Education Technologies and Teacher’s Professional Development. The Project Motus (Monitoring Tablet Utilization in School) run by Cremit

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This paper intends to deepen the relationship between teachers’ professional development and technology as educational issue, through the discussion of a case study – the project Motus that combines research and intervention as core actions – focused on the introduction of mobile devices in nine Italian schools (located in Lombardy, Emilia and Marche).

The outcome of the project, recently discussed, allows us to highlight some of the dynamics in teachers’ innovation-related practices, reducing the weight of many conversations that combine innovation with technology, bypassing the human context in which the innovation would find place and meaning.

The aim of the project was, in fact, to give teachers the opportunity to undertake a course on the pedagogical use of the device, and enquiry into the main pedagogical problems and opportunities related to the use of mobile devices in the classroom, with the support of a research center and the competence of a team of researchers: teachers were at the same time the main actors of the research - as researchers – and the most important “object” of the study, within the methodological framework (Blec Model) developed by Cremit.

KEYWORDS: Teacher training, mobile devices, technology, school innovation, professional development.

This article has been developed jointly by the authors.
Alessandra Carenzio is the main researcher of the project, she wrote § 1, 1.1, 3 and 4; Serena Triacca took part in the project, monitoring teachers’ classroom activities, she wrote § 1.2;
Pier Cesare Rivoltella is the scientific coordinator of the project, he wrote § 2.
1. “To tech or not to tech”: how school seems to run after technologies

The idea of discussing the introduction of mobile devices in the classroom is not new, but it seems to be important especially considering three factors: the political intervention, that will be discussed in regard to Lombardy (the Region where our research has been conducted and framed), with some brief hints to the national context related to the introduction of technology in education (see 1.1); the current discussions against the technology market (that tries to introduce devices in the classroom with no pedagogical reasoning) or in favor of technology as a sort of miracle able to transform school; mobile learning and the need for changing the setting of the classroom itself with mobile devices (see 1.2).

The process of massive introduction of mobile devices (like many other instruments), if not supported by high-quality training, monitoring processes and teacher’s support, mainly generates turbulence without results, running three risks:

1. it does not change traditional teaching practices, which simply remain the same with some slightly variation;
2. it considers the contribution of technology at the level of its simple technical use (that means for teachers, if you can put the device on, you can handle it, but it’s not just a matter of technical confidence);
3. it tends to mortify students’ participation, boring them and causing frustration, considering that, although not necessarily digitally wise, students perfectly know the potential of technologies as they use them in their informal learning, playing, socialization and private life.

The situation actually seems to feed a sort of run towards technologies, with no attention to education, teachers’ real practices and what concretely teachers will do with the brand-new devices they bought. It is a big lack.

Motus, a one year research project that supported the introduction of tablet in nine secondary schools, lives in this environment.

1.1 Fostering the introduction of technology in the classroom: “Scuola Digitale” and “Generazione Web”

Schools are now playing in a favorable position, thanks to many financial lines supporting institutions to introduce devices and technologies in their contexts.

As regards to schools, we refer to two recent actions (national and regional) that we will discuss in brief, as they are actually the flywheel for the research Motus chosen as a model for teacher professional development with and on technology: “Scuola Digitale” (Digital School) and “Generazione Web” (Web Generation).

The “National Plan for Digital School”¹ (“Scuola Digitale”) proposed by the Ministry of Education, University and Research, has been built with a clear goal: to implement at a national level a number of actions aimed at the modernization

¹ For details, URL: http://www.scuola-digitale.it.
of education, with the primary objective of combining the use of technology in educational institutions, through a review of the overall learning environment. It means that we do not only need technologies to innovate and change schools, but we need to “review”, as stated in the official document, the learning environment itself.

It is actually an important clarification, a sort of improvement compared to previous actions in favor of school innovation².

The new attitude shown can be summed up in a positive shift from “top-down” initiatives (one for all, that means from the Ministry to schools with no clear understanding of local situations and past efforts), to a “bottom-up” model (from school, thanks to the development of a local and single project, to the Ministry that is called to evaluate the project and give its formal approval).

The path to innovation starts from an idea generated by schools and it is supported by a group of Universities assisting schools with seminars, coaching, training sessions devoted to specific issues and other initiatives on a local/regional basis to personalize each route. It is a good start, but not sufficient for schools to be self-confident and on the run.

As for the second action, “Web Generation Lombardy” was officially opened in June 2012, providing the amount of 8.7 million Euros to allow classrooms to adopt technological tools (about 25,000 students), to switch to digital texts (e-books) with the support of a net book or a tablet.

The initiative, first of its kind in Italy on a regional basis, is aimed at students attending the first and third level of higher education, including vocational training.

The announcement was a huge success – 280 schools have submitted valid and eligible applications – so much so that the budget has been sufficient to finance only 219 schools, with the additional funding of 4 million euros approved by the Government for further projects³.

Although the initiative is reserved to those schools that have already approved the adoption of digital books, have adequate technological infrastructure – such as broadband and Wi-Fi – and have skilled teachers in the use of ICT tools, reality is not so clear and pure. Many teachers actually need for further educational support and training to use tablet and net book, something that has to be taken in serious account as we will easily see in the following pages.

In fact, as to the plan for Lombardy, some training has been provided: as we can read in the official documents, four occasions have been organized to discuss the main topics around technology in the classroom such as privacy and legal responsibility or how to use devices for non-technological teachers⁴.

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³ Facts and numbers can be found at the following URL: http://www.istruzione.lombardia.gov.it/protlo4354_12/

⁴ See, URL: http://www.istruzione.lombardia.gov.it/milano/prot-mi17830_12/
It is actually a good point in favor of the project, but still not enough to let teachers act properly and confidently with a tablet on their desk (12 hours training are not enough to be independent, especially because it is not only a technical issue).

The sensation is that many schools have now a “Ferrari”, but they do not know how to drive it or where to go.

1.2 State of the art: mobile devices and formal education

As considered, thinking about technologies, mobile or not mobile, as a direct reason for innovation – especially in complex contexts such as school and with special professional profiles such as teachers – is very naive and somehow dangerous.

What needs to be taken into account is related to educational models and methods of teaching with technologies. It does not mean that we have to forget paper and pencil or blackboards or face to face argumentation with our students, but we cannot make the mistake of using the same methods with a new device.

As shown by experience and literature we need to balance and create a new agenda.

Mobile devices, in this case, help a learning which:

– is not confined in school or in the classroom, as for Pachler’s *Episodes of Situated Learning* (Pachler, 2007);
– welcomes a different organization of the time of learning, as for the *Flipped Lesson* model which takes origin in Freinet’s “retrospect lesson” (Freinet, 1978);
– supports social strategies and social connections to learn better and deeper, as for Gee’s *Groups of affinity* (Gee 2003);
– lives on short learning occasions mainly based on production and creation of contents, as for *Episodi di Apprendimento Situato* (Author 3, 2013) and Hug’s *Microlearning* (Hug 2007);
– is progressive and continuous as for Gee’s *Principle of Exploration* (Gee 2003);
– is situated, as for Gee’s *Principles of Situated Meaning*, as «recent research suggests that people only really know what words mean and learn new ones when they can hook them to the sorts of experiences they refer to – that is, to the sorts of actions, images, or dialogues the words relate to».

And finally, it needs a new competence for teachers, related to the definition of the learning experience in at least three moments:

– *anticipatory*, that means the preparation of the activity and the main stimuli (charts, book chapters, websites, grids for detailed analyses, pictures, videos);
– *operative* (the learning moment itself, which is guided but social and regulated);

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5 Episodio di Apprendimento Situato (EAS) can be translated as Episode of Situated Learning (ESL).
– final (to let students know they have actually learned something and that what they learned has theoretical backgrounds useful to frame their present and future learning experience).
This process reminds of Laurillard’s design model (Laurillard, 2012) and of Cope and Kalantzis’ triad of Designed-Designing-Redesigned (Cope and Kalantzis 2000).

2. A proposal for teacher’s professional development: Monitoring Tablet Utilization in School

The research Center CREMIT, based at the Catholic University of Milan, has run a one year research project to support the introduction of tablet in the classroom in nine secondary schools in Northern Italy (as indicated by “Web Generation”, first and third level of study).
Schools were not selected by Cremit, but the other way round: schools chose Cremit to support their pedagogical change with the introduction of a mobile device and especially with the definition of a new pedagogical framework to work with in a “mobile” classroom. That is why the sample is not representative of the whole schools in the country, but the studied topics and methodology can be applied nationally.

The project was built up to meet the following goals:
– collect data on the use of mobile devices and the representations of the device provided by students and teachers, not forgetting students’ family (questionnaire);
– coach teachers in their use of the device at school (course on the use of mobile device on a pedagogical basis);
– promote a cultural appropriation of technology providing educational support and professional development (course and seminars during the project);
– study whether and under what conditions the device can become an instrument in ordinary teaching (video observation of the classroom, questionnaire, focus group);
– provide opportunities for sharing experiences among teachers in different schools, through local seminars and online participation (group seminars and individual sessions with the coach).

2.1 Methodology

The training model is inspired by the BLEC Model (Blended Learning, E-tivities, Coaching”) developed by CREMIT during the last few years working alongside schools, and consists of three panels:

1. training (blended learning), which includes three seminars to share ideas and theories that have a direct impact on teaching and online environment to discuss, share and learn;

2. coaching, that means to accompany teachers with a familiar figure (the Coach in fact) that becomes a guide for methodology issues and for supporting the group;

3. a well-defined set of activities (E-tivities) suggested to the group, analyzed to return comments and guide practices in school (Salomon 2002).

As can be easily understood, Motus is at the same time a training project and a research.

First side, teachers met the coach three times for intensive training sessions and twice at school, and in between they practices what they built with the support of the coach, who was an expert both in mobile devices and in educational issues.

Second, every single step was guided by researchers and teachers and the results of the different research levels (representations, uses, expectations, problems) were not discussed at the end of the project but during each training sessions and seminars: one seminar at the beginning to help teachers meet and familiarize with the coach; one seminar in the middle of the year to examine the data of the first questionnaires and discuss with the coach on the main line of their pedagogical work with the devices; one seminar at the end of the project to discuss the final data of the last questionnaire, the focus group and definition of a new path tailored to each school.

The main results coming from the video observation in the classroom were discussed privately with teachers, during a dedicated session in each school, trying to get information, advices and hints to better their performance, get facts “watching things happening” and getting a sort of detached view on the way we act in the classroom. The coach in fact watched the whole videos and selected the most important details to be discussed with teachers, in order to make them useful for them.

<table>
<thead>
<tr>
<th>What</th>
<th>When</th>
<th>Why</th>
<th>Where</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kick off meeting and seminar</td>
<td>September</td>
<td>Meeting with the staff and the coach, launch of the research, training</td>
<td>University</td>
</tr>
<tr>
<td>Meeting with the coach</td>
<td>November</td>
<td>Training and etivities</td>
<td>School</td>
</tr>
<tr>
<td>Middle-term seminar</td>
<td>January</td>
<td>Discussion of the results from the first research step and training session</td>
<td>University</td>
</tr>
<tr>
<td>Meeting with the coach</td>
<td>March</td>
<td>Training and discussion of the video observation</td>
<td>School</td>
</tr>
<tr>
<td>Final seminar</td>
<td>May</td>
<td>Discussion of data from research</td>
<td>University</td>
</tr>
</tbody>
</table>

*Table 1 – Training and coaching: timing and facts*

The research instruments used are the following:

- an initial questionnaire to investigate uses and expectations, aimed at students, teachers and families (95 teachers, 100 parents, 276 students). The main areas have investigated the following topics: representations of the tablet (creative/passive, dangerous/harmless, useful/useless), with selected
images to be chosen; expectations in terms of learning and motivation improvement; use of digital media in the classroom; use of the tablet; problems and opportunities as imagined by teachers before using the tablet; pedagogical issues as related to methodology, time and engagement of teachers and students. Families were engaged just in getting their representation of the device and on its impact on the classroom and students’ learning;

- a focus group at the end of the school year, which involved students to explore issues related to teaching methods with tablet and their ideas on the presence of the tablet in the classroom (10 sessions with 8 students each). The focus group analyzed the following topics: use in the classroom, best practices and problems with the device, conducting a real trial to the device, asking the group to split in two categories (prosecution and defense, studying their strategy and writing sentences to be read in public to get a formal confrontation);

- two sessions of classroom observation under the method of video research (Goldman, Pea, Barron, Derry, 2009), using the camera to observe the setting and a grid to order the findings got by researchers. The grid was focused on the content of the lesson, the setting of the classroom, students’ attention, participation, interaction, the climate of the classroom, teachers’ attitude towards technology as an isolated tool or as an integrated facilitator of teaching and learning processes, teachers’ reaction to students and accidental problems during the lesson. Every researcher had to focus on the grid while recording the lesson in the classroom, to have a common ground for the analyses;

- a final questionnaire for teachers to detect the perception of changes in practices, critical and positive remarks regarding their experience with the device (especially making a comparison between expectations and real practices and facts lived in day to day life with the device on their desk.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Focus</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial questionnaire</td>
<td>Detect representations on the device, analysis of pedagogical issues and methodology and of uses referred to technology</td>
<td>Teachers, students, parents</td>
</tr>
<tr>
<td>Video observation</td>
<td>Analysis of the use of the device in the classroom</td>
<td>Teachers, students</td>
</tr>
<tr>
<td>Final questionnaire</td>
<td>Customer satisfaction, comparison between starting expectations and real practices</td>
<td>Teachers</td>
</tr>
<tr>
<td>Focus group</td>
<td>Analysis of issues related to attention, participation and day to day uses, detected during the observation and from the initial questionnaire</td>
<td>Students</td>
</tr>
</tbody>
</table>

Table 2. Research: instruments and focus

8 See 3.1 for the discussion of main issues.
9 Referring to these sessions, in the first project year the research team has collaborated with the University of Salerno for the development of a software based on Kinect Technology in order to map teacher’s movement and to quantify it, as to identify recurrent patterns related to some actions. «The recording module converts Kinect inputs to images in JPG format and records them on the hard drive with user-selectable resolution and frame rate according to estimated recording time». The software, called MOTUS after the project, will be in fact used in the second year of MOTUS (2013/2014). To better deepen the main technical issues, see: Ferrari S., Carlomagno N., Di Tore P. A., Di Tore S., Rivoltella P. C. (2013), How technologies in the classroom are modifying space and time management in teachers’ experience?, REM V, 2, December.
3. Teachers as innovators: main results in brief

In the following pages we will discuss some of the main findings related to teachers, as the main focus of the paper is teachers’ professional development, using Motus as a stimulus to talk about technology in school and what to do to foster a pedagogical change.

Data refers to questionnaires, focus group and video observation in the classroom, we will specify to which research tool data and results refer in footnotes.

The results are deeply linked to the BLEC model, as every tool used with teachers is part of a serious and planned partnership based: on the relationship with the coach, as someone helpful and close to the school environment (he/she is not a technician); on the etivities, where teachers could easily find the direct link between research topics and practice; on the training, as many ideas could arise around the data discussed and taken from the questionnaire, as well as the observation in the classroom.

Every single action (research and training) was combined in the model to get in and out of the classroom, to move something from school to research and at the same time to put something from research to teachers’ practice in the classroom, using a sort of two way ticket to ride.

3.1 Teachers’ representations and activities in the classroom: mobile technology as a toolbox

First of all, the initial questionnaire asked teachers to chose an image describing their idea of technologies (toolbox, copy&paste, a creative mind, a prohibition sign, a bad intruder coming from the computer screen, a connected world).

![Figure 1. Metaphores to talk about mobile devices](image-url)
Teachers represent the device with the metaphors of a toolbox\textsuperscript{10} (chosen by 30.5% of teachers) and of a “creative mind” (28.1%). The first relies on the idea that the tablet is a great aggregator of tools, putting together useful apps for education and recreation, camera, voice recorder, networks, writing, Internet. All you need to have at school. The second refers to the multi-language that can encourage greater creativity and the expression of students’ talents in the Multiliteracy age (Cope and Kalantzis).

These images are very current in the work of teachers, as observed in the classroom, both in teachers’ description of classroom activities (what they do) and in students’ reports collected during the focus group sessions (what students say their teachers do).

In fact, as related to teachers’ activities with the tablet, they reflect past occupations normally done with other technologies: the use of presentations and the use of technology to write papers.

Data seem to confirm, on the one hand, how often the use of a new tool assumes a previously experienced logic, at least in the choice of the activities (the tablet as a screen).

In fact, according to the grid used to observe lessons with the tablet, visual and verbal intelligence still seem to be active and stimulated, as noted observing the work in the classroom.

On the other hand, we noticed an increase in the use of Internet to do research and an increase in group work, as to show that a mobile device is actually a social and relational environment that forces people to connect, share and do things together. If we look at Figure 2, we have to remark the following changes: Web search obtained 24% in the initial questionnaire, while online communication obtained 3% in the initial questionnaire. Data shown refer to the final questionnaire, delivered at the end of the project Motus.

\textbf{Fig. 2. Teachers’ use of the device in the classroom}

\textsuperscript{10} Metaphors can be analyzed thanks to a system of axes intersecting two main aspects: the one of production/use (that means what you do with technology as active of passive user) and the one of control/freedom (that means the attitude towards technology in the classroom).
3.2 A gate to participation and communication: the emotional side of technology

Teachers consider the device as a potential tool for increasing students’ interest in staying at school (47.8%) and in participation (46.7%).

We point out that the increase in classroom participation is significant and it is described by students too. We wonder, however, if it depends on the tablet, or on the simple fact that the instrument is framed within different activities compared to the usual ones.

If students basically listen to teacher’s talk, they are certainly more involved working with mates in preparing a presentation or editing a video. But does it depend on the fact that they work with classmates in small groups, putting their skills at the disposal of the other, or on the use of an app or a camera (if enabled)? Maybe both.

The device seems to affect emotional and relational processes. In this sense, it appears to activate closeness between student and teacher and among the students themselves (80.8% of students, as referred thanks to students’ questionnaire and then during focus group).

Students in fact indicate a robust increase in communication, not only among peers but also between teachers and students: teachers who respond also via e-mail and communicate with them outside the classroom are significant for students\(^\text{11}\) (and this seems to affect their performance at school and their well-being).

3.3 Problems to face: students’ attention, setting management and technical issues

The problematic features encountered by teachers are related to technical issues and the management of the classroom/students, with substantive equality between the problem of the applicability of tablet functions and teachers’ working time.

<table>
<thead>
<tr>
<th>Technical issues</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>The device as a fixed presence in the classroom</td>
<td>28.35%</td>
</tr>
<tr>
<td>Apps difficult to use in my lesson</td>
<td>22.83%</td>
</tr>
<tr>
<td>Fragile competences in the use of ICT and mobile devices</td>
<td>17.32%</td>
</tr>
<tr>
<td>Fragile competences in methodology related to mobile devices</td>
<td>17.32%</td>
</tr>
<tr>
<td>Time needed to prepare lessons</td>
<td>17.32%</td>
</tr>
<tr>
<td>Regulation of the classroom</td>
<td>6.30%</td>
</tr>
</tbody>
</table>

Figure 3. Problems faced by teachers

11 This aspect is taken from the focus group session, where students argued that the device has helped them in being closer to teachers.
We can highlight an important observation: mobile device is a benefit especially when used to work together, because it promotes communication, although at the same time it is distracting. Communication is based on talking and confronting, so it means chaos and loud voices around the classroom.

Is it a problem for teacher’s management of the classroom? Yes, under the traditional notion of silence as a synonymous of attention and talking as doing something else distracting students. That means that during the training we should deepen this aspect and encourage collaborative learning, sharing, social construction of knowledge and activities that enable students’ participation.

As suggested by a student, it also depends on who uses the device, on his intention: “if you want to be distracted you simply need a piece of paper and a pen, to play the old and famous naval battle game” (or at least a window to look at with dreaming glance)\textsuperscript{12}.

Certainly we are facing a stage of transition, we experience difficult tasks destined to be a routine in few years and somehow essential. In Figure 4, we underline on the contrary the main benefits as detected during the final questionnaire.

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Increase of students’ participation</td>
<td>11.88%</td>
</tr>
<tr>
<td>Increase of students’ interest during lessons</td>
<td>6.88%</td>
</tr>
<tr>
<td>Improvement of the methodology</td>
<td>10.00%</td>
</tr>
<tr>
<td>Better understanding of concept/lessons</td>
<td>9.38%</td>
</tr>
<tr>
<td>Better organisation of the activities</td>
<td>9.38%</td>
</tr>
<tr>
<td>Individualization of the lesson</td>
<td>9.38%</td>
</tr>
<tr>
<td>Possibility to experiment something new (teachers)</td>
<td>28.12%</td>
</tr>
<tr>
<td>Better competences in the use of technologies (teachers)</td>
<td>15.00%</td>
</tr>
</tbody>
</table>

**Figure 4. Benefits faced by teachers**

4. Final remarks

As taken from the research experience and the training, as combined elements of the project Motus, the contrast between Old and New, Culture and Technology, Paper and Digital, is still very strong in our classroom settings and this often leads to attitudes of resistance or explicit rejection.

A first element in favor of technologies when well introduced (“well” here means with a supporting action and not just thrown from the main door) is related to the movement of this inertia: teachers are brought into play, they accepted the challenge.

Of course, this does not delete critical elements, which refer in particular to two aspects.

The first has to do with time. Research and teaching practices of expert teachers have set two unwritten laws: learning deep (with or without technology) re-

\textsuperscript{12} This idea is taken from the trial to the tablet, during the focus group session.
quires a lot more time to prepare lessons and also a lot more time in the classroom.

Specifically, if I want to select resources for my students to surf the web, if I want to prepare a lesson storyboard, I need much more time as if I do lectures using my materials, accumulated over the years in my teacher portfolio. Similarly, if I want my students to learn through discovery, whether my teaching is meant to be active and involves the production and collaboration of students, I imagine it to need more time than the “chalk and talk” traditional way.

Teachers should say, “Check your time, at home and in the classroom! If you need more time, you’re doing a good job”.

The second aspect relates to the primacy recognized, even with mobile devices, to the visual and verbal intelligence, to quote Gardner. This means that, even with mobile devices, talking and supporting teacher’s explanation with presentations continue to be the core business.

A logic of full exploitation of technology potentials, however, should encourage as much as possible a “flipped” logic in which finding and a first appropriation of information is done at home by the student, while on the contrary the time of the lesson should be released for the problem solving (individual and collaborative), to discussion, laboratory activities, experience.

This produces a second indication for teachers: “Check your initiative in the classroom! If you realize you talk less, you’re doing a good job”.

These two problems – time and teacher’s work – are probably the two crucial points on which schools willing to continue their innovation process will have to work out in the future, especially as innovation starts from teachers’ methods and their professional development.

The idea that we want to stress takes the form of a triangulation, replacing the linear, deterministic idea on which we do create innovation simply crossing technology and school. On the contrary we need to work on teacher’s practices.

The case of Motus supports this indication: when the tablet has joined the classroom as new tool within established practices, very little has changed in terms of teacher’s and student’s satisfaction, reducing it to a “board” to take notes on. Instead, when the cycle of teaching moved with new patterns and new matrices, then a tablet (that means technology) has led to innovation. Not as technology, but as an element that has undermined the usual teaching practices.

Mobile devices are in fact a sort of formal “excuse” to re-define and adjust teacher’s practices and methods, as learning processes are too complex and too stratified to change simply thanks to the brute introduction of technologies.

Motus helped this concerns and suggestions to come out thanks to the complexity of the model: helping teachers to think and reflect on their practices while in action, and not at the end of the training session, when we usually focus on the last concept discussed and when trainers are no more at teachers’ disposal (blended learning and activities during the project); supporting teachers reflection on pedagogical issues emerged along and thanks to the research (professional development is helped also when I have instruments to ask questions); getting new suggestions on how to act in the classroom thanks to the help of a coach who knows the environment, the resources and the problems teachers usually face.
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http://www.istruzione.lombardia.gov.it/protlo4354_12/: facts and numbers related to “Generazione Web Lombardia”.
http://www.cremit.it: website of the research centre CREMIT.