ICTs-related policies and their impact on compulsory education: the cases of England and the Netherlands

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Abstract: In this paper the ICTs-related policies and their impact on compulsory education in England and the Netherlands are analysed and discussed. The aim is to provide a comprehensive overview, as well as identify strengths and weaknesses in the process of integrating ICTs into school teaching and learning. The analysis is based on eight interrelated dimensions and relies on recent data from national surveys and policy documents in these two national cases.

Περίληψη: Σε αυτό το κείμενο αναλύονται και σχολιάζονται οι πολιτικές ενσωμάτωσης των Νέων Τεχνολογιών της Πληροφορίας και Επικοινωνίας στην Αγγλία και την Ολλανδία, καθώς και οι επιπτώσεις τους στην υποχρεωτική εκπαίδευση. Σκοπός είναι να προσφέρουμε μια ολοκληρωμένη επισκόπιση, αλλά και να αναγνωρίσουμε τις δυνατότητες και τις αδυναμίες στην πορεία ενσωμάτωσης των τεχνολογιών αυτών στην σχολική διδασκαλία και μάθηση. Η ανάλυση βασίζεται σε οκτώ αλληλοσχετιζόμενες διαστάσεις και αντλεί πηγές από πρόσφατες ερευνητικές επισκοπίσεις και πολιτικά κείμενα των δύο αυτών εθνικών περιπτώσεων.

Introduction

During the last five years compulsory education in many European countries is experiencing the implementation of massive programmes aimed to integrate Information and Communication Technologies (ICTs) into school life, and in particular day-to-day teaching and learning. Although the type of education administration among European countries differs widely (from highly centralized to highly decentralized at the level of municipalities, provinces and territorial jurisdictions or independent school boards strategic), ICTs policies in schools are primarily designed, implemented and monitored by central government authorities and government-appointed bodies. While bottom-up initiatives for the integration of ICTs in schools are encouraged[1], the character, pace and degree of integration of ICTs in schools have been and continue to be driven by nation-wide educational policies with, in many cases, the substantial contribution of EU policies and initiatives.

ICTs policies throughout Europe share many common characteristics, aiming to develop and update strategic computing and networking infrastructures, to increase the numbers of schools, teachers and students who have access to computers and the Internet, to raise ICTs literacy among teachers and students, to provide schools with access to educational software and digital learning resources, and to reform school curricula (see, for example, Eurydice, 2001). However, there exist great differences in the degree and depth of the integration of ICTs in schools which are deeply rooted in the historic record of each country in forming and implementing ICTs policies in schools. While a few EU countries, such as the UK, the Netherlands and the Nordic countries have a long history of such efforts -they can be traced back in the early '80s and in some cases early '70s- for most of the EU countries it is only around five years now that undertook large scale initiatives. Thus, the new century found EU countries at very different levels of saturation, readiness, experience and knowledge gained by the implementation of policies related to the integration of ICTs in schools.

In this paper a number of dimensions related to the policies being implemented to integrate ICTs in schools are discussed on the basis of two national case studies: England and the Netherlands. The analysis and discussion of their efforts, successes and failures can potentially offer valuable insights to policy makers, administrators and teachers, especially those from other European countries which are in the early phases of the implementation of ICTs in schools. The analysis that follows is based on six interrelated dimensions:

Key policy initiatives and evaluation/monitoring strategies
ICTs in schools: administration, infrastructure and management
ICTs and school curricula and attainment targets
Education on-line and educational software
Teacher training on the use of ICTs
Teachers' attitudes towards ICTs
ICTs-related innovation policies
Types of use of ICTs in schools and their perceived impact

Case study 1: England

The *United Kingdom* took a lead in the introduction of computers into schools since the establishment of the Council for Educational Technology in 1967. During the '70s major development work was carried out by the

[1] Especially in cases where nation-wide large scale policies were only recently introduced, bottom-up initiatives preceded top-down initiatives.

National Development Programme for Computer Assisted Learning. The "Microelectronics in Education Programme" (MEP, 1980-86) was focused on the development of software and course materials to be used in the first microcomputers as well as staff development, while the "Micros in Schools" scheme, which was the first centrally funded initiative to invest heavily in ICTs equipment for schools, provided half the cost of one computer per school, on condition that the school raised the remainder of the funds itself. The MEP Primary Project was particularly influential, producing and distributing to every LEA[2] in the country a suite of "freely copyable" innovative software and accompanying training materials. During the decade 1988-1998, the National Council for Educational Technology (NCET) was responsible for leading IT initiatives in education (see Twining, 2002, p.4; Somekh *et al*,1999, p.50). The year 1998, where most of the large-scale policy initiatives were launched by European Governments, statistics published by the UK Department for Education and Skills (DfES) showed that in English primary schools the average number of pupils per computer was 18 while in secondary schools was 9. The same year, 90% of the primary and 85% of the secondary school teachers had received training in the use of ICTs, while more than 61% of them felt confident in the use of ICTs within the curriculum (see Statistical Bulletin, 1988).

In 1998 NCET was re-launched as the British Educational and Communications Technology Agency (BECTa) with a remit to carry through government policy for ICT. The National Grid for Learning (NGfL3) launched in 1998 is the recent UK Government's key initiative to stimulate and support the use of ICTs to improve standards, and to encourage new ways of teaching and learning. The NGfL Programme, which was the largest and most costly single initiative ever to be undertaken by local authorities in the UK, aimed to involve learners, the education and lifelong learning services, industry and local government in a vision focused on three key areas: a) stimulating the development of on-line and off-line digital content relevant to the UK education system, and developing an accompanying Internet portal – the NGfL web site, b) ensuring that schools have the means to access and use these resources effectively, and c) providing teachers with appropriate training opportunities so that they are able to incorporate the use of these technologies and resources into their everyday teaching. Today, there is a changing policy context as the NGfL programme is completing its life-cycle and its successor for the English schools, the "ICT in schools" programme (2003 to 2006) is starting to being implemented. The emphasis is shifting from building the ICTs infrastructure, schools' connectivity and teachers' professional development to issues of ICTs pedagogy and whole school improvement (see DfES, 2003).

The NGfL evaluation strategy is mainly based on two evaluation programmes, the ImpaCT2 and the NGfL Pathfinders. ImpaCT2 is a longitudinal study (1999–2002) involving 60 primary and secondary education schools in England and more than 2000 pupils. The NGfL Pathfinders is another strand of the NHfL evaluation strategy aiming to evaluate the roll-out of the NGfL in ten LEAs.

ICTs in schools: administration, infrastructure and management

NGfL funding is targeting at individual schools which are required to produce an ICT Development Plan on a yearly basis. Local Educational Authorities (LEAs) can hold back a small percentage of these funds for services they provide to schools; however, their main role is to manage the distribution of funds and monitor the effectiveness of schools' use of these resources. LEAs have developed their own strategies for the distribution of the NGfL funds depending on local needs and circumstances. LEAs' strategies are also influenced by their already established relationships with individual schools. Some LEAs have traditions of collaborative partnerships with schools while others do not and therefore it is an individual school's responsibility for making choices about connectivity, networking, hardware and software. Geography is also a critical factor as LEAs in large rural areas are difficult to manage discussions with schools and reach consensus in contrast to urban LEAs, especially small ones, where it is easier to have closer contacts with schools. Furthermore, the government established 11 Regional Broadband Consortia (RBCs) of LEAs to investigate the provision of broadband connections to schools through the procurement of an appropriate infrastructure. This situation have led to different implementation types, ranging from totally decentralized approaches where schools take all the responsibility to centralized approaches where LEAs contract a company over a long period of time to provide for networking, hardware, software and content (Somekh *et al*, 2002, p.10). This has an impact on schools, as centralized approaches mean that LEAs have greater negotiation power with Managed Service Providers but this leaves individual schools with less power to influence decision-making on services provided (for example what software to buy), while decentralized approaches leave room to schools to seek for solutions better adapted to their own needs but have less negotiation power and sustainability potential, and depend highly on their own skills for management and planning.

Overall, the latest statistics show that in England the year 2002 the average number of pupils per computer was 9,7 for primary schools and 6 for secondary schools[4]. Furthermore, over than 99% of schools are connected to

[2] Local Educational Authority.

[3] See http://www.ngfl.gov.uk/index.jsp

[4] It is characteristic that there are more computers than teachers in schools: in England the year 2002 the pupil/teacher ratio was 22,5 for primary schools (with an average class size 26,4) and 16,9 for secondary education schools(with an average class size 22). Source: National Statistics Bulletin (2003).

the Internet (9% of primary schools, 66% of secondary schools have broadband connections) (National Statistics Bulletin, 2002). However, in a recent survey on schools' connectivity, a sizable proportion of primary and secondary schools (between 37% and 39%) reported dissatisfied with the speed of access (BECTa, 2002, p.8). The findings of another recent survey indicate that slow, unreliable or difficult access to the Internet is the single most often mentioned cause of ICTs-related problems by the schools (BECTa, 2003, p.90)[5].
As a result of new infrastructure and networking requirements, primary schools gradually shifted from the organizational model of placing (stand-alone) computers in classrooms to "computer suites" i.e. computer labs where classrooms have access on the basis of a timetable. The latter was an already widespread model in secondary schools which tend to develop more for subject teaching. Wireless networking and interactive whiteboards offer great advantages in terms of organizational flexibility and there are schools which take advantage of it (Somekh *et al* (2002, p.23). Recent survey research data indicate that today the vast majority of primary and secondary education students (76% and over) use computers in a special computer room (Hayward *et al*, 2003, p.20).

ICTs and school curricula and attainment targets
Information and Communication Technologies in compulsory education are both integrated into teaching across the primary and secondary school curricula and a separate subject matter. The use of ICTs across the curriculum is a general teaching requirement. Teachers are expected to provide pupils with opportunities to apply and develop their ICTs capabilities through the use of ICTs tools to support their learning in all subjects. At key stage 1 (usually pupils aged 5-7), teachers are expected to use their judgement to decide where it is appropriate to teach the use of ICTs across non-core foundation subjects. In Key Stage 2 (7-to 11-years olds), Key Stage 3 (11-to 14-year-olds) and Key Stage 4 (14-to16-year olds) there are statutory requirements to use ICTs in all subjects, except physical education[6].

Learning about ICTs in Key Stages 1 and 2 is based on four aspects which also extend to key stage 3 and 4:
finding things out,
developing ideas and making things happen,
exchanging and sharing information, and
reviewing, modifying and evaluating work as it progresses.
During Key Stage 1, children are expected to explore, become familiar with and develop their confidence in using ICTs. In Key Stage 2, children are expected to be able to use a wider range of ICT tools to support their work in other subjects. The use of ICTs is closely related to the development of digital information searching, handling, assessment and presentation skills. The "Framework for teaching ICT capability: years 7, 8 and 9" exemplifying the national strategy for Key Stage 3 recommends all schools with Key Stage 3 pupils to provide at least 1 hour weekly for specific ICTs lessons. From Year 7 to 9, students are required to develop in-depth knowledge and skills on ICTs. Characteristically, among the objectives for Year 9 are for students to be able to construct, test and document the development of a database, to create macros, and use independently and efficiently a variety of software to combine, refine, interpret and present information.

Education on-line and educational software
Since it was launched in 1998, the NGfL web site has grown to over 362, 000 unique indexed documents. Resources for teachers include the VTC (Virtual Teacher Centre) and the Teacher Resource Exchange to which teachers are invited to contribute lesson ideas. The needs of pupils are also addressed in the Grid Club, which provides a range of activities and information for 7-11-year-olds. The dominant tendency is to open-up the market and leave to the local authorities and school boards the responsibility to select and buy educational software and other services by private vendors (often on the basis a list of approved products and services compiled by educational authorities at national, regional or local level). A recent example of public private partnerships in the UK is the "Curriculum Online" project. It was launched in 2002 by the UK Government aiming to provide digital course materials for all National Curriculum subjects; these materials are primarily developed by the private-sector educational publishing industry. "Curriculum Online" is characteristically identified by the DfES as "… the world's first partnership between the Government, leading public/private broadcasters and innovative software producers to provide materials for every curriculum subject to transform learning in schools7." Eligible schools are entitled to almost 1500€ as a starting point plus 15€ for each pupil at the school. This money is distributed in the form of electronic Learning Credits (eLCs), an e-payment mechanism so that schools can make on-line payments directly to suppliers.

Teacher training on the use of ICTs

[5] This survey was based on interviews with 2,501 representatives from maintained schools in England (a sample of approximately 12% of schools), between October-November 2002.
[6] See http://www.ncaction.org.uk/subjects/ict/inother.htm
[7] See http://www.dfes.gov.uk/pns/DisplayPN.cgi?pn_id=2001_0413

The provision of pre and in-service teacher training on ICTs, and support for professional development on the use of ICTs in schools were all main policy priorities during the past five years. These initiatives are quite wide and even include the provision of computers to teachers for free. For example, the recent "Laptops for Teachers" initiative8 aims to provide 2/3ds of the teaching workforce with laptops up to year 2006. Overall, because of the curriculum demands on the use of ICTs in all curriculum subjects, all teachers in England are required to know how to use ICTs. The "Qualifying to Teach" Standards and Requirements introduced in 2002 by DfES require from all parties involved to initial teacher training (teacher training providers, trainee teachers, as well as those who employ and support newly qualified teachers) to make sure that those awarded the Qualified Teacher Status "know how to use ICT effectively, both to teach their subject and support their wider professional role" (DfES and TTA, 2003, p.9).

The quality of pre-service teacher training on ICTs provided by the Initial Teacher Training (ITT) institutions is monitored and evaluated by the Teacher Training Agency (TTA), a government organisation responsible for the raising standards of teacher education and training. The TTA in 1998 introduced a National Curriculum for the use of ICTs in subject teaching; TTA is also supporting financially ITTs for purchasing software and hardware. Continuing professional development on ICTs is supported by the "New Opportunities Fund" (NOF9) programme (1998-2003) which allocated funds for training to every maintained school in the UK and targeted over 400,000 practitioners in England (around 750€ for every teacher). This training was essentially aiming to raise all teachers' ICTs skills to a minimum level and therefore teachers who already knew how to use ICTs could not benefit from it. However, the training was expected not to raise ICTs literacy among teachers (this was expected to be achieved through other sources, such as the schools' budget) but to develop their ability to use ICTs in their specialist subject. Each school could choose, on the basis of a "marketplace" model from 47 Approved Training Providers (ATPs), which included individual organizations or consortia involving LEAs, Universities, charities and businesses. Headteachers were responsible for deciding who is to get training but participation was voluntary.

The latest UK Government statistics show that in England the year 2002 the percentage of teachers who had got ICT training was 93% for primary school teachers and 73% for secondary school teachers while more than 75% of the teachers felt confident to use ICTs within the curriculum (see National Statistics Bulletin, 2002). However, according to the recent Ofsted10's progress report on ICTs in education, "NOF training remains unsatisfactory in its overall effect. Training in around six out of every ten secondary schools and half of the primaries has so far failed to tackle adequately those issues relating to the quality of ICT use in classrooms. Training materials for specific subjects at secondary level have often failed to excite teachers. In many secondary schools, the programme has simply ground to a halt" (Ofsted, 2002, p.3). A recent NOF report points out problems resulting from the operation of the "marketplace" model adopted for teachers' continuing professional development on ICTs. Many schools, although had control of budgets for in-service training for years, they proved quite inexperienced in assuming the role of "consumer" of training services provided by ATPs and of handling contractual relationships with them. As the NOF report points out "…the concept of schools as consumers able to demand a quality service or a refund seems surprisingly new to many of them" (NOF, 2002, p.15). On the other side, some ATPs also proved quite inefficient to provide teachers with high quality training on the use of ICTs for teaching specific subject matters. According to this report, "as became apparent over time, a number of LEAs involved in commercial arrangements did not have staff with the subject-specific expertise needed to undertake the specialist subject training role effectively, which left large numbers of participants with unsatisfactory training experiences." (o.p.). Furthermore, many participants begun training (focused primarily on professional development as it was earlier pointed out) without experience on the use of ICTs or access to them at home or school, conditions that were assumed as necessary to achieve the goals of the training. This problem, according to the same NOF report, shifted in some cases the balance of the training away from its original goals (o.p., p.26). Overall, it appears that inefficient or lack of training had a strong negative impact on how ICTs are used in schools. As the Ofsted report indicates, "where training has not yet started or has failed to meet the needs of teachers, the use of ICT is usually underdeveloped in schools. Too many teachers still lack confidence in using ICT and this is often made worse by a lack of appropriate software, unreliable computers and Internet connections, and insufficient technical support when things go wrong" (Ofsted, 2002, p.11).

Teachers' attitudes towards ICTs

As Somekh *at al* (2002, p.8) argue, "there has been an impressive shift in primary teachers' attitudes to the use of ICT in their teaching. It is now accepted as a normal and expected part of a primary teacher's role …In secondary schools there has not been the same universal change in expectations because ICT is still regarded as a

[8] See http://lft.ngfl.gov.uk/index.php

[9] NOF is a non-departmental public body, sponsored by the Department of Culture, Media and Sport (DCMS), responsible for managing and funding the teacher training programme, using policy directions drawn up in consultation with the DfES and the Teacher Training Agency (TTA).

[10] Office for Standards in Education. Ofsted's principal role is the management of the system of school inspection. Its inspects and reviews include schools, LEAs, initial teacher training courses, the private, voluntary and independent nursery sector, independent schools and service children's education and report on LEA-funded youth services.

specialist subject by many secondary teachers." According to the Ofsted progress report "the last few years have seen a sea-change in the general attitude of the teaching profession to ICT" (Ofsted, 2002, p.22). Furthermore, the latest statistics show that over 76% of primary and secondary teachers feel confident to use ICTs within the curriculum (National Statistics Bulletin, 2002, p.22).

ICTs-related innovation policies

Identification, facilitation and diffusion of effective practices and innovations related to the integration of ICTs in education is another critical dimension of ICTs policies in schools. The latter are linked to wider top-down policies targeting to raise the standards through institutional reforms, programmes and incentives aiming to encourage schools to innovate, spread excellence, share best practices and learn from each other. From an institutional perspective, the Education Act 200211, with the introduction of the "Power to Innovate", gave all schools and LEAs the opportunity to apply for exemptions from regulatory requirements in education law for a time-limited period, in order to pilot a specific innovative proposal. A related initiative is the establishment of the Innovation Unit, launched in June 2002 by the DfES White Paper "Schools: achieving success". In this white paper it is argued that "…the time is right to move further to extend the scope of our best schools and our best teachers to innovate and so to lead the way in transforming secondary education" (DfES, 2001, p.42). The main task of the Innovation Unit is to promote understanding of the innovation process and then identify strategies for making it powerful and systemic. In the primary education sector, the "Excellence and Enjoyment - A Strategy for Primary Schools", which was launched on May 2003, set the vision for the future of primary education; innovation is seen as a key point in realising this strategy: "schools should feel empowered to develop their own rich and varied curricula. We will try to cut burdens on schools, and encourage and support them in being innovative12". Based on the introduction of the "Power to Innovate" by the Education Act 2002, the strategy targets to the extension of freedoms and flexibility already allowed to primary schools and to support teachers to use these in innovative ways to raise standards. Overall, the above indicate innovation is seen as one of the main keys for raising the standards in schools and that innovation can be further encouraged by selectively relaxing institutional barriers to innovation, especially for schools already exhibiting a high degree of innovativeness and success.

Beyond innovation policies and initiatives at institutional level, programmes targeting to innovation and best practice sharing are under way. The "Excellence in Cities13" (EIC) is an "umbrella" programme, which aims at raising the standards of secondary education schools in major cities. Among the seven policy strands of the EIC is the establishment of a network of school-based "City Learning Centers" (CLCs) aiming to provide state-of-the art ICTs-based learning opportunities for the pupils at the host school, for pupils at a network of surrounding schools and for the wider community. They are further anticipated to act as test beds for innovation and new ways of teaching and learning, and to diffuse best practice amongst the local network schools, as well as the wider schools' community14. "Specialist Schools15" is another policy strand of the EIC launched in 1994 which encourages secondary education schools in partnership with private sponsors to focus on a chosen subject curriculum area and establish a distinctive identity, raise standards and drive innovation. One of the main findings of a recent Ofsted evaluation report on Specialist Schools is that for most of the 46 such schools that were inspected in 2001 the status of Specialist School "…has often been a catalyst for innovation and helped to sustain or accelerate the momentum of school improvement" (Ofsted, 2001, p.5). Increased access to up-to-date ICTs, teachers' exploitation of the full potential of ICTs resources and extended use of ICTs by students were identified among the features of good practice. "Leading Edge16" is the most recent programme aiming to identify, extend and spread innovation and excellence in the secondary sector. From April 2003, "schools at the cutting edge of innovation and collaboration will be selected from amongst the country's best schools to act as a lever to transform secondary education, to engineer the growth of collaborative learning communities and federations, and to promote innovation, research and development to push the boundaries of current teaching practice17".

Institutional reforms and programmes are also accompanied by other related initiatives. The BECTa "ICT in Practice Awards18", is one such initiative aiming to identify and diffuse models of excellent practice. The "innovation and change" award is every year given to individuals and teams who used ICTs to inspire and effect change that transforms the teaching or learning environment and raise standards in its area of application. Criteria for nomination are for individuals or teams to demonstrate that they are transforming the teaching or learning environment in order to raise standards, they have an understanding of how change was introduced

[11] Accessible at: http://www.legislation.hmso.gov.uk/acts/acts2002/20020032.htm

[12] Quotation from the "Excellence and Enjoyment - A Strategy for Primary Schools" document; accessible at http://www.dfes.gov.uk/primarydocument/

[13] See http://www.standards.dfes.gov.uk/excellence/

[14] See http://www.standards.dfes.gov.uk/excellence/policies/CLC/?seclist=1023

[15] See http://www.standards.dfes.gov.uk/specialistschools/

[16] See http://www.standards.dfes.gov.uk/leadingedge/

[17] Quotation from http://www.standards.dfes.gov.uk/leadingedge/what_is_leading_edge/?version=1

[18] See http://www.becta.org.uk/corporate/awards/practice_awards/index.cfm

(aims and strategies), how ICTs contribute to change (impact in measurable terms) and other qualities required to implement change (relevance, sustainability and replicability, visions).

Types of use of ICTs in schools and their perceived impact

According to the ImpaCT2 longitudinal study (1999-2002), "classroom observations indicate that when teachers use ICT in lessons (such as English, science or history) they often focus on basic rather than higher-order thinking and reasoning skills. Link Researchers report that the use of the computer for 'copying out in best' is still common, and this practice misses the greater potential for learning" (ImpaCT2, 2001, p.14). Furthermore, the NGfL Pathfinders preliminary evaluation report on how ten LEAs identified as following innovative ICTs strategies implemented the NGfL programme revealed that "a few teachers are finding innovative and productive ways of integrating ICT with their teaching, but for many – particularly in secondary schools – use of ICT appears to push their teaching towards being directive, routine and lacking in imagination. In classroom observations subject teachers often only talked to pupils about technical issues relating to hardware and software, rather than the subject that was the supposed focus of the lesson. The reasons for this need further exploration but are likely to be linked to both the school's understanding of the requirements of the National Curriculum and the deployment of computers in specialist ICT rooms away from departmental bases as much as to teachers' lack of expertise or confidence with ICT" (Somekh et al, 2001, p.15).

The final NGfL Pathfinders report indicates that primary school teachers mostly use word processing regularly, as well as the Internet for lesson planning. The use of databases and spreadsheets is also widespread. The use of the Internet and word-processors is also common among secondary education teachers, along with PowerPoint (Somekh et al, 2002, p.23). In a recent survey entitled "Young People and ICT 200219", data show that pupils at Key Stage 2 (aged 7-11), mostly use computers in their school to draw pictures (59%), write stories (54%), play games (47%), type letters and connect to the Internet (45%). The use of educational CD-ROMs is not as widespread (35%) as the previous activities. Finally, only 17% of the pupils reported that they use computers in schools to do their homework (Hayward et al, 2003, p.20). Pupils aged 11 to 14 (Key Stage 3) reported that while in school they mostly use word-processors (65%) –mainly to write essays and reports, spreadsheets (49%), graphics/simulation packages (34%) and databases (32%). The least used applications are multimedia tools and e-mail (13%) (see o.p., p.21). In yet another research entitled "Connectivity Survey20" it is revealed that schools mostly use school-produced digital learning materials stored locally in the school network (57%), and other free content either produced from LEAs or published over the Internet from other sources (over 47%). It is interesting that only 13% of the schools reported that they buy content from publishers of learning materials over the Internet (for example managed/virtual learning environments) (see BECTa, 2002, p.13). The Internet in particular, is used as a huge database of digital learning materials. Working with the Internet usually involves whole-class research (over 39%). Only 1%, however, of the schools make use of the Internet on the basis of collaborative work (see o.p.).

The statistics published by the National Statistics Bulletin (2002) show that apart from the "Information Technology" subject matter where the use ICTs is required, primary schools report that they make "substantial" use of ICTs for teaching English (65%), Mathematics (48%), and Science (26%). Secondary education schools make substantial use of ICTs in Design and Technology (56%), Science (29%) and Music (26%). However, when these findings are compared with those for the year 2001 it appears that in 2002 less schools report that they did not use ICTs but also less schools report that make "substantial" use of ICTs in curriculum areas than in 2001 (see o.p., p.23).

Organizational arrangements seem to shape the pattern of access to ICTs for teaching purposes. According to Somekh et al (2002, p.23), the way ICTs have been organized in schools (in labs or spread in classrooms) is very likely to affect the nature of ICTs curriculum offered by a school. In schools with suites there is a tendency to teach computer skills in isolation from the general curriculum. As Somekh et al argue "even when taught within a subject, if access is less than weekly the activity will be an addition to the 'real curriculum' and not integral to the learning process for that subject" (o.p.).

An analysis of the Ofsted data from inspections back in 1998-99 indicated that there was a consistent trend for pupils in schools with better ICTs resources to achieve better grades for English, mathematics and science in Key Stage 2 national tests (see BECTa, 2000, p.7). In the 115 schools that have been commended by HMCI21 for high standards or good improvement, "…ICTs are being used widely in a range of subject areas with positive impact" (BECTa, 2000, p.25). In the recent Ofsted report on ICTs in schools, it is further argued that broadband connections and improved reliability of hardware has affected teachers' perceptions on what they can achieve and has further raised the overall level of ICTs use in schools (Ofsted, 2002, p.5). However, it is not clear how better ICTs resources or use leads to improved attainment and what is the relative impact of other factors, such

[19] This survey was based on 2073 interviews with parents and their children (aged 5-18) and was conducted in September-October 2002 (see Hayward *et al*, 2003).

[20] This survey was based on 518 interviews (mostly head teachers for primary schools and IT coordinators for secondary education schools) and was conducted between March and June 2002 (see BECTa, 2002).

[21] Her Majesty's Chief Inspector of Schools, heading Ofsted.

as socio-economic circumstances. It is characteristic, for example, that schools in more privileged areas tend to show better attainment levels, regardless of other factors (BECTa, 2000, p.37).

On the other side, research findings suggest that the majority of teachers believe that ICTs have a positive impact on school learning; however, secondary education teachers appear to be more sceptical on this issue. In a recent survey, carried out by BT Education22 in 2001, teachers reported that they feel overwhelmingly that technology is helping to raise standards. Ninety eight per cent of teachers said that technology improves the quality of their teaching, while 95% believe it boosts pupil attainment and 95% agree it boosts pupil employability. The final NGfL Pathfinders report indicates that most primary school teachers believe that ICTs would have an impact on pupils' learning and attainment23. However, secondary teachers appeared to be mixed in their views regarding the impact of ICTs on learning, ranging from very positive to uncertain but also to negative ones. The latter suggested that the use of ICTs had a negative impact on literacy and numeracy (see Somekh et al, 2002, p.23-4). The National Statistics Bulletin (2002, p.24) data show that primary school teachers believe in most curriculum subjects the use of ICTs offer "some" benefits. It is only in English, apart from Information Technology, that the majority of teachers (53%) believe that the benefits are "substantial". On the other side, the majority of teachers believe that there are no benefits from the use of ICTs in Physical Education (95%), Modern Foreign Languages (73%), Religious Education (71%), Music (66%), and Design and Technology (57%). Many also believe that this is true for Humanities (40%), Geography (28%), and History (25%). In secondary education there is no course apart from Information Technology that the majority of teachers believe that ICTs provide "substantial" benefits. For most of the courses the majority of teachers believe that ICTs provide "some" benefits, except Physical Education where the majority (63%) believes that there are no benefits.

Case study 2: The Netherlands

The Netherlands' recent policy initiatives are to be found in the 1997 plan entitled "Investment in the Future"(*Investeren in voorsprong*). By that year the average number of pupils per computer was 23 for primary schools and 15 for secondary schools; however, only 23% of the primary schools had internet connection, especially when compared to the respective statistic for secondary schools which was 72%[24]. The "Investment in the Future" plan was focused on reinforcing the role of ICTs in primary and secondary education, vocational and adult education, and in-service teacher-training programmes through centralised initiatives and direct funding to schools. The memorandum "Education On line 1999-2002" (*Onderwijs on line*) describes the policy targets for this period. This document distinguished between four main policy focus areas: a) professional development, b) educational software, c) management of ICTs infrastructure, and d) the Knowledge Net (*Kennisnet*)[25].

The *Education Inspectorate* has the responsibility to monitor and evaluate schools in terms of cost effectiveness, as well as on whether core aims for ICTs are being achieved and how ICTs are contributing to the quality of the education provided. The "ICT Onderwijsmonitor[26]" is a yearly survey ordered by OCenW and the Inspectorate to monitor and evaluate the degree of ICTs integration in primary and secondary education, vocational, adult and higher education, and teacher training institutions; four dimensions (policy, software, infrastructure, and expertise) are of special interest, focusing in particular on the identification and study of factors that hinder or contribute to the integration of ICTs in educational institutions.

ICTs in schools: administration, infrastructure and management

Although schools are advised to make the introduction of ICTs part of the school's overall policy plan, the highly decentralised nature of the Dutch educational system allows schools to decide how to spend the ICTs ear-marked funds they get from the government. Schools can, for example, use the money for in-service teacher training on ICTs, for new educational software, for hardware and/or to pay the cost of employing ICTs administrators or co-ordinators. However, it is the responsibility of the ministry to come up with quality requirements, to determine the direction of development and suitable legislation, to ensure that the schools receive sufficient resources and get the support they need to fulfil their responsibilities. Day-to-day management of ICTs in schools are generally carried out by the ICTs coordinator who also is working as teacher. According to the "ICT Education Monitor 2000-2001", "resolving technical problems demands a great deal of the ICT coordinator's time, and staffing is therefore not surprisingly seen as an important stumbling block at the majority of schools" (OCenW, 2002, p.9).

The latest Education Monitor survey (2002-2003) data indicate that the average number of pupils per computer dropped to 7,2 for primary schools and 9,2 for secondary education schools and that 91% and 97% of the computers respectively are connected to an internal network. However, 54% and 41% of the primary and

[22] See www.bteducation.com
[23] Italics added.
[24] Source: The Dutch Ministry of Education, Science and Culture (OCenW); available at http://www.ictonderwijs.nl/eenet/nl-0500.html
[25] See www.kennisnet.nl.
[26] See www.ict-onderwijsmonitor.nl

secondary school computers respectively have a Pentium II processor or lower (12% of primary school computers have 486Mhz processor or lower) and they have soon to be replaced (see ICT in Figures, 2003)27.

ICTs and school curricula and attainment targets

ICTs in Dutch education are both a separate subject matter and also a tool for teaching other curriculum areas. To illustrate how far the integration of ICTs into Dutch compulsory education has gone, the compulsory attainment targets for basic secondary education[28] in the Netherlands for the period 1998 to 2003 (OCenW , 1998) will serve as case study. Attainment targets describe the standards that students are expected to attain in terms of knowledge, understanding and skills. The requirement for schools is that they use the attainment targets as minimum levels of achievement for the completion of basic secondary education.

Basic secondary education in the Netherlands is based on two types of attainment targets: general attainment targets and attainment targets for each of the 16 disciplines included in the new curriculum. The review of the general attainment targets for basic secondary education shows that only in one (the "Learning to learn") out of six general targets, it is quite evident that ICTs should be integrated, where appropriate, to the teaching and learning of all disciplines. Further review of the references made on the use of ICTs on each basic secondary education discipline[29] in the Netherlands indicates that the use of ICTs is seen as essential to the attainment of general educational targets, and in particular the "Learning to do" and "Learning to learn" targets. However, specific descriptions of skills related or requiring the use of ICTs are not included in 7 out of 15 disciplines; for some of these disciplines, such as *Language*, *History and Politics*, and *Biology,* it is not easy to see the reasons why the use of ICTs have not been included. It is also interesting that in the *Physics* and *Chemistry* discipline the use of ICTs is mentioned in just a sub-target of one out of nine fields of targets. In total, only in 11 out of 79 fields of attainment targets the use of ICTs is encouraged or is a requirement for their attainment. The disciplines where the use of ICTs is a requirement in more than one field of targets are *Mathematics* and *Technology* but only in *Geography* there is a quite detailed list of skills which are based on the use of ICTs. Most of the ICTs-related skills are quite basic: a) Information access and handling skills (use of electronic reference resources such as dictionaries and media libraries), and b) skills related to the use of "simple computer programmes" (problem-solving for Mathematics, painting and drawing applications for arts etc), making it quite difficult to see how general attainment targets such as "Learning to learn" can be achieved. The attainment of skills that go beyond learning how to use computers to involve interpretation, identification of relations between data, and decision making are only cursorily mentioned in some fields in *Mathematics*, *Geography*, *Economics*, *Technology* and *Care*. No meta-cognitive skills are specially related to the use of ICTs. It should also be stressed that while attainment targets of some disciplines are explicitly connected to attainment targets of other disciplines in order to support interdisciplinarity, no attainment target for the *Information Technology* discipline is explicitly related to attainment targets of other disciplines (for example, the IT target "pupils should be familiar with the practical applications of computerized data processing, including software for word-processing and data file management which have an important role in modern society" is not connected to any other discipline although it is quite apparent that it can).

Education on-line and educational software

The Knowledge Net is a non profit organisation responsible for the Kennisnet portal and the infrastructure supporting it. Until 2002, more than 11,000 schools and other educational institutions, libraries, museums and content providers -a total of some 2.5 million users- were connected to the Internet via this network. Kennisnet does not itself produce educational content. The portal uses a License Management System to distinguish between validated users of the web site who have paid to gain access (2€ per user per year[30]) and others who have not. Private sector suppliers, such as publishing houses, offer certified on-line content accessible through the portal; in this way the Knowledge Net also contributes to the creation of an educational market for digital content and other educational services. However, according to the "ICT Education Monitor 2000-2001[31]", "roughly half of the teachers see the shortage of educational software and its poor match with their own teaching methods as the biggest problem" (see OCenW, 2002, p.15). In the "ICT after 2002" White Paper published by OCenW in May 2002, it is pointed out that teachers, students and parents are concerned with the quantity and quality of the digital educational materials. According to this White Paper, among the factors which may contribute to this are: the large number of suppliers (68 in lower secondary education only) competing on a relatively small educational market, the slow change in traditional educational methods, the insufficiency in e-

[27] Characteristically, the 2000-2001 Monitor survey data indicated that almost half of the primary school computers had a 486Mhz processor or even older (see OCenW, 2002, p.8). The comparison with the latest data indicates that primary schools do have in place mechanisms for ICTs replacements.

[28] Basic secondary education in the Netherlands lasts from two to three years, and provides a broad, general education for all students aged between 12 and 15 years.

[29] Except from the "Information Technology" discipline because what interests us in this context is how the attainment targets set encourage the integration of the use of ICTs not solely in ICTs-specific courses but in all curricular areas.

[30] This amount is based on the total number of students and teaching staff of a school.

[31] In total 317 and 174 primary and secondary schools respectively participated in this yearly questionnaire-based survey; the latter also also included 7 case studies for each education level.

payment methods and the relative unwillingness of people to buy educational services through such methods, the lack of guarantees on the quality, and the reliability and performance of the services and products offered (OCenW, 2002a, p.18). In the Netherlands public private partnerships are seen as having "growing importance" and mainly realise through sponsorships and offers in terms of hardware, software and expertise transfer[32]. Furthermore, educational publishing companies (such as Malmberg, Wolters-Noordhoff, Zwijsen, Swets & Zeitlinger, Thieme, TeleacNOT and others) are important players on the Dutch educational software market being responsible for most of the software that is now used by schools[33].

Teacher training on the use of ICTs

More than half of the primary teacher training institutions have ICTs policy and plans and virtually all teacher trainers use computers in the teaching process. However, there are still institutions which do not have ICTs policies; this is also true for intermediate secondary school teacher training centres. Furthermore, collaboration with schools for improving the quality of pre-service training, the integration of ICTs into ICTs into teaching/learning and the development of teaching materials "…are not being widely exploited" (OCenW, 2002, p.40).

In-service teacher training on ICTs is offered by training institutions outside schools but schools are responsible for the ICTs skills of the teaching staff and it depends on the school if it wants to have every teacher trained. Two alternative testing instruments are available for school teachers to get (optionally) certified: the ECDL and the 'Digital Educational Driving License' (DRO). The Netherlands teacher training policies are currently concentrating on the second training cycle which is about the educational use of ICTs (Meesters and van der Plas, 2002, p.21).

According to the "ICT Education Monitor 2000-2001" survey report, while most primary school teachers felt competent in basic ICTs applications (word-processors, Internet browsers and e-mail), the majority were not familiar with databases, spreadsheets and presentation programmes (OCenW, 2002, p.13). The most common problems faced by teachers is the lack of time and the match between the in-service training offered and their own wishes and teaching practice (o.p., p.7). More than 40% of the secondary education teachers considered themselves as having "excellent" computer skills; however, over 60% also believed that they have no or just a few skills related to the "didactic" use of ICTs, meaning "…using the computer as a teaching aid, using computer programmes for their own subject area or organizing lessons in which ICT is used" (o.p., p.19). The latest Education Monitor survey (2002-2003) shows that ICTs coordinators believe that around 60% of the secondary education teachers are not competent in the "didactic" use of ICTs; this percentage is considerably lower for primary education teachers where 67% are considered by ICTs coordinators as competent in the use of ICTs for teaching and learning34.

Teachers' attitudes towards ICTs

The "ICT Education Monitor 2000-2001" (see OCenW, 2002) findings indicate that primary school teachers have positive attitudes towards ICTs believing that ICTs makes both teaching an learning enjoyable. However, the opinions of secondary education teachers "… are somewhat divided: here it seems that a relatively large group remain to be convinced of the added value of computers in education" (o.p., p.7). The latest Education Monitor survey (2002-2003) shows that many secondary education teachers continue to be unconvinced about the educational value of ICTs. According to the schools' ICTs coordinators who participated in this survey, more than 40% of their colleagues are sceptical on the educational use of ICTs (see ICT in Figures, 2003).

ICTs-related innovation policies

Since the '70s primary and secondary education schools have been encultured on pupil-centred pedagogic theories and practices. However, because schools and individual teachers enjoy great freedoms on their pedagogic methods and also because there is a variety of school types in terms of orientation (for example, Public, Catholic, Protestant, Reformed and lately Islamic), there is a relatively limited uniformity in a single pedagogic model. Nevertheless, the introduction of ICTs in schools is seen as a catalyst for change in terms of methods, content, organization and teaching-learning practices. "ICT School Portraits[35]" is one of the main current initiatives to identify and diffuse innovative uses of ICTs in schools. Until today 40 such "portraits" have been created in three thematic units: thematic portraits on a certain subject or theme, local cooperation portraits and portraits of schools abroad. International cooperation at various education levels is strongly supported. There is a widespread ethos among schools to develop links with other schools abroad and to collaborate in the context of EU programmes and initiatives, such as the European Schoolnet (EUN). Furthermore, the OCenW supports international cooperation at the policy making level not only within EU but also at other levels. A recent

[32] Source: The Netherlands Ministry of Education, Science and Culture; accessible at http://www.ictonderwijs.nl/eenet/nl-0700.html

[33] Source: The Netherlands Ministry of Education, Science and Culture; accessible at http://www.ictonderwijs.nl/eenet/nl-0900.html

[34] See ICT in Figures (2003).

[35] See http://www.onderwijsinspectie.nl/ictschoolportretten/index_engels.html

example is the establishment in 2001 of the "ICT-League", an informal network of policy makers and experts from the Nordic countries and Canada, which particularly focus on the pedagogic use of ICTs in schools and e-learning (see OCenW, 2002b).

Types of use of ICTs in schools and their perceived impact

According to the 2000-2001 survey report (OCenW, 2002), virtually all primary school teachers made some kind of computer use for teaching purposes (mostly word-processing but also the internet), particularly for teaching Dutch language, arithmetic and geography. Secondary school teachers used computers for preparation, teaching and educational support. However, more than 15% of the teachers did not use computers at all. Pupils, on the other side, used computers for completing assignments or as tools in project-based work, for example to search to the internet for information. The Education Monitor survey (2002-2003[36]) data indicate that almost 70% of the primary schools use educational software as an add-on to their teaching practices but more than 75% of the schools' ICTs coordinators believe that in the future educational software will become an integral part of teaching practice. The data from latest Education Monitor survey further indicate that secondary education teachers are divided in two large groups; almost half of the secondary education teachers use ICTs for teaching (mainly word-processors, Internet browsers and e-mail), while the other half do not use or just started to use them. Characteristically, only around 30% of them use educational software for teaching. ICTs coordinators believe that most teachers now use ICTs as an add-on to their teaching (63%) but in the future most teachers are expected to use it as in integral part of their teaching (77%).

Furthermore, a point made by the 2000-2001 survey report (see OCenW, 2002) report is that more didactically innovative use of ICT and the use of ICT for supporting or communicating with pupils were much less common practices in schools. A reason offered was that many in-service and pre-service teachers, as well as teacher trainers did not feel very confident in using ICT for teaching purposes. According to the OCenW report "from the perspective of achieving progress in didactic innovation in education using ICT, this can be described as worrying" (o.p., p.7). Signs of innovative use of ICTs come from the 2002-2003 survey where the data showed that although the majority of primary school teachers (more than 60%) use ICTs for practice and remedy purposes, a quite sizable percentage of them (around 30%) use also computers for open-ended learning tasks where pupils assume responsibility for their learning. Nevertheless, it appears that teachers are unimpressed by the "impact" of ICTs on their teaching. Almost 70% of the primary schools reported that the use of ICTs had no or little impact on their teaching practices. Only 2% of the schools reported that the use of ICTs had a strong impact in achieving their teaching/learning aims (see ICT in Figures, 2003).

Further discussion

As the data presented and the issues raised in the previous pages indicate, the integration of ICTs in compulsory education is a complex, long-term process, the success of which depends on many interrelated factors. In this paper the focus was on those factors that are education-specific (educational policies, infrastructure, management, human resources etc); however, when these are seen from a wider perspective it becomes more clear that the integration of ICTs in schools is driven not primarily from pedagogic visions about the best ways to educate the new generation but economic and social priorities, needs and policies. Powerful socio-economic and ideological-political visions essentially shape the landscape for the integration of ICTs in schools. These are related to raising the competitiveness in the global economy through enhancing the capacities of individuals, businesses and whole nations to create and exploit knowledge (the "knowledge-based" societies vision) and paving the way for greater involvement of the worlds of economy and work in education.

The above create huge tensions since they challenge education in many and sometimes conflicting ways. The implementation of top-down large scale policies for the introduction of ICTs in schools, for example, contrasts sharply with parallel policies which provide schools with more autonomy to manage their budgets and to shape their curricula and teaching methods. Thus while in theory schools, on the basis of their extended freedoms, can choose where to spend the funds they get for improving the quality of education they offer to their children, they are actually under heavy direct and indirect pressure to invest on ICTs. A characteristic example is teacher training on ICTs. The implementation of huge ICTs training programmes targeting the entire teacher workforce within a relative short period of time (no more than 3 years) meant that schools had no other choice but to take part en masse, irrespective of their other training priorities and needs. It also meant that schools did not have but limited power to shape the quality of the training provided. The provision of greater autonomy essentially pushed schools to the world of free market where they should act as "consumers" of goods and services. The problem is that neither the schools nor the market have so far proved mature enough to deliver. Headteachers and local school administrators found themselves in the position to have to deal with internet providers, hardware and software vendors and digital content developers with little or no training at all. Software houses, on the other hand, were traditionally more focused on the profitable home market and are only recently, with the massive introduction of ICTs in schools, are turning their interest in the school market. As the recent "Learning to

[36] Source: ICT in Figures (2003), pp.15-18.

Change: ICT in schools" OECD report points out "… commercial understanding of specific curriculum needs is frequently inadequate, and the market is under-developed" (OECD, 2001, p.46). Training services provided by for profit organizations and consortia also often lack the expertise to provide teachers with curriculum-specific training on ICTs, leaving many teachers, particularly secondary education teachers who are specialists and need training on how to teacher their courses with the use of ICTs, with unsatisfactory learning experiences.

While the implementation of massive programmes both in England and the Netherlands achieved to considerably raise the quantity and quality of ICTs infrastructure and support in schools, as well as teachers' basic ICTs literacy and confidence, it appears that schools, particularly secondary education schools, still use ICTs as an add-on rather than as an integral part of their teaching practices. School curricula and attainment targets also contribute to this phenomenon since, despite the reforms introduced, still do not demand from either teachers or students develop such skills and knowledge that could not be developed without the use of ICTs. As a consequence it is difficult for teachers to appreciate the added value of the use of ICTs.
This period is a crucial one as a new round of ICTs-related initiatives are starting to be implemented, now with an emphasis to "pedagogy". While it is a valuable practice to evaluate the successes and failures of the massive programmes of the period between 1998 and 2003, not only in England and the Netherlands but all around Europe, it also could be useful to rethink about the logic and effectiveness of "top-down" massive strategies that so far monopolised policy making in this area. Perhaps it is time to decentralize not only responsibilities but also decision making and leave room to schools to find their own ways to respond to the challenges that ICTs bring into teaching and learning. As the examples of England and the Netherlands show, top-down massive programmes can bring computers into schools and provide basic training to hundreds of thousands of teachers within a relatively short period of time but they cannot necessarily change their practices or at least not in the scale that is expected from the sheer volume of the investments. What is the real challenge for policy making is to truly involve the world of schools (teachers, pupils, parents, administrators and local communities) in a process where their own learning priorities and needs shape the ways ICTs are being used, in other words to help schools take ownership of (not simply to buy) technology and genuinely respond to the challenges of wider socio-economic visions and trends.

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