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Quote from a child at a conference in San Francisco:

*"Whenever I go into class, I have to power down."*

This paper takes stock of the progress made in terms of ICT use and integration in schools and learning. It looks primarily at Europe and moves on to assess some of the more innovative initiatives, what have they done and what makes them successful? Finally the paper identifies key characteristics of new millennium learners that can be built on in future ICT for learning initiatives.

## State of ICT in schools

Some evidence on the impact of ICT use on learning and learners in schools is emerging and providing a basis for a number of preliminary conclusions. The review carried out by European Schoolnet groups the conclusions arising from existing impact studies in terms of quantitative and qualitative outcomes. The main conclusions in terms of quantitative outcomes are:

- *"ICT impacts positively on educational performance in primary schools, particular in English and less so on science and not in mathematics;*
- *Use of ICT improves attainment levels of school children in English- as a home language- (above all), in Science and in Design and technology between ages 7 and 16, particularly in primary schools;*
- *In OECD countries there is a positive association between the length of time of ICT use and students' performance in PISA mathematics tests;*
- *Schools with higher levels of e-maturity demonstrate a more rapid increase in performance scores than those with lower levels;*
- *Schools with good ICT resources achieve better results than those that are poorly equipped;*
- *Broadband access in classrooms results in significant improvements in pupils' performance in national tests taken at age 16;*
- *Introducing interactive whiteboards results in pupils' performance in national tests in English (particularly for low-achieving pupils and for writing), mathematics and science, improving more than that of pupils in schools without interactive whiteboards."*<sup>1</sup>

The qualitative outcomes are the following:

- *"Pupils, teachers and parents consider that ICT has a positive impact on pupils' learning;*
- *Pupils' subject-related performance and basic skills (calculation, reading and writing) improve with ICT, according to teachers;*

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<sup>1</sup> European Schoolnet (2006), "The ICT Impact Report, a review of studies of ICT impact on schools in Europe" ([http://insight.eun.org/shared/data/pdf/impact\\_study.pdf](http://insight.eun.org/shared/data/pdf/impact_study.pdf))

- *Academically strong students benefit more from ICT use, but ICT serves also weak students."*<sup>2</sup>

Nevertheless, according to some of the studies reviewed by European Schoolnet, the full creative potential of ICT is not exploited to engage students as active creators of knowledge<sup>3</sup>.

The report<sup>4</sup> recently published by BECTA in the UK is a comprehensive review of the impact of ICT in schools. Referring to the situation in the UK, it consulted more than 350 literature sources. Among the report's conclusions the following are especially noteworthy:

- *"A critical factor in the effective use of ICT is the existence of a school-level e-strategy that addresses future development and sustainability and includes some means of monitoring progress against identified milestones";*
- *"...the evidence on attainment is somewhat inconsistent, although it does appear that, in some contexts, with some pupils, in some disciplines, attainment has been enhanced. There is a need for more systematically gathered evidence although it is already apparent that, where ICT has been successfully embedded in the classroom experience, a positive impact on attainment is more likely";*
- *"There is a growing body of evidence on the positive impact that ICT can have on the learning of pupils with special needs"*<sup>5</sup>.

In another review of the impact of ICT on learning, Punie, Zinnbauer and Cabrera<sup>6</sup> suggest that "ICT generally has a positive impact on learning but the expectations that ICT could, in some ways revolutionise processes at schools, have not (yet) been realised... The preconditions for using ICT for knowledge-sharing, communication and home-school co-operation are almost in place, though the positive impact as yet is only moderate". The authors also stress that institutions will need "to be adapted to the requirements of the knowledge society and to the way the digital generation is learning by using technologies, intuitively in the everyday life".

The report produced by European Schoolnet<sup>7</sup> analyses the impact of ICT on learners, learning and teachers and teaching based on a number of different studies primarily from advanced ICT using countries. It confirms wider positive benefits of ICT on learning modes, such as cognitive processing, independent learning, critical thinking and teamwork. The fact that ICT enhances a more student-centred learning approach is seen by many researchers as among its most important benefits. Studies reviewed by the report also suggest that the benefits of ICT should be more intentionally exploited following a pedagogical approach. Case studies show, for example, that teamwork does not automatically mean increased collaboration. Many tasks which teachers called 'collaborative' merely involved pupils working alongside one another rather than jointly addressing a problem.

<sup>2</sup> European Schoolnet (2006), "The ICT Impact Report, a review of studies of ICT impact on schools in Europe" ([http://insight.eun.org/shared/data/pdf/impact\\_study.pdf](http://insight.eun.org/shared/data/pdf/impact_study.pdf))

<sup>3</sup> E.g. Impact of ICT in Nordic Schools, Ramboll Management, 2006

<sup>4</sup> Condie, R., Munro, B. (2007) "The impact of ICT in schools – a landscape review", Becta Research, [http://partners.becta.org.uk/page\\_documents/research/impact\\_ict\\_schools.pdf](http://partners.becta.org.uk/page_documents/research/impact_ict_schools.pdf)

<sup>5</sup> Condie, R., Munro, B. (2007) "The impact of ICT in schools – a landscape review", Becta Research, [http://partners.becta.org.uk/page\\_documents/research/impact\\_ict\\_schools.pdf](http://partners.becta.org.uk/page_documents/research/impact_ict_schools.pdf)

<sup>6</sup> Punie, Y., Zinnbauer, D., Cabrera, M. (2006) "A Review of Impact of ICT on Learning. Working Paper prepared for DG EAC". Institute for Prospective Technological Studies, DG JRC.

<sup>7</sup> European Schoolnet (2006).

The studies indicate that teachers see a high impact of ICT on learning and learning outcomes, whereas the perceived impact on teaching methodologies is assessed to be much more moderate.

In changing the teacher–student relationship as part of the learner-centred approaches, the most difficult process for teachers is to give up control and have more trust in students planning their work independently. Furthermore, teachers do not feel confident yet in exploiting ICT to support new approaches in teaching. Most of the teachers are still at a stage of using ICT to enhance existing pedagogical practice. Current pedagogy is subject centred, and uses ICT for differentiation and project based teaching in more advanced cases. Collaboration between students is not yet sufficiently exploited.

### **Examples of innovative learning environments**

The elementary school Josefa Mareše<sup>8</sup> is located in a small town near the Austrian border, Znojmo in the Czech Republic. The school was created three years ago and has a strong focus on ICT-supported teaching and learning. The school also welcomes foreign students, talented students and special needs pupils and has special integration/education programmes for them.

The school has developed its pedagogy around the targets of developing the teaching of foreign languages (English, French, German, Italian, and Russian), focusing on special needs education and talented students while making the process of learning practical and motivating.

To achieve this ICT is used in lessons to look up information for studying and to make multimedia projects. The school has wireless broadband internet and the pupils have access to computers mainly in the primary school level and in special training classrooms of the secondary school level (language classroom).

Pupils can use Whiteboards, smartboards, visualizers, Turning Point System during lessons across all subjects. The tools help the teachers to make the lesson motivating and more interesting and understandable for pupils.

The pedagogical approach is focused on helping learners to see the relationship between the school curriculum and their real-life experiences. Through the aid of group work pupils learn to think and solve problems and develop communication and presentation skills. The role of the teacher is that of a coach assisting and stimulating the learners' interest to find explanations or answers to questions rising from their work on cross-curricular topics.

### **Sharing of good practice through peer learning between schools**

School leaders and teachers from Northern Ireland, The Netherlands, France and Finland visited and welcomed their partner schools in the four participating countries of the P2P project. P2P allow exchange of ICT practice, learning from each other and bringing home some understanding of how school innovation works in another country. The P2P exchange was also seen by schools as a useful tool for self-reflection by putting their own experiences and working methods into a European perspective.

Good practice examples:

*Mantymaen Koulu* which provides a comfortable learning environment where a variety of different learning styles are applied and a true partnership between pupils and teachers had been established. *The Sintermeerten College* in the Netherlands where the school has constructed several web-based learning areas. One of these is 'industrial heritage'. Students take an artefact from their own

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<sup>8</sup> Calibrate database, European Schoolnet (2007)

environment and describe it (web based). They are then guided through a virtual environment, consisting of small parts of information about the background of their artefact and several challenging assignments. The progress is monitored electronically by the teacher and at the end the students make a presentation about his or her artefact.

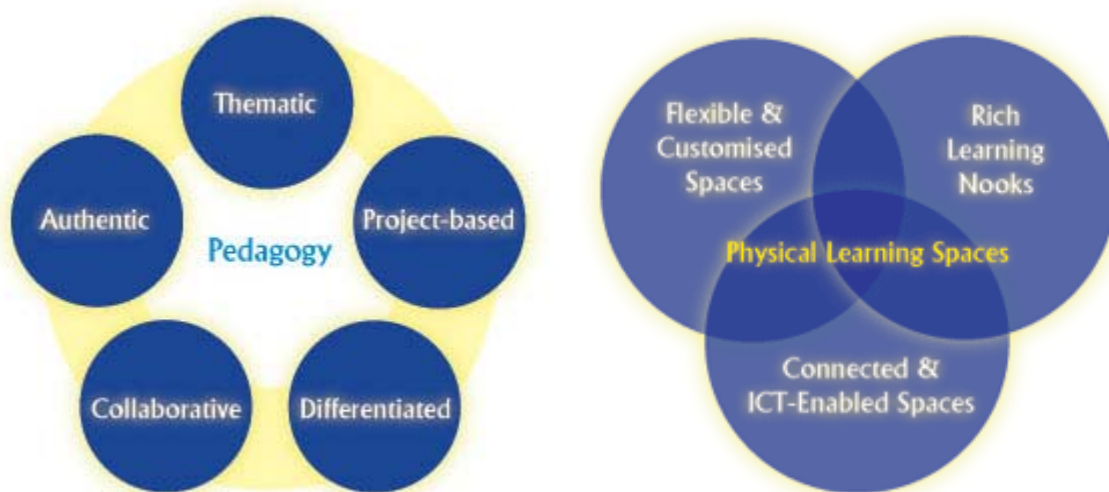
At the school, *Tikkakosken Koulu*, in Finland students are using ICT to make an online newspaper: they use the Internet for collecting information and afterwards they publish their articles at the school website.

### **Integration of pedagogy with physical and virtual learning spaces in Singapore**

In Singapore the Government has initiated a programme to establish five innovative schools and the Beacon Primary School is one of them.

The school adopts a range of teaching and learning approaches to foster desired qualities in the pupils: creativity, confidence, curiosity, collaboration and a sound character. These approaches include differentiation and choices in learning collaborative and project based learning as well as holistic assessment.

Key aspects of the pedagogical approach and learning space design at Beacon Primary School, Singapore:



The school seeks to develop vibrant learning environments that include conducive, engaging and safe physical and virtual learning spaces which are flexible in addressing pupils' needs. The introduction of state-of-the-art technologies provide seamless and integrated support for learning programmes and assessment.

The assessment strategy of the school includes formative and summative assessments. Pupils receive regular feedback on their performance and the assessment modes include digital portfolio, reflection journals and oral presentations.

A small primary school in Shropshire, UK has by using ICT succeeded in integrating the school with the community, the parents and the out of school interests of the children. Although a slow process strong school leadership led to the whole community going online via the local pub. At the school all the children were equipped with PC lap tops and later on also with hand held computers. Nobody is forced to use the PCs, but the school exploits the technology in various innovative ways. For instance, whole class 'silent' debates are conducted MSN style covering a wide range of

subjects. Teachers at the school feel confident enough to encourage the children to experiment and they work in line with the interest of the children as far as possible.

At Thomas Hardy, a secondary school in Dorchester, each student does not have their own laptop to take home, but for each core subject there is a designated IT room, except science where sets of laptops are used. Whether manipulating images to illustrate a History essay or using computer aided design (CAD) in Design and Technology which characterises children's experience in their everyday lives.

Case study research show positive results on the potential of ICT-enabled learning for supporting low-achievers and young people with complex lives outside the education system, but they also highlight some important challenges. The "Notschool project" in the UK involved early school leavers in learning through the creation of a community of researchers who enter profile themselves on their own web-page, and communicate with their peers, with tutors and mentors. Tutors "encourage interest, prompt for ideas, set formal work, assess work, look around the community and tell their researchers what's new...". The project focussed on areas such as mathematics, literacy, dance, saxophone playing, juggling and the environment. Most participants who had very low levels of literacy when they joined Notschool.net improved their literacy substantially and over 50% of the young people achieved formal accreditation of some sort. This model, however, was thought not to work with seriously dysfunctional families. Furthermore, the initiative is difficult to upscale and mainstream, given the number full-time equivalent staff needed (circa 1 tutor per 20 students)<sup>9</sup>.

Another initiative analysed the use of computer-simulation techniques to boost the learning experience of low achieving pupils in the 12th grade. The learners were doing final electricity studies as part of a blend of general and vocational education in comprehensive high schools. The use of computer simulations of electronic systems, allowed the students to rapidly develop far more independent working procedures than those anticipated by the teachers. The pupils' dependence on the teachers reduced progressively. Another positive outcome was that that it transformed the teachers' self-perception from a technical-vocational perception to an emphasis on the development of pupils' thinking skills and self-esteem<sup>10</sup>.

Learning through social networks does not rely on one single mode of communication. It can be underpinned by a wide variety of ICT tools. The Internet is only one element and other different tools can be suitable for enhancing learning, e.g. mobile phones or interactive TV applications. The BBC 'Bitesize' initiative, as an example, provided revision materials via mobile phones, using a downloadable Java game and SMS text messages. The service became so popular that the BBC was forced to start charging for messages, which led to a sharp decline in use. (Naismith, L et al., 2004). The increased use of social software tools, virtual environments and sites opens interesting opportunities for learning. Experimentation with these alternative tools shows that not only people increases their social networking potential, but also that these networks provide an important platform to access, share, discuss and collectively evolve skills and competences<sup>11</sup>.

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<sup>9</sup> Davies, 2005

<sup>10</sup> Davies, 2005

<sup>11</sup> Demos, 2007

## Factors for success

Common for most of the above initiatives is that they are results of coherent and deliberate national, regional or school strategies to integrate ICT in learning processes and they involve strong leadership from school management, project managers or policy makers. Often these initiatives involve an open and participative process also linking to other schools and other countries. They succeed in meeting the pupils and learners where they are – building on their experiences and interests inside and outside the school while linking the work to the curriculum.

Furthermore, these initiatives provide the teachers with the skills and the flexibility to allow the children to experiment with the technology and to be creative, communicative and take ownership. The initiatives encourage teachers to take on new roles in terms coaching and guiding the pupils in the learning process and facilitating new methods of assessment – building on presentation, feedback and reflection.

Importantly, successful initiatives involve the community and the parents to ensure support, interaction and networking. Often it involves pupils from several schools working together over the net. These initiatives have also solved most problems in terms of codes of practice, required infrastructure, resources, capacity and maintenance of equipment. Where resources are scarce they do this by being flexible and adopting the pedagogies and learning to the facilities at hand.

## Taking inspiration from general characteristics of digital pioneers

Quote from a 12 year old:

*“At school, you do all this boring stuff, really basic stuff, PowerPoint and spreadsheets and things. It only gets interesting and exciting when you come home and really use your computer. You’re free, you’re in control, it’s your own world.”<sup>12</sup>*

Drawn from conversations<sup>13</sup> with young digital natives four shared characteristics can be seen as seeds of change for the ways all children could learn from their digital activities:

### *Self motivation*

Most of the NML are motivated by the idea of a wider public coming into contact with their creations. For children pursuing their own interests in the virtual environments it is the self determination that marks their behaviour out from school, family duties or part-time work.

### *Ownership*

A voluntary project for example which brings together a group of young people a couple of times per week to learn about and make films in Peckham (UK). There is adult supervision, but it is the teenagers who own the animation project. They make the decisions, talk about ideas, write scripts and then act, film and edit. They have a sense of joint ownership and they are about to launch their own channel on you Tube.

### *Purposeful*

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<sup>12</sup> Guardian Education (2007)

<sup>13</sup> Demos (2007)

NML always have an end goal in mind although they would not necessarily be recognisable by a formal assessment system. Their aim may be to design a web page or an online magazine or recording a dance and broadcasting it on the web to get critique from other dancing groups.

### *Peer to peer learning*

When asked about where their knowledge came from, many children indicated the importance of their interaction with friends, cousins, sisters and brothers. Many would not have gained that knowledge or expertise without peer to peer learning.

### **Concluding remarks**

So far huge investments in ICT infrastructure, in teacher training and development of online learning materials have had some impact in terms of usage of ICT in schools and progress in terms of achievement as many of the studies cited in this paper indicate, but it has not led to step change in the level of innovation. Pedagogical and learning practices have still not changed much and ICT is still primarily being used to administrate and support existing pedagogical practices. This paper highlights some of the more innovative initiatives and point to recent thinking in terms of how real innovation can be achieved.

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