From Learning to Use Towards Using to Learn

About Lessons to be Learned from ICT-Education in the Netherlands

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Abstract. Implementing ICT in secondary education and teacher training is not a complete success story in the Netherlands. One of the reasons is that for a long time the focus was on the system and learning to use the machine. By introducing the European Computer Driving License (ECDL) and it's educational variant in the 1990's the focus remained on the machine and the use of general applications we know from MS-office. Although a lot of effort is put in the training of teachers still less than 50% of the secondary school teachers in the Netherlands use ICT in there lessons. On the basis of the experience of more then 20 years of ICT implementation and research in cognitive learning theory, it is possible to give an account of this. Using to learn seems more and more a condition for learning to use.

1. Introduction

A survey in the Netherlands in 2005 shows that in secondary education (from 12-18 years) in 2005[1], 47% of the Dutch teachers use ICT in there lessons. What we see is a very slow growth in the use of computers in the learning process within the schools. In 2002 66% of the interviewed teachers expected that they would use ICT within three years. From this same 2002 survey we learned that in fact 41% of the teacher used ICT in there lessons. It seems almost as if the use of ICT is slowing down in secondary education in the Netherlands. The situation in primary education seems better. In 2002, 72% of the primary school teachers were using ICT and they

[1] TNS NIPO onderzoek ["research"] januari 2006 in opdracht van St.Ict op school

expected that in 2005 93% would use ICT. Reality is that in 2004 84% used ICT which is a nice figure compared with secondary education.

What could be the reason of this difference in use between primary and secondary education? The large majority of teachers in primary as well as in secondary education have positive attitude towards the use of ICT in teaching.[2]

As I will point out it is not availability of hardware or the access to the internet. Is it the software? Alternatively, has it to do with training and the professional development of teachers? That seems more likely if you consider that more than 60% of the teachers have no skills or skills on a very beginners level in the use of ICT in education as a added value.[3]

In this paper, it will be tried to show that there are reasons to believe that it is the combination of lack of innovative software and the way the professional development of teachers was setup in the Netherlands that can explain the slow implementation of ICT in secondary schools. ICT was far from every day practice: teaching in a regular subject area.

2. Training and the Curriculum During the "Learning to Use" Approach

The formal introduction of information technology in Dutch schools goes back too 1984. Dutch government presented in that year a plan to parliament called the INSP (INformatics Stimulation Plan)[4]. It was an overall plan with a special education paragraph. In the years 1984-1987, the focus was on secondary education. The approach toward the school was integral: every school should be facilitated with hardware in a computer classroom, teachers should be trained and educational software developed. The idea was that in every school three teachers should attend training. Afterwards they would disseminate there knowledge and skills to their colleagues in their schools. This did not happened enough though.

Training was not perceived as adequate by many teachers. In their rapport, the school inspectors[5] mentioned several problems: some teachers who already taught information science for several years and were pioneers within their schools experienced that they knew more then there trainers. On the other hand there were teachers send to the training by there school management who hardly ever used a PC. So a generic approach was not satisfying. Schools received start package in the

[2] ICT Education Monitor 2003-2004. Neut, Irma van etc. *ICT in the Netherlands. Learning for the future.* Nijmegen/Tilburg 2004. Facts and Figures 2003/2004. p. 39 also on see http://www.ict-onderwijsmonitor.nl/

[3] See publication referred to in note 2 p.37

[4] *Informatica-Stimuleringsplan. Onderwijsbijlage. Versnelde invoering van informatietechnologie in het onderwijs*. Ministerie van Onderwijs en Wetenschappen. Zoetermeer, januari 1984.

[5] *Het Nivo-project in de scholen.* Inspectierapport 25. Zoetermeer 1988.

1980's with a special spreadsheet program (PC-calc), a word processor (PC-Type) and a D-base program (PC-file). Teachers were learned to use these tools.

Almost 70% of the content in the "basiscursus" handbook[6] was technology orientated with special attention for IT-applications, programming and system development. But it was not all technology. A special chapter about the information society should also be mentioned. For many teachers there was not much of a relation with there subject teaching. A lot of theory not much attention for the pedagogical and organizational aspects teachers complained.[7]

Because of the top-down approach there was clearly not a situation as mentioned by Fulhan in his advisory report for the Canadian government about introducing new educational technologies (NET). In the second part of the report, he states:

> "The best models of use will grow out of local implementation. The strategic ideas in this report are centrally built around the idea of "backward mapping. Good implementation must rest on what people in schools are really up against. Thus, the Ministry needs to engage local school personnel in an active collaborative search for the best ways of using NET. Cumulative, shared learning about NET is the key of the process."[8]

Although the proposed curriculum was certainly more than just "Learning to use", as you will later see, fact is that what happened in the school was often just "Learning to use". One of the most popular schoolbooks Babbage, was (but there are still new editions) a "non-nonsense" course (as the publisher calls it) that students could use individually in combination with there computer, almost without a teacher. It learns them to use a PC and some of its tools.

3. Informatics as a New Subject Area in Secondary Schools

Schools for secondary education started in 1984 with a new experimental subject area called "civil information science" (burgerinformatica) a project for students form 12 – 16 years. The national institute for curriculum development SLO coordinated the project. The curriculum was a combination of computer awareness and computer literacy. Its main general purpose was "The development of knowledge and skills that makes it possible for students to react adequate in

[6] Casimir, Gerda and Cor Nagtegaal. *Nivo-basiscursus Informatiekunde.* Zeist, 1987

[7] See note iii

[8] See Fullan, M., and M.B.Miles ands S.Anderson. *Strategies for implementing microcomputers in schools: the Ontario Case. Ministry of education, Ontario, April 1987.* quoted by Jan Timmer in his study about the use of educational software in secondary education in the Netherlands. Opstapreeks nr. 32. Zoetermeer 1991.

situations where the use of data-processing systems where possible ore necessary. And students should be able to make critical evaluation of the social meaning and impact of the use of such systems."[9]
This general goal has been specified in five sub goals that dominated the information science curriculum for the next twenty years.

1. Learning to work with, in general (collect, select ,evaluate, process and distribute data without computers)
2. Learning to work with data processing systems, the computer as:
   i. a tutor, and learning machine i.e. in some role as a teacher
   ii. a tool (word processor, calculator etc.)
   iii. constructor i.e. using the programming language Logo
   iv. an object in terms of it's hardware features: open it up and show it's components and where they for.
3. Gaining insight in some important applications of information technology i.e. systems for seat reservation, human-machine interaction.
4. Gaining insight in some of the implications of IT for society: e.g. privacy, lose of certain jobs etc.
5. Developing insight in the basic principles of data processing systems.

Because of these goals, four areas for learning were identified.

1. Use of applications
2. The social implications
3. Problem analysis and programming
4. Building principles ('architecture") of hard- and software

After the school reform in the Netherlands of 1993, Informatiekunde (the new name) became a school subject with a curriculum of 80 hours. However, it was practiced between 20 and 40 hours on the school timetable. The school inspectors also claim in a report[10] that this is not enough to make this a serious subject within the curriculum. The national institute for curriculum development developed the core objectives for this subject area with as long-term objective of integrating this learning to use skills in the regular subject areas (math, language, and sciences).

4. New Hardware and the Introducing of MS-DOS

The first hardware used in a national school project in 1983 was made in the Netherlands: the Philips P2000 computer and the Aster a company that went bankrupt soon afterwards. All were 8-bit computers.

[9] Raamwerk ["framework"] *Burgerinformatica. Stichting voor leerplanontwikkeling*. Enschede 1983
[10] See also note iii

It was in the year 1985, when MS-DOS personal computers where introduced in secondary education in the Netherlands. With its commando-driven interface not a tool easy to handle but a PC that could partly be manufactured in the Netherlands by IBM, Philips and Tulip Computers. No WYSIWYG, and it has also not very much in- and external memory (640Kb was the limit of directly addressable memory).That made learning to use also a more legitimate issue.

Apple introduced in 1984 the first PC with a graphical interface for the consumer and small business market. It formed the basis of a modern personal computing. "The Mac's elegant system software was its great accomplishment. It displayed a combination of aesthetic beauty and practical engineering that is extremely rare" [11] wrote Paul Ceruzzi in it's history of modern computing.

Before the MS-DOS introduction schools in secondary education where already experimenting with for example CP/M machines. British Acorn-BBC network were installed in Dutch computer classrooms. The importance of having an emerging educational standard should not underestimated. In the UK, it was the start of an emerging educational software industry,

There was strong a lobby for the Apple approach, but without success. In 1990 Bill Gates signed a Windows contract with the Dutch government who started to supply elementary schools with a special MS-DOS computers called the Comeniuscomputer, after the famous 17th century Tsjechian philosopher and pedagogue Jan Amos Comenius. It was installed with the new Windows interface.

The choice was made on the basis of a rapport from the Centre for Education and Information Technology (COI) published in 1987. There were also efforts to promote the MSX2-computers who were popular as game computers at that time for gaming. Main argument (although the cost aspect played a role as well) for not choosing the Apple Macintosh line was the fact that they were manufactured by only one company and the MS-DOS machines by a lot of companies.[12]

5. Software and the Curriculum

The Netherlands, like most other northern European countries where reasonable equipped during the 1990's. Important is in this respect the research of T. Plomp, and W. Pelgum in there Comped-studies in which the international development of the use of computers in education was measured and compared.[13]

Still there is in the present days not a lively and strong educational software market in the Netherlands. An important European conference took place in 1986 called Eurit 86. On this first European conference on education and information

[11] Ceruzzi, Paul E. *A history of modern computing.* P.273-276 MIT press Cambridge, 1998.

[12] Schoenmaker, *J. Apparatuur en besturingssystemen voor het basisonderwijs.* COI.Enschede 1987.

[13] Pelgrum, W.J., and Tj.Plomp, Tj. *The IEA study of computers in education: Implementation of an innovation in 21 education systems*. Oxford, (1993). UK: Pergamon Press.

technology, the main theme was Developments in educational software and courseware. In addition, IFIP acted as a sponsor. Important other issues were methodology of courseware development, implementation and national plans, teaching programming and instructional design, intelligent tutoring and expert systems.[14]

A new initiative to stimulate educational software development called the Poco project was launched in 1987. In the Poco-project educational software was developed by various organizations and later published by publishing company's .

Although millions of Euros (then guilders) were invested in the stimulation of software development during 1987-1991 a commercial independent market did not develop. Of course, one of the reasons has to do with the use of the Dutch language. The Dutch market is a relative small market, and the peculiar way in which the delivery of educational content is organized in the Netherlands - where the commercial publishers have a de facto monopoly- makes commercial educational software development not easy. It is all together unclear if there is a return on investments developing educational software considering the illegal copying practices in those days. Even large government funded developing programs did not led to the start of a successful software market in secondary education.

In the second half of the 1990s, the emphasis on information science was not an issue anymore. This could be an excellent moment to shift from learning to use toward using to learn. Unfortunately, this did not happen. A strong lobby for the educational variant of the so-called European Computer Driving License (ECDL) seemed partly successful. With a small educational adjustment, it became an educational driving license. School managers send there teachers to ECDL-courses. However, the government never made it obligatory. The ECDL approach for teachers is controversial. Teachers want to learn more about how they could use ICT in there lessons and not just follow a course word, PowerPoint, or Excel.

In the Netherlands, there is not a national curriculum as for example in England. Only at the end of secondary education, there is a national examination. Learning objectives though are formulated. For primary education and the first years of general secondary education, certain objectives that should be reached are formulated. The situation in vocational education is more complex. Although there is not a national curriculum it does not mean that school develop there one curricula. Most of the curricula are developed by the authors of schoolbooks on the basis of curriculum examples. The majority of the schoolbooks are more les tradition in there pedagogy. That implies that they are course driven and have an instructional character. ICT comes with it as an extra. Educational publishers say that they are willing to develop more innovative material other then so called book plus

[14] See Moonen, Jef and T.Plomp (ed.) *Eurit 86. proceedings of the first European conference on education and information technology.* Pergamon press. Oxford 1987.

production (traditional course with some software) but the majority (70%) of the market asks for "traditional" material they claim. Recent surveys support this.[15]

6. The Shift from Learning to Use to Using to Learning

The key problem seems that in the last 15 years there was not enough attention for using ICT in the learning process and its pedagogical implications in the Netherlands. This focus on the use and knowledge of systems seems the be international phenomena in the midst of the 90's of last century as we can see in a UNESCO document in which a Informatics curriculum for secondary education is formulated.[16] Developing some kind of computer literacy was considered to be an important aspect of school learning.

One of the main reasons is the lack of knowledge and experience in using ICT in the classroom. A disturbing fact in the Netherlands is that also in higher education i.e. the teacher training centers more than 60% of the teacher trainers claim that they should like to have more knowledge about educational use of ICT.[17] In a recent policy document of the ministry of education, quality assurance of the teacher education is an important issue. During a parliamentary discussion in June 2005 the necessity of a quality impulse was supported by must of the members of parliamentary education committee.[18]

So what we see is that despite of the fact that every school in the Netherlands has a free broadband connection with internet, the existence of a national educational network (kennisnet) and an average pupil-computer ratio of 9:1 in elementary and secondary education[19] educational use in secondary education is below expectation.

Are the other successful examples? More successful seems the Swedish approach where in the Itis-project[20] professional development, and school development were integrated. The button line is a school tailored approach, with an focus on education, improvement of learning and proven or expected added value for the use ICT.

As stated four guiding principles have underpinned the planning of the action program of Itis and shall be applied to its implementation in the municipalities:

1. Equal standards between schools and quality for pupils

[15] See ICT in the Netherlands. Fact and figures 2003-2004. IVA/ITS Nijmegen/Tilburg 2004. and http://www.ict-onderwijsmonitor.nl/

[16] See p. 5 *Informatics for secondary education. A curriculum for schools.* Produced by a working party of IFIP. Unesco document , Paris 1994.

[17] See http://www.ict-onderwijsmonitor.nl/ section Hoger onderwijs

[18] See http://www.eerstekamer.nl/9324000/1/j9vvgh5ihkk7kof/vh1jf30xeuxg/f=x.doc

[19] See note v

[20] See http://www.logos-net.net/ilo/150_base/en/init/swe_7.htm

2. School development[21]
3. Supplementing and reinforcing programs planned and already completed by the municipalities.
4. Increasing the school's accessibility to the Internet and e-mail

In the development of "learning to use" curriculum material the concept mental model played an important role. Users develop a mental model of a system and on the basis of this model they can also use other similar systems. Nevertheless, it should be an adequate model. Our mental model of a typewriter should not be similar on that of a word processor. If it is, the user can easily be identified by the hard return after ever line. A mental model is a cognitive construction. It deals with the way people think about what's happening within a system.[22]

We consider learning to be more effective as it perceived as meaningful, embedded in authentic situations.[23] It is in what we now call the social constructivist approach of Lev Vygotsky where we find a great emphasis on the importance of interaction between people (children, teachers, parents) in cognitive development. Anchoring instruction in real life problems that have to be solved and creating rich environments that stimulate to interact about real life problems and situated learning is becoming more and more mainstream in the use if ICT for learning.[24] By situated learning we mean the physical and social context within which learning takes place this remains an integral part of which is learned.[25] That is hardly the case in the traditional technology driven courses where one is supposed to learn to work with software applications in isolated way. Children learn to use word processors by learning to express themselves by writing, learning to use spreadsheets by e.g. during statistic research in there environment. Learning to use creative tools, mind maps by exploring there creativity. It is this more constructivist approach - opposite of the mechanistic, behaviorist – that is now in our full attention. This approach differs fundamentally from the more mechanistic, behaviorist approaches in which trough training and instruction one learns to use ICT.

What we learn from the Dutch situation is that it is difficult to change patterns that are followed for years. In countries where ICT is recently introduced, we could learn from new approaches by action research methods and the exchange of free

[21] Note: The Itisproject is now integrated in the national Swedish schooldevelopment plan. See: http://www.skolutveckling.se/in_english/

[22] A mental model is an explanation in someone's thought process for how something works in the real world. It is a kind of internal symbol or representation of external reality, hypothesised to play a major part in cognition. The idea goes back to Kenneth Craik (1943) and Philip Johnson-Laird (1983)

[23] See Bereiter, C. *Education and mind in the knowledge age.* Mahwah, New Jersey LEA Publishers. (2002).

[24] See Maddux, Cleborne D. , D.Lamont Johnson and Jerry W.Willis. *Educational Computing. Learning with Tomorrow's Technologies.* Second ed. Boston. 1997.

[25] See Wood, David. *How children think and learn. The social contexts of cognitive development. 2e edition.* London 2005.

open source material. Education should primary be a matter of student/pupils/ teachers and parents. The involvement of large soft- and hardware companies is not automatically a benefit for developing school systems with ICT. Different then in elementary school, teachers in secondary schools are subject orientated i.e. they are teaching math, language, physics, history etc. Only by developing concrete plans and projects for the use of ICT, that is integrated in there subject areas and every teaching works. That is why in physics teaching in the Netherlands, where there is longstanding tradition in the use of science labs, ICT is well integrated in the curriculum. From the start in the 1980's tools like IP-Coach and coach lab, developed by Prof. Dr. Ton Ellermeijer of the University of Amsterdam, were introduced to support modern teaching of physics.[26]

7. Conclusions: Toward Development of Community of Practices CoP

The first hardware used in school had a commando-driven user interface (MS-DOS) and word processors like WordStar dictated the focus learning to use the machine. Unfortunately, this led to a practice that is still very manifested in the Netherlands. In a 2004 national report we read "In 1999, the training of teachers was based on acquiring basic skills and learning to use standard ICT-applications. In 2002, this does not seem to have changed a lot. Teachers are still "learning to use" instead of "Using to learn".[27]

During the WCCE conference in July 2005 in Stellenbosch, South Africa the so called Stellenbosch declaration[28] was formulated. It states that good teaching skills are more important than good ICT skills. It put the teachers where he belongs: together with the pupil/student in the center of the learning and teaching process. ICT should empower the teachers and should not be seen as a barrier that has to be taken. The integration of ICT in the curriculum will lead to new pedagogies and new roles for teachers and active learning.

On the basis of our past experiences we can discriminate a top down instructional ("learning to use") approach focused on ICT use and a more bottom up constructivist approach focused on learning ("Using to learn"). In this scheme, I will try to sum up some of the differences. The were in a preliminary form also mentioned in[29]

[26] See also http://www.cma.science.uva.nl/english/index.html

[27] Lam Ineke etc. *Ilab. Dutch National Report IVLOS. Centre for ICT and education. Utrecht University. Utrecht 2004.* see www.theknownet.com/ilab/uploads/sector_national_reports

[28] See http://www.unesco-iicba.org/index.php?option=com_content&task=view&id=76&Itemid=1

[29] See Lepeltak, Jan en Verlinde, Claire, *Education for the twenty-first century: issues and prospects, Contributions to the work of the International Commision on Education for the Twenty-first Century*, chaired by Jacques Delors, 1998, Pagina 281-298.

	LEARNING TO USE Traditional dessimation model	USING TO LEARN CoP-model
Training	Generic: one curriculum for all (top down). A curriculum set up by specialist	Tailored: on the spot. On the basis of school/teachers needs
Content	Learning isolated skills. Knowledge as a function for these skills	Integrated e.g. Word-processing in learning to write stories or reports
Pedagogy	Instruction based. Decontextualised learning. Individual	Social constructivist: Collaborative learning in situated in authentic context
Assessment	Individual testing with certificate	Products, port folio
Role Teacher	Directs process	In mentoring role
Knowledge	Is distributed by teachers to learners	Is shared and build up together
Organized	In school setting	In learning network or Community of practice
Research	Quantitative statistic. Methods from Neopositivist social studies.	Qualitative, Practice based action research: Cyclic. The participants as reflective professionals
Dissemination	Through research reports and scientific publications and periodicals. On academic conferences	Through publishing on Internet. Direct communication to peers and presentations on seminar

The emerging Community of Practice/Learning network[30] will play the role of a starting expert center where all the participators (students, teachers, teacher trainers, soft- and hardware specialist) share knowledge and experience, A model we are trying to implement in Indonesia you se below

However, the question remains, How can we effectively implement ICT in our schools? For countries that are in a developing phase, the next scenario seems promising as a starting point[31] within small communities. Plans are now developed to experiment on a larger scale in Indonesia with Nahdlatul Ulama (NU), the largest Moslem organization in Indonesia. NU is exploring the possibilities to stimulate the use of ICT in Indonesian primary, secondary schools, and teacher education.

[30] See for a definition of Wenger's notion of Community of Practice
http://fdhis.inknoise.com/CommofPractice/2004/12/30/0001

[31] See the world e-citizensproject in http://www.mirandanet.ac.uk/

8. Seven steps for integration

Step 1 Organize: A small starting seminar in which participants can articulate the possibilities and challenges.

Step 2 Form a CoP in which teachers, students, teacher trainers, ICT-specialist and advisers participate. Investigate issues of infrastructure, content, and expertise among participators

Step 3 Choose a platform - Virtual learning environment that can be used for your emerging learning community to exchange experience, content and communication.

Step 4 Choose one or two priories for development e.g. writing and physics. And collect resources.

Step 5 Make general plans for a education project in which you do practical e.g. you environment.

Step 6 Make an overview for the necessary ICT-skills and integrate the training in the project. E.g. the use of internet (starting with email) but also the use of tools as PowerPoint, etc.

Step 7 Use ICT for learning and define a cyclic action research project for students and teachers that's can be linked with curriculum goals. (See step 5.) For example an environmental project about the quality of the water of a river nearby or a (rain) forest. Elements from writing, science (chemistry and geography) can be integrated

Developing country's could build up their capacity in developing e-community's in which teachers, teacher trainers, subject specialist, experts and students work together, share knowledge and experience and develop a learning network.