming from other countries and are not yet comfortable with the Spanish language, being able to use tablets for adapting their syllabus and working with them has been very helpful”

Teacher’s Forum
7.- IMPACT OF TPCS ON SCHOOL GRADES

a) A significant number of students say that their school grades have improved with TPCs...

![Bar chart showing the impact of TPCs on school grades]

Even though we cannot establish a causal connection between using TPCs and the improvement of the students' school grades, 27.6-percent of students say those have improved. Two-thirds say their grades are about the same as before, and just a negligible 1.9-percent of cases, grades have worsened.

This chart should be compared to the table showing the impact of portable computers on the acquisition of specific competences by students (chart 49 in the full report); changes in students after deploying the TPCs (chart 52); improvements perceived by families (chart 53), and so on.

b) ...but boys (rather than girls) are the ones who think their school grades have improved with TPCs...

29.7-percent of students said their grades had improved. In the case of females, the positive evolution was lower: 25.1-percent. The positive impact of the TPC deployment may be influenced by gender variables, because male students display a more positive perception than girls about the TPC impact on the assessment of the learning process.
c) ...and students not born in Spain are those who think that TPCs have impacted the most on their school grades

<table>
<thead>
<tr>
<th>Place of birth</th>
<th>Have improved</th>
<th>Have worsened</th>
<th>Stay as before</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>25,20%</td>
<td>1,40%</td>
<td>73,40%</td>
</tr>
<tr>
<td>Abroad</td>
<td>37,60%</td>
<td>3,10%</td>
<td>59,30%</td>
</tr>
<tr>
<td>Chi-Square Significance</td>
<td>0,00**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A noticeable result is the differential effect that using TPCs has had on students coming from various places. The percentage of students who were born outside Spain and say that their grades have improved since the introduction of computers is clearly higher—statistically—than the percentage of students born in Spain (37.6-percent vs 25.2-percent). Those who think their grades have worsened is also higher.

d) ... also, students whose mothers are less educated are the ones who value the most the positive impact of TPCs on their school grades.

<table>
<thead>
<tr>
<th>Level of studies of mother</th>
<th>Have improved</th>
<th>Have worsened</th>
<th>Stay as before</th>
</tr>
</thead>
<tbody>
<tr>
<td>None / Primary</td>
<td>28,60%</td>
<td>2,00%</td>
<td>69,40%</td>
</tr>
<tr>
<td>Secondary / Higher</td>
<td>26,10%</td>
<td>1,40%</td>
<td>72,50%</td>
</tr>
<tr>
<td>Chi-Square Significance</td>
<td>0,04**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For those students whose mothers have not studied or have reached only primary, the use of TPCs has more impact on the improvement of their grades when compared with students whose mothers have secondary or higher education. You could say that using TPCs is an equalizer of school grades as related to the mothers' education level.
“Last year my mother took a class in computing in order to help me with my homework. Now she is more knowledgeable and she uses it to do her own tasks.”

…“The first year of the project, the parents did meet often to help each other. One of us knew about something, while another knew about something else…”

Students’ Forum
8.- CONCLUSIONS AND RECOMMENDATIONS

EDUCATION POLICY

- Preferential implementation of TPCs in public schools, in rural environments and at the Primary education level shows the commitment of the Education Department of the Government of Aragón to add prestige to such educational contexts and the political willingness to close the education gaps in the Region. Also, these measures can explain why the impact of TPCs has been higher in rural than in urban areas.

- Voluntary participation of schools in the project has been a driver of its successful implementation and it has enabled a deeper involvement of teachers.

- The high mobility of teachers prevents the optimization of the programme. Even though we consider that some mobility could foster the exchange of news and experiences among schools, the current mobility makes the creation of stable teams harder and impacts negatively on the utilization of the programme and the resources allocated to it.

- The tasks of the Ramón y Cajal coordinator (computing in schools) are too limited in the daily operation of schools to technical issues. The support and consultation that it is providing to teachers contributes to a continued, support-oriented technology model and it does not encourage a more innovative and dynamic pedagogical model.

- The continuing education about TPC encouraged up to now is required to understand the operation of the computer from a technical point of view, but not enough to change attitudes and to encourage the introduction of new methodological proposals among teachers.

- The model of continuing education of teachers recognizes the need to encourage peer learning, nor relying exclusively on the ICT expert. It is believed that will be the kind of learning that will succeed in fostering an effective change in methodology and will allow optimizing the potential of TPCs.

- The possibilities offered by TPCs vs. portable computers make it specially appealing for the phase of Primary education. Even though the use of the device features is still very limited, we believe that it provides advantages at this stage of education, compared with regular computers.
• Most students and their families demand that the project is extended to the ESO (Secondary Education) stage.

• In spite of the resources invested into implementing the programme in the whole region, there are some differences in the infrastructures of territories and some technical deficits that impacts on the overall utilization of TPCs in each area.

We recommend:

• Encouraging the initial training of teachers on TPCs at the Faculty of Education in order to increase the knowledge of their operation by future teachers, as well as to implement a more efficient continuing education later on.

• Encouraging in the field of continuing education a second phase of peer learning where materials and new experiences are discussed, exchanged and evaluated.

• Optimizing the exchange of best practices through the existing online platforms and face-to-face meetings, in order to encourage more interaction and cooperation among teachers, as well as more efficiency of the resources.

• Reviewing the functions of the Ramón y Cajal coordinator and considering the possibilities of increasing their dedication in schools and/or adding another person with computing profile who can handle effectively the technical demands. It is also required to make a strong bid on encouraging pedagogical advice among teachers.

• Introducing portable computers in the ESO classrooms, following policies like the ones used for deploying them in Primary education. We believe that in this level, portable computers can provide students with similar performance than TPCs at a lower price point.

• Improving telecommunications infrastructures in some areas, and promoting the generalization of quality bandwidth in all schools. This will allow a more successful deployment of TPCs, specially in those areas currently lacking technical resources.
SCHOOLS

- The programme acceptance by principals and teachers has been good. Teachers have shown positive attitude and motivation for participating in the programme and low resistance to using TPCs.

- The success of the programme is higher when all teachers in the school (beyond the higher levels) become involved. Evidences show that in these cases, TPCs are better optimized because the devices are also used at lower levels.

- Centers more predisposed to innovation seem to be environments more favourable to deploy TPCs. These environments show higher willingness to use more interactive methodologies and a stronger support to individual learning.

- Teachers show a high level of satisfaction with the programme, specially those who have changed the most their methodologies and have been working longer with TPCs. This demonstrates that familiarity with the project encourages its acceptance and that progressing towards the change in methodology has a positive reinforcing effect among teachers.

- Using TPCs, as with the introduction of any innovation, increases the workload of the teachers. This situation contains a discussion that extends beyond the programme implementation, because it is related to the issue of the current responsibilities of the teaching function.

- The implementation of TPCs has increased the coordination within schools and the cooperation among teachers. However, choosing and implementing more or less intensively an innovative methodology by such teachers is more related to strictly individual decisions than to methodology options by the schools.

- Teachers are aware of the programme and they are well informed about it, which has made the process of implementing TPCs easier. This awareness is lower among families, who say they are getting the information about the programme mostly from their children.

- Although teachers say they are satisfied with the TPC training they received, the less innovative schools demand more training and resources. In this scenario we could think that teachers at those schools feel insecure and need more training; another explanation of the above could be that they expect to get more training before starting to implement innovation processes.

- Sometimes the schools have shown their willingness to carry out informal assessment activities, but it is clear that schools are lacking objective evidences that would allow them to evaluate the impact of TPCs and the programme among their students.
All the involved groups --students, teachers, principals and parents-- believe that the use of TPCs increases the quality and the standing of the school. This aspect becomes relevant because such assessment of the school can have a positive impact on the expectations of these groups regarding the institution.

We recommend:

- Increasing the processes of information and participation of the families in the schools, stressing the TPCs' goals and potential beyond their exclusivity as a computing tool.

- Fostering and encouraging the use of TPCs as related to projects of technology innovation in the schools. This should go along with processes of continuing education of teachers involved in these innovation projects.

- Carrying out systematic assessments of the programme and the impact of TPCs in the schools. Such assessments should allow to know how the models of TPC usage are related to the students' grades and, therefore, to plan processes for optimizing the devices in the school. This would also allow exchanging programme experiences between the participating teachers and the rest of faculty and management.

CLASSROOMS

- The TPCs are mostly used in the instrumental subjects - knowledge of the environment, Spanish language, Maths And English language. This contrasts with the results obtained in other research and has a dual meaning. It shows that teachers do not think that the device is slowing learning, but they consider it a tool with high potential instead. This also impacts the value of thr TPC, that increases due to its use in the more prestigious subjects in the traditional school culture.

- The use of TPCs increases teacher-student interactions, improves the mood in the classrooms and increases the students' motivation towards learning. These factors are key for improving learning and the school grades.

- There is evidence showing that the TPC is a tool that drives change and modification of methodologies in the classroom. However, there is still a long way to go if we want to optimize the possibilities of the programme and exceeds the traditional model of the teaching-learning process and more technological-instrumental of the resource.

- The use of TPCs allows the introduction of more flexibility in the classroom and encourages individual learning. This scenario benefits all the students, specially those who experience higher difficulties. For this group, using TPCs is also a major factor of motivation. This can transform TPCs into highly effective tools for reducing inequalities within schools.
• The students' competences improve by using TPCs, specially those related to certain automatisms --such as searching for information-- or using ICT. Other competences very useful for the knowledge society also get improved. However, the teachers' assessment of the competences that get improved among their students shows a mirror effect: the teachers with the highest expectations of TPCs give it the highest scores.

• The students say they are learning more with the tool, but they do not think such use has improved their grades. This outcome could be explained in part by the lack of assessment of the new competences that students acquire with the TPCs.

• It becomes clear that more competences are acquired in those classrooms where each student has his/her own TPC. The individual availability of TPCs generates a higher efficiency of the resource.

• Although every group of students gives high scores to the TPC, it must be noted that girls are grading it higher than boys, and there are no genre-related differences in the willingness to continue using TPCs in high school. These results show that girls are more adept to the requirements of school culture, but they also question some considerations of the pedagogical literature regarding the difference in ICT appreciation by genres, and they could point to a change of direction in the future.

• Students not born in Spain and those with less educated families say that since TPCs were deployed they are learning more, even if these students are using the devices at home less than the rest of the native students.

• The deployment of TPCs has a positive impact on the school performance of all students. Specially, such impact is higher among students not born in Spain and among students born in Spain whose mothers are less educated. This confirms that the TPC programme can become a good tool for equalizing education.

We recommend:

• Encouraging a culture of assessment in the various subjects that highlights the new competences acquired by the students with their TPCs.

• Increasing the number of TPCs until reaching 100-percent, in order to increase the effectiveness of the resource and to optimize its impact among students. Should it not be possible to extend TPCs to every student, we recommend deploying portable computers.

• Running an encompassing study that allows knowing the impact of the programme among boys and girls, specially considering the impact of using
ICT and TPCs in the selection and development of school and job careers of these young people.

- Encouraging the use of TPCs at home by every student, as a tool for reducing inequalities in education and for fostering more possibilities of school achievement among more socially underprivileged students.

FAMILIES AND ENVIRONMENT

- The use of TPCs remains constrained to the classroom environment, and they are seldom used in networks. The impact of the tool on the creation of social networks and the development of communication processes between the schools and their environments has been lower than expected.

- The use of the computer by the families is limited hindered by their level of education. However, we have noticed that a higher use if TPC at the school reinforces the use of the computer at home and since the programme was implemented, several families have purchased computers mostly for the school use of their child.

- Families show a high level of satisfaction and expectations with the programme. The families that have received information about it from the school have motivated themselves regarding their own training on ICT, but schools still must drive their resources in order to make ICT and TPCs more available to these families.

- The introduction of TPCs has favoured that the families help more their children at home with their homework. This change has happened more intensely among less educated mothers. The results show the potential role of TPCs in the process of involvement of families in the education of their children.

- Since the deployment of TPCs, less-educated families are showing higher needs and willingness to train themselves in ICT. The previous training received by those families mostly explains the need to continue learning about this subject.

- In general we can consider the positive impact of TPCs on the reduction of education inequalities caused by class and/or social-economic and cultural status of the families.

We recommend:

- Using TPCs more extensively at the school, within a plan that optimizes the device potential as a tool for communicating with the families.
• Encouraging the access of families and the community to the computing resources and the TPCs, both by opening the schools and by promoting public facilities and services --libraries, civic centers-- that provide access to these technologies.

• Implementing training programmes in ICT and use of the TPC for families, in order to minimize the impact of the generational technology gap with their children, and fostering the process of support of school homework.

• Fostering the increase of sectorial and territorial relationships at the local level from the school, based on networking and the optimization of the TPC features.