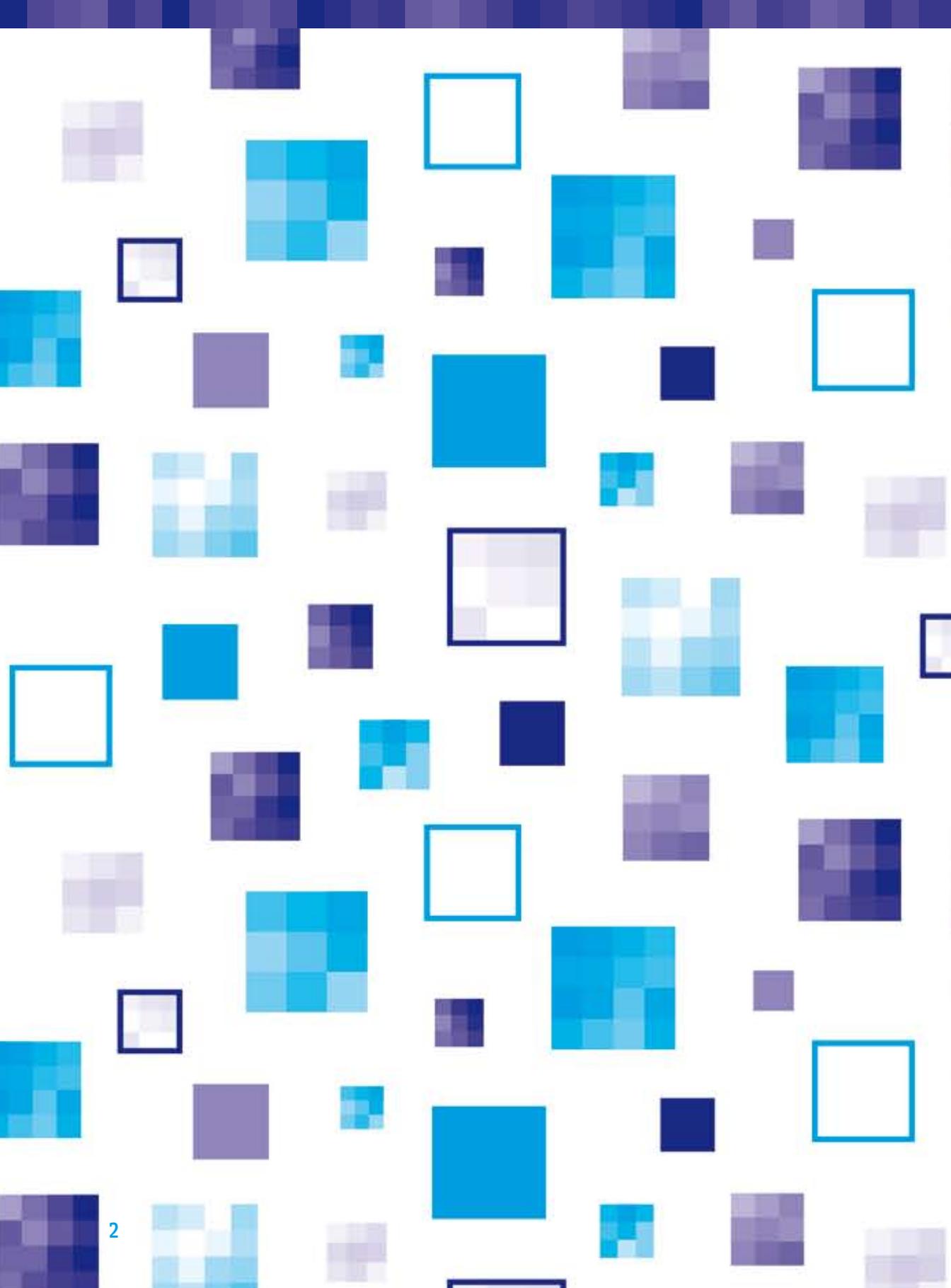


Four in Balance Monitor 2007

ICT in Education in the Netherlands





Four in Balance Monitor 2007

ICT in Education in the Netherlands



Contents

5	Summary
13	Four in Balance
17	1 Education and ICT Use
17	1.1 Computer use
18	1.2 Application
21	1.3 Intensity
23	1.4 Learning with the Internet
25	1.5 Homework
25	1.6 ICT use at schools
28	1.7 ICT management
30	2 ICT Yields
30	2.1 Conceptual framework
32	2.2 Research reviews
34	2.3 Yields
40	2.4 Opinions
44	3 Vision and Leadership
44	3.1 Vision
45	3.2 Leadership
47	3.3 Teachers
50	3.4 ICT applications
52	4 Professional Development
52	4.1 Expertise of teachers
54	4.2 Pupils
56	5 Educational Software and Content
58	6 ICT Infrastructure
58	6.1 Computers and the Internet
62	6.2 Parents
63	7 Support
63	7.1 Priorities
65	7.2 Support for management
66	7.3 Support for teachers



Summary

Where is the computer in Dutch education? What are the short term ICT ambitions of teachers and school management? And, crucially, does ICT use improve education and make it more attractive for teachers and pupils, as is so often claimed? The Four in Balance Monitor 2007 answers these questions.

This Monitor, written by Kennisnet Ict op school, provides an up-to-date overview of ICT developments in primary and secondary education in the Netherlands. It assists in implementing ICT in schools in a balanced and lasting way and helps schools determine and compare their position with that of other schools.

Four in Balance

The *Four in Balance Monitor* is based on the Four in Balance conceptual model, developed by Kennisnet Ict op school. The core of the Four in Balance model is that using ICT for educational purposes is a matter of a well balanced deployment of four elements:

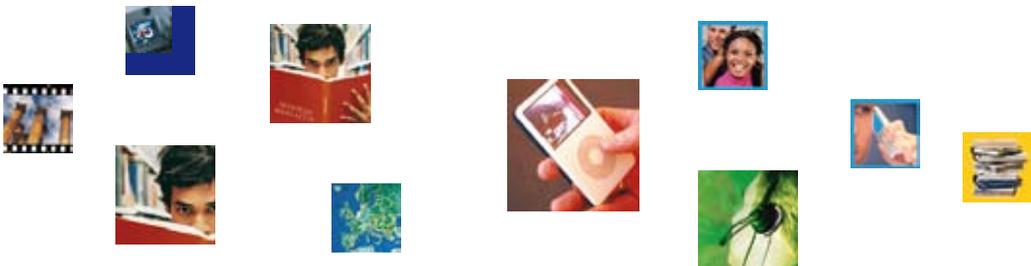
- 1) Vision and leadership
- 2) Knowledge, attitude and skills (professional development)
- 3) Educational software and content
- 4) ICT infrastructure

Until now, the implementation of ICT in teaching has mostly involved the acquisition of hardware and educational software (technical elements). But effective and efficient ICT use above all requires attention to the questions of teachers and ICT managers who work with it in daily practice. How is ICT integrated in a vision for education, and what expertise is needed for an effective use of ICT (social elements)? If attention is paid to both technical and social building blocks, and their integration, there is a greater chance that investments in hardware, software, and content will provide the demanded yield. This requires leadership of managers, and more cooperation between teachers with respect to sharing knowledge and practical experience.

Education and ICT use

Many schools in primary education strive to use ICT to improve the quality of their teaching. But teachers and management disagree about the proper approach. Managers want to integrate ICT into education, and therefore choose to give priority to installing more computers in primary schools and invest further in enlarging the expertise of teachers. Many schools are buying digital blackboards. Teachers in primary education think that apart from improving computer facilities, school teams should give priority to developing a shared vision on ICT use.

In secondary education teachers think that better computer facilities are what is most important. According to management, buying extra ICT facilities has no priority. They wish to give special attention to the knowledge and skills necessary for effective use of ICT in education. More than two thirds of the parents think that schools especially should work towards improvement in communication. They want schools to inform them by means of e-mail and school websites. Most parents would like computer access to their children's examination results.



ICT Yields

In primary education nine out of ten teachers use the computer for teaching, mostly for drill and practice programs. But in comparison with previous years, the popularity of such software is decreasing. Instead, finding information and using the computer for word processing is becoming increasingly important.

In secondary education half of the teachers use computers. Pupils mainly use computers for writing papers and as an aid to information research. The computer is also used as an electronic learning environment supporting independent studying, and it is used for course-specific software.

In the last years of primary education, using the Internet for homework is almost common practice. About half of the pupils use the portal website of Kennisnet for this purpose. In secondary education one out of five pupils consults kennisnet.nl for school assignments.

Profits

Studies on yields of ICT in education show that ICT is contributing more frequently and more systematically to the quality of education. The most important ICT yields are:

- Students learn more, quicker, and more enjoyably
- Better results for both good and weakly performing students
- Pupils are more motivated and have more self-confidence
- ICT supports several pedagogical approaches, such as transfer of knowledge, independent studying, and cooperative learning.

Yields of ICT can rarely be ascribed to using ICT applications alone. In order to profit from ICT, it is necessary that:

- Teachers are sufficiently equipped
- There is a supportive organisation of schools
- There are sufficient technical facilities
- The ICT form that is being used fits in with the school's vision on education.

Research convincingly shows that there is a clear relation between ICT

yields and the extent to which teachers are equipped to integrate ICT into education.

Vision and leadership

School management wants to make more use of ICT applications in the future to improve the quality of teaching. Most ICT managers say that their school has developed a vision for ICT use. Most teachers disagree: more than 50% in primary schools and 70% of the teachers in secondary education say that they really need the school management to develop a broadly shared vision on using ICT in schools, in collaboration with the teaching staff.

Coordination

Out of every ten teachers in secondary education, nine claim that their school lacks leadership and substantial coordination of ICT use. In such schools, teachers themselves determine whether ICT is used. The coordination of technical facilities is in the hands of the ICT coordinator or systems-manager. In primary education, more than in secondary education, teachers make agreements about the pedagogical use of ICT. One third of all teachers respect these agreements. In secondary schools, such agreements are very rare.

Professional development

By no means all teachers and pupils are competent enough to use ICT effectively for learning. In general, pupils know how to handle a computer. But that is not to say that they can use the computer to learn. Teachers, however, tacitly assume that they can. Problems arise, then, especially with respect to searching, selecting, interpreting, and processing information.

Papers

Most teachers in secondary education assign homework for which pupils use the Internet at home. Almost half of the pupils are unsatisfied with the tips that teachers give for searching information on the Internet. Pupils claim that teachers usually do not notice their plagiarising a paper from the Internet and pretending that it is original work.

Understanding ICT

Managers think that teachers understand the capacities of ICT for learning. Teachers themselves are less convinced that they do. Less than half of the teachers consider themselves really able to benefit from ICT.

Research on professional development of teachers in pedagogical use of ICT shows that many teachers learn most from and with each other.

Educational software and content

Even though teachers say that they are happy with the degree of ICT in teaching methods, 70% of them need more usable teaching material and content for computer use.

Only very few pupils and their parents believe that textbooks can be replaced by the Internet. Half of the pupils never consult the website that pertains to a text book; only 7% regularly visit such sites.

Costs

Research on costs, opportunities and threats of digital learning materials shows that using digital learning materials could considerably help lower the costs to schools of textbooks. A reduction in costs will require extra investments in expertise and support of teachers, in addition to taking optimal advantage of ICT for learning.

ICT infrastructure

In primary and secondary schools, there is one computer for every seven pupils. According to managers, 30% of all computers in primary schools ought to be replaced. Only 21% of the hardware that needs replacement will in fact be replaced in 2007. In secondary education, 20% of all computers needs to be and will be fully replaced.

Almost all computers in secondary education have Internet access. In primary education, this is 87%. A quarter of the primary schools and four out of every ten schools in secondary education have a broadband Internet connection. Most schools that are not yet connected by fibre optic cable, are interested in it, or are actually planning to switch to fibre optic technology.

Digital blackboard

Digital blackboards are very popular. At the end of 2006, 11% of all primary schools and 42% of all secondary schools had these blackboards. Of the schools that did not yet have them, four out of ten intend to acquire one or more in the coming two years.

Support

Financing ICT is, according to management, the most important obstacle for the further integration of ICT into education.

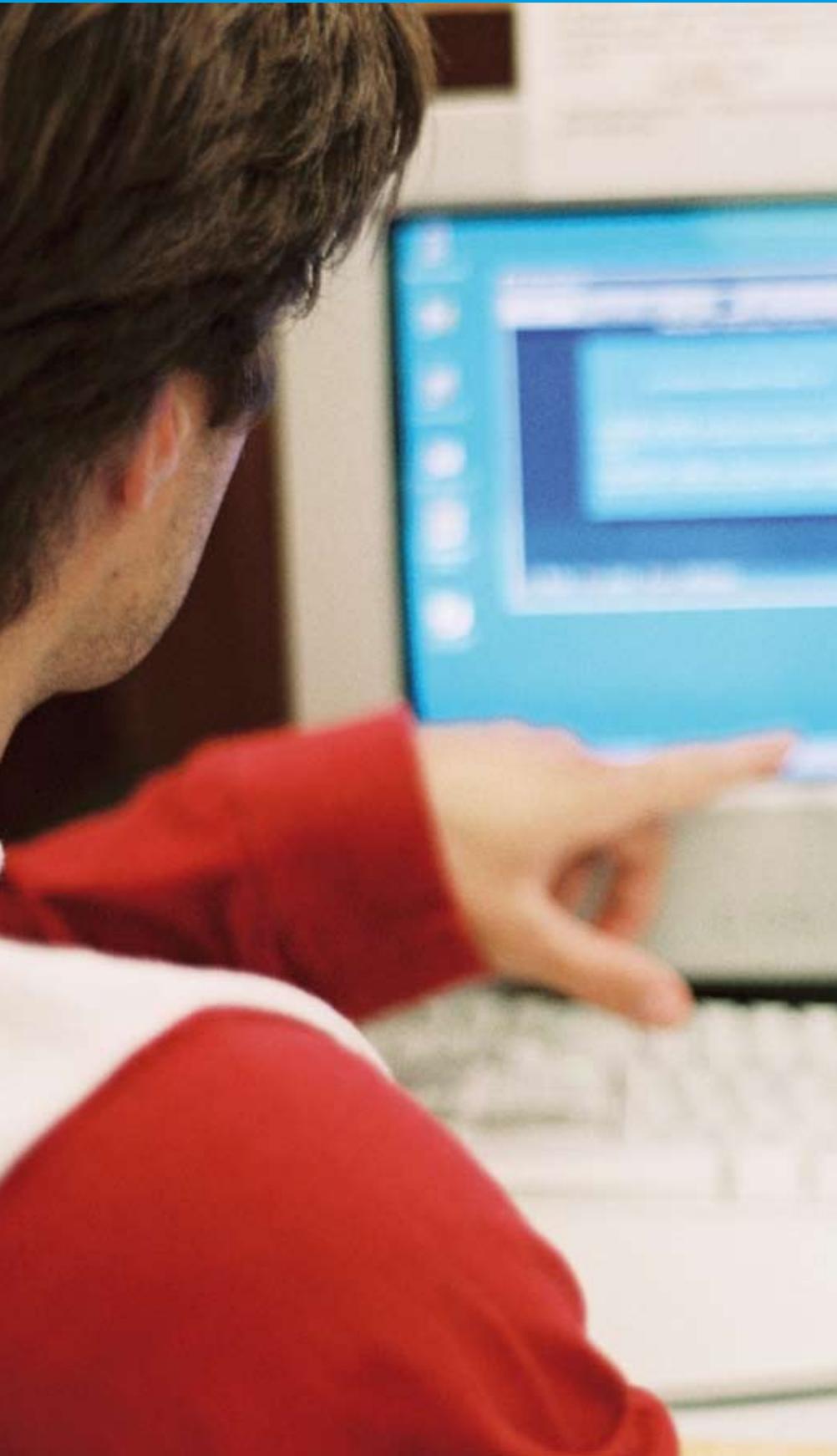
Apart from financial support, managers say that schools need:

- Help in making choices: development of vision, examples of best practice, and support in finding good software;
- Facilities necessary for using ICT: workable software, content, and pedagogical aid.

Teachers and managers in both primary and secondary education believe that the three most important needs for support are:

- Software that pupils can work with independently;
- Good examples of pedagogical use of ICT;
- Useful digital learning material and content.

The same three needs were reported last year.





Four in Balance

Where and how are computers used in Dutch education? Are computers making education better and more attractive for pupils and teachers? Do the efforts of teachers, managers, parents, and policy workers have any effect? These questions are at the heart of the Four in Balance Monitor 2007 of Kennisnet Ict op school.

This report gives an overview of the use, availability, and impact of ICT in primary and secondary education in the Netherlands. It discusses the nature, extent, and benefits of ICT use, as well as the most important conditions that influence effective and efficient ICT use in teaching. This Four in Balance Monitor 2007 is based on developments in the past years and as such also gives insight in the most important trends in ICT use for learning.

Monitor for schools

The Four in Balance Monitor 2007 is comparable with previous Monitor research on ICT in the Netherlands. But there are also differences. Earlier Monitors were primarily meant to account for government policy. This report, however, is in the first instance written for schools. It should inform schools about balanced and lasting integration of ICT into their teaching.

The concept

The conceptual framework and the structure of this report are taken from the Four in Balance model¹. This model reflects a scientifically researched vision for the implementation of ICT in schools. This vision was presented by the Ict op School foundation in 2001, and updated in 2004 under the heading *Four in Balance Plus*. In what follows, we will refer to this simply as *Four in Balance*.

¹ http://www.ictopschool.net/deskundigheid/publicaties/uitgaven/dutch_ict_tools.pdf

The core idea of Four in Balance is that use of ICT for educational purposes is a matter of a well balanced deployment of four elements:

- (1) Vision and leadership
- (2) Knowledge and skills (professionalisation)
- (3) Educational software and content
- (4) ICT infrastructure

The challenge facing the field of education is to attune these elements to the learning process as organized for pupils. Managing this coherence is a task that no teacher can realise alone. It also demands leadership from management and it requires the realisation of conditions of support and cooperation with other professionals. The four elements, together with leadership and cooperation, influence the use of ICT for learning (see figure 1).

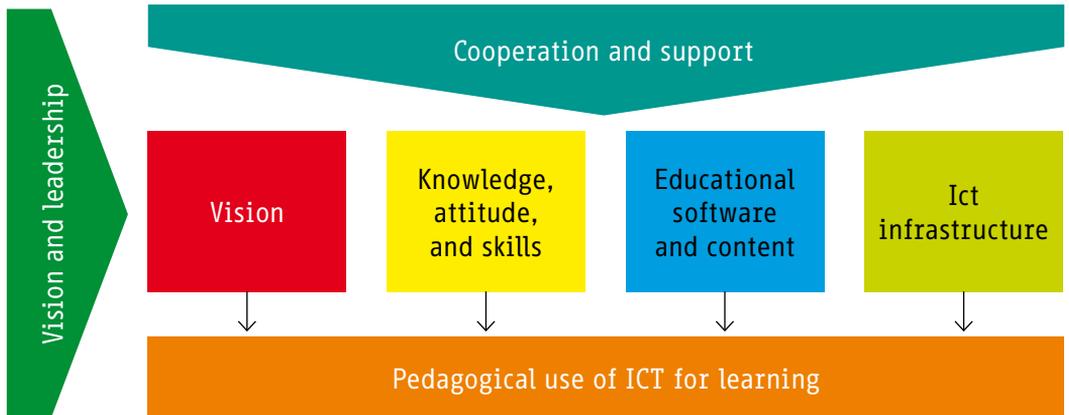


Figure 1: Elements of Four in Balance.

Sources

The Four in Balance Monitor is based on the results of independent research. Recent data has been collected by the Educational Inspectorate² and through research carried out by several research institutes on behalf of Kennisnet Ict op school³. For comparisons over time, use has been made of data from the ICT Monitor (1997-2000)⁴, the ICT education monitor (2001-2005)⁵, and surveys carried out in 2001-2006⁶ on behalf of Kennisnet Ict op school. Apart from that, relevant data from (inter)national studies has been used, in as much as this provides an insight into the elements of Four in Balance. Sources (in English when available) are annotated in the footnotes.

Benchmark

The results of this monitor function as a benchmark and enable schools to compare their results to those of other schools⁷. The results give insight into the speed and direction of developments of ICT use in primary and secondary schools. The monitor provides ‘hard’ data on the approach taken by schools in integrating ICT into their education, and the achieved results.

² Inspectie van het Onderwijs (2007). *Onderzoek naar het gebruik van ICT in het basis- en voortgezet onderwijs in het schooljaar 2006-2007* (internal report)

³ a. ITS (2007). *Didactisch handelen van leraren*. Available in Dutch at www.ictopschool.nl/onderzoek;

b. Sardes (2007). *Digitale prentenboeken*. Available in Dutch at www.ictopschool.nl/onderzoek;

c. IVO (2007). *Deelrapportage Monitor the Internet en jongeren: resultaten 2006-2007*.

Available in Dutch at www.ictopschool.nl/onderzoek.

⁴ *ICT-monitor 1997-2000*. Available in Dutch at www.ictopschool.nl/onderzoek/ICT-monitor_1998-2000;

⁵ *ICT-onderwijsmonitor 2001-2005*. Available in Dutch at www.ict-onderwijsmonitor.nl.

⁶ TNS-NIPO 2001-2006. Available in Dutch at www.ictopschool.nl/onderzoek

⁷ There are several instruments available for the collection of data, specifically developed as tools for schools to map their own situation and to compare it with that of other schools. See www.onderwijstools.nl.

Some tools are available in English:

www.ictopschool.net/deskundigheid/publicaties/uitgaven/dutch_ict_tools.pdf.

Recent insights

The Four in Balance Monitor also collects actual insights on ICT yield. By systematically collecting data over a longer period of time, we gradually gain an understanding of the conditions under which ICT in teaching has additional value. This is not only important for teachers, managers, parents, and supporting institutions, but also for providers of ICT applications and for services, policy makers, and researchers.

Research Program

At the same time, little is known about the effectiveness of ICT in education. Further development and distribution of knowledge about ICT use is high on the agenda of Kennisnet Ict op school⁸. The research program of 2007 has recently begun and the initial results are part of this report. Giving schools insight in the yields of ICT enables them to make reasoned choices in effective use of ICT and in better education.



⁸ See www.ictopschool.net/onderzoek/stimuleringsregeling.

1 Education and ICT Use

Investing in the expertise of teachers or in the availability of ICT facilities is not a goal in itself. What matters is that ICT contributes to better, more efficient, or more effective education, and possibly to a more attractive way of learning and teaching for pupils and teachers.

1.1 Computer use

According to ICT management, eight out of ten schools are in a (well) advanced stage of development in computer use. In primary education, the number of schools with a (well) advanced stage of development in computer use has more than doubled in the last four years (table 1.1).

Characterization	'01-02	'02-03	'03-04	'04-05	'05-06	'06-07
	% PE					
No use	1	-	-	-	-	-
Orientation on use	1	-	-	-	-	-
Starting use	57	57	41	27	21	18
Advanced use	36	34	56	64	71	68
Well advanced use	1	2	3	7	6	13
	% SE					
No use	-	-	-	3	-	-
Orientation on use	-	-	-	-	2	2
Starting use	36	58	24	14	20	11
Advanced use	52	36	64	72	61	62
Well advanced use	12	6	12	11	16	24

Table 1.1: Characterization of computer use in primary education and secondary education according to management.

Teachers assess their own use of ICT for educational purposes far less positively than managers. In primary education 46 per cent of the teachers classify their own use of computers for educational purposes as (well) advanced; in secondary education this is 30 per cent of the teachers (figure 1.1).

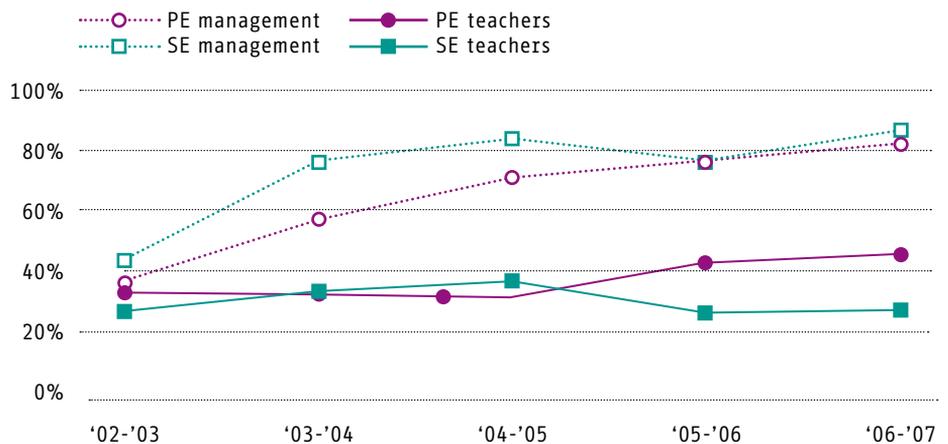


Figure 1.1: Percentage of schools and percentage of teachers in a (well) advanced stage of ICT use according to ICT management and according to teachers.

In 2002 managers and teachers had about similar assessments of the development of computer use in their schools. Since then, managers perceive a strong development in ICT use, while few teachers experience such a progress.

1.2 Application

The percentage of teachers who use a computer for teaching is significantly higher in primary education than in secondary education (figure 1.2). The difference between primary and secondary schools has increased in the past years. As a result, the connection of secondary education to the world of computer and Internet technology remains relatively limited.⁹

⁹ SCP (2007). *De digitale leefwereld van tieners en de rol van hun ouders*. Den Haag: Sociaal Cultureel Planbureau.

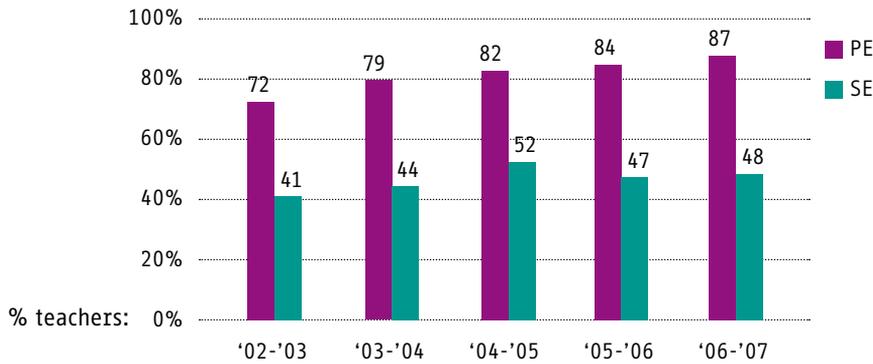
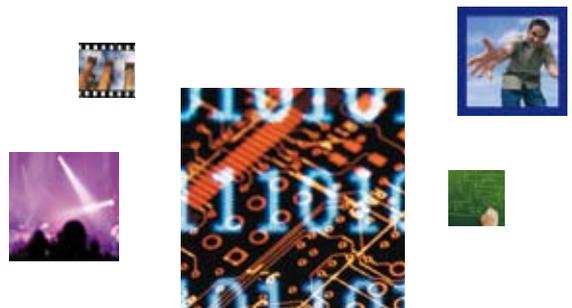


Figure 1.2: Percentage of teachers in primary and secondary education who use ICT for teaching, according to management (source: TNS NIPO, 2002-2006).

Primary Education

According to the management of primary schools, 87% of the teachers use a computer in their teaching¹⁰. In 2003 primary schools expected 95% (an increase of 16%) of the teachers to be using computers in the classroom in 2006. In reality, computer use in the last three years has increased by 8%. Management expects 93% of the teachers to use computer applications in their teaching in the school year 2009-2010 (figure 1.3).



¹⁰ Research of the Educational Inspectorate (2007) indicates a higher share: 91% of the teachers in primary education regularly use ICT in their teaching and 9% (almost) never.

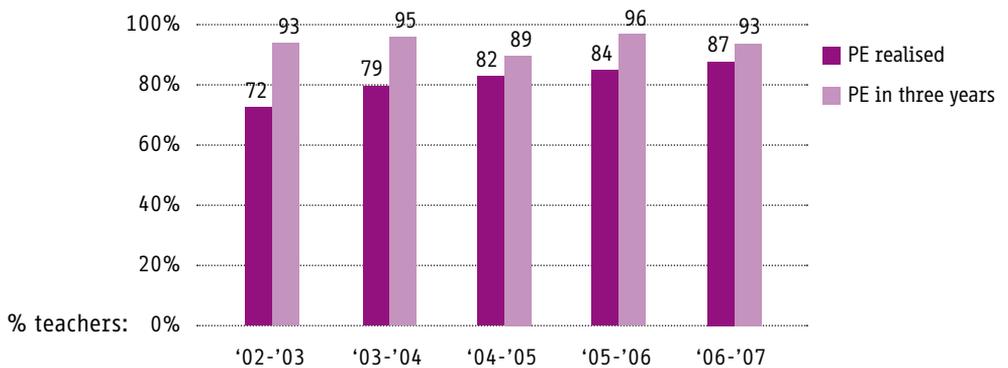


Figure 1.3: Percentage of teachers in primary education using ICT according to management; and their estimations for the coming three years (source: TNS NIPO, 2002-2006)

Secondary Education

In secondary education slightly less than half of the teachers (regularly) use computers in their teaching¹¹. 36% of the teachers have incidentally used a computer, and 11% have never used a computer in their teaching (Educational Inspectorate, 2007). Managers think that in 2009 about 71% of all teachers will use computers in secondary education. If this is true, almost 25% of all teachers will have to start using computers in their teaching in the coming years. Figure 1.4 shows that the expectations of managers of the growth of computer use are always rather optimistic.

In the past ten years the number of teachers using computers has grown annually by on average 3%. At this rate of growth it will take another 10-15 years before all teachers in secondary education use ICT.

¹¹ Research of the Educational Inspectorate (2007) indicates a slightly higher share: 54% of the teachers in secondary education regularly use ICT. Teachers in havo/vwo (i.e. senior secondary education/ pre-university education) use the computer significantly less: 29%. Teachers in lower secondary professional education use computers more than average in their teaching: 60%.

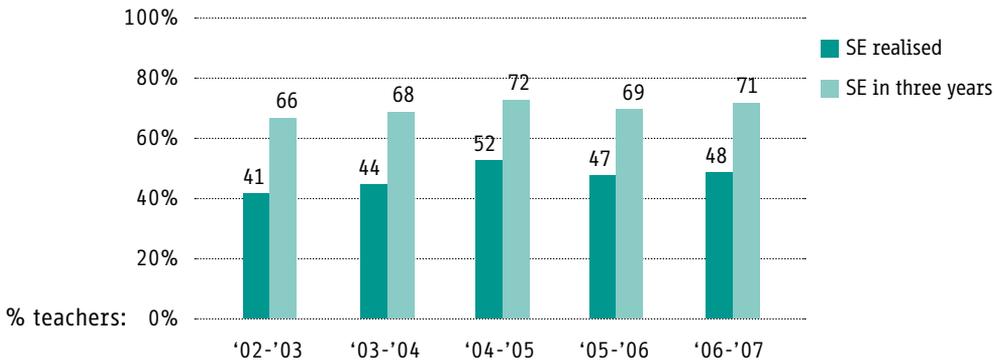


Figure 1.4: Percentage of teachers using ICT according to ICT management in secondary education; and their estimations for the coming three years (source: TNS NIPO, 2002-2006).

1.3 Intensity

A teacher in primary education on average uses a computer for teaching for 6 hours per week: on average that is more than one hour every day. Teachers in secondary education on average use a computer for teaching for 4 hours a week. Time spent by teachers on computer use for their classes is steadily increasing. As both the number of teachers that use a computer, as well as the time spent using computers, is increasing, the intensity of computer use on schools increases as well.

There are, however, large differences between pupils. The time spent behind a computer depends in the first place on the specific teacher, but also on the relation between the class size and the number of computers available.

Increase of the use of the Internet on schools

The use of the Internet for teaching increases steadily. In 2006 almost 30% of the pupils from 11-15 years of age did not use the Internet in school. In 2007 this percentage decreased to 23%. Figure 1.5 shows that more and more pupils use the Internet every week: 24% in 2006 and 34% in 2007.

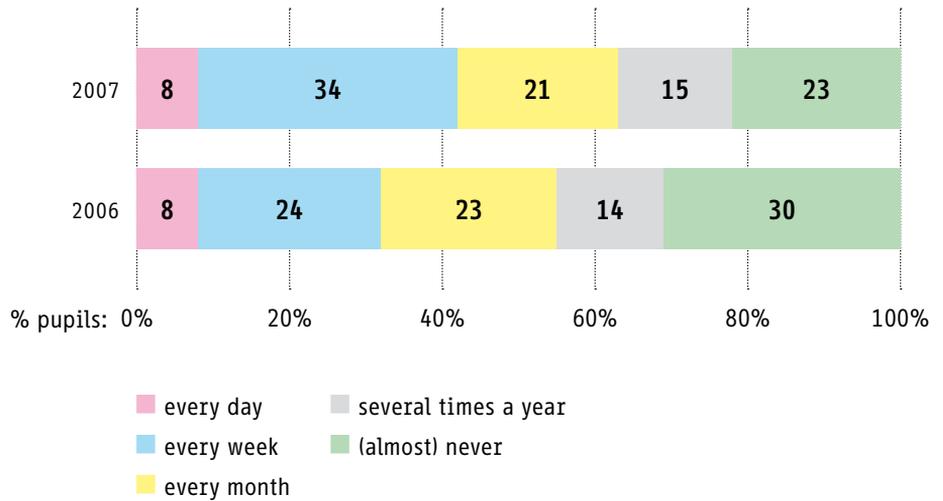


Figure 1.5: Number of times pupils 11-15 years of age make use of the Internet at school (source: IVO, 2007).

Pupils in pre-vocational education use the Internet significantly more in school (19%) than students in general secondary education and students in pre-university education (2%).

Kennisnet

In the last three years of primary education around 50% of pupils make use of the Kennisnet portal-website. In the first three years of secondary education the use of Kennisnet decreases. As figure 1.6 shows, the Kennisnet website is then consulted by one out of every five pupils.

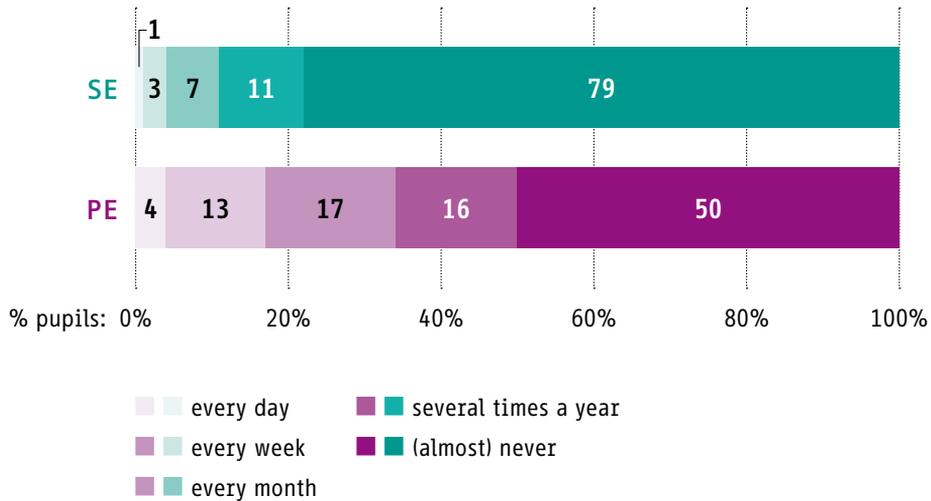


Figure 1.6: Use of the Kennisnet portal-website for school tasks by pupils in the last three years of primary education and pupils in the first three years of secondary education (source: IVO, 2007).

1.4 Learning with the Internet

Teachers tacitly assume that pupils who know how to operate a computer also have the necessary information-handling skills. Problems arise in searching, selecting, interpreting, and processing information (Haan & Hof, 2006)¹².

Research done by Kuiper (2007)¹³ shows that many pupils at a very early age are skilled in searching the Internet as far as it concerns activities such as using search terms, using a menu, navigating a website, and scanning Internet documents for keywords.

Pupils are often incapable of properly reflecting on search results and of critically reading web texts. Yet these skills are essential for effectively using the Internet for learning. Internet routines which pupils learn outside school must be completed in school. That is not an easy task for teachers who wish to use the Internet effectively.

¹² Haan, J. & Hof, C., van 't (Red) (2006). *Jaarboek ict en samenleving*. Amsterdam: Boom.

¹³ Kuiper, E. (2007). *Teaching web literacy in primary education*. Amsterdam: Vrije Universiteit. Beschikbaar via www.ictopschool.net/onderzoek.

Using the Internet for teaching is therefore taken to be difficult. Teachers are unsure how to coach their pupils. They have the impression that pupils are able to produce good-quality written assignments, but are unsure whether pupils actually learn something from the information they have collected from the Internet.

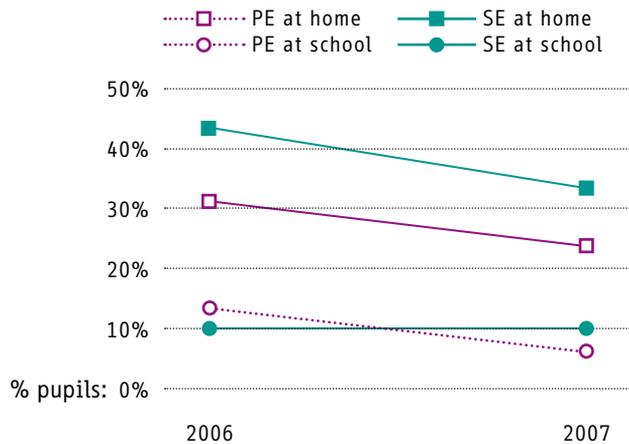


Figure 1.7: Percentage of pupils in the age of 11-15 who claim that no one supervises them when they use the Internet (source: IVO, 2007).

Extending competences

Using the Internet for learning rarely ties up with the way in which children access and use the Internet outside school. Apparently, pupils do not automatically pick up those Internet skills that are required for learning. This suggests that using the Internet for learning requires an extension of competences; this concerns both pupils and teachers, as well as teacher-training colleges. If these competences are not developed, schools will not maximally profit from what Internet facilities in schools may actually have to offer (Kuiper, 2007).

Pupils

Four out of every ten pupils believe that teachers are generally unaware when they have copied information for a piece of work from the Internet while pretending to have written it themselves. In comparison with 2006,

teachers in 2007 slightly more often notice those occasions when pupils copy information from the Internet (36% and 40% in 2006 and 2007 respectively. IVO, 2006).

Half the pupils say that their school gives them good advice concerning searching for information on the Internet. This is almost equal to last year: 55% in 2006, 56% in 2007. Opinions on whether Internet use improves school results have not changed in comparison with last year: 29% agree, 36% do not know, and 25% disagree. About 15% of the pupils say that their school results suffer from the time spent on the Internet at home. In 2006 this percentage was 18% (IVO, 2007).

Supervision

Pupils are usually supervised when they use the Internet at school. Pupils of 11-15 years of age are supervised by either a teacher (57%) or someone else (29%). In 2006 14% of the pupils in the last two years of primary education indicated that nobody was paying attention to what they do on the Internet; in 2007 this number decreased to 7%. In secondary education 10% of the pupils say that nobody supervises them when they use the Internet (IVO, 2007). At home parents pay more attention to what their children do on the Internet than before. Still, the number of children who use the Internet without supervision is significantly higher at home than at school (figure 1.7). The general impression is that supervision is increasing.

1.5 Homework

At primary schools three quarters of all pupils are set homework assignments for which the Internet must be used at home. In the last year of primary school this is 90%. In secondary education almost every pupil is set homework assignments for which the Internet must be used at home (figure 1.8).

Pupils use the Internet at home mainly for searching for information (PE 64%; SE 74%). The Internet is also used for working on assignments together with other pupils (PE 21%; SE 45%) or discussing assignments together (PE 15%; SE 41%). The importance of the Internet for learning is

gradually increasing, indicated by a number of applications such as:

- doing drill and practice tests (PE 11%; SE 27%)
- looking up homework assignments (PE 8%; SE 14%)
- sending in homework assignments by e-mail (PE 4%; SE 19%)
- asking the teacher a question by e-mail (PE 3%; SE 9%)
- asking an expert a question by e-mail (PE 5%; SE 6%)

More than 80% of the pupils say that they rarely or never rush through their homework in order to surf the Internet. Only 4% of the pupils (very) often spend too little time on their homework in order to surf the Internet.

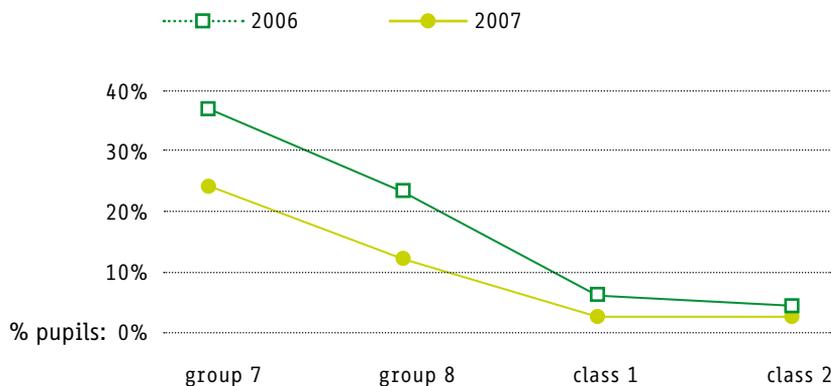


Figure 1.8: Pupils who are not set homework assignments for which they use the Internet at home (source: IVO, 2007)

1.6 ICT use at schools

Computers are most widely used in education for drill and practice programmes. Over the last few years, the popularity of drill and practice programmes has decreased, whereas searching for information and using the computer for word processing has increased in relative importance (figure 1.9).

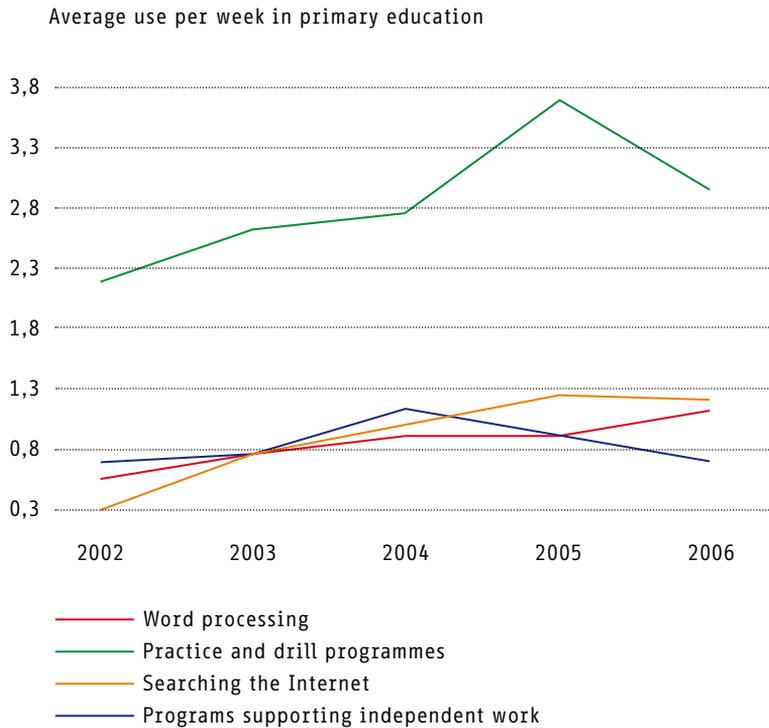


Figure 1.9: Forms of use in primary education (source: TNS NIPO, 2006).

In secondary education teachers use computers mainly for their pupils' work in preparing written assignments, and as information tools. Teachers also use computers for course-specific practice and drill programmes and as electronic learning environments supporting independent learning (figure 1.10).



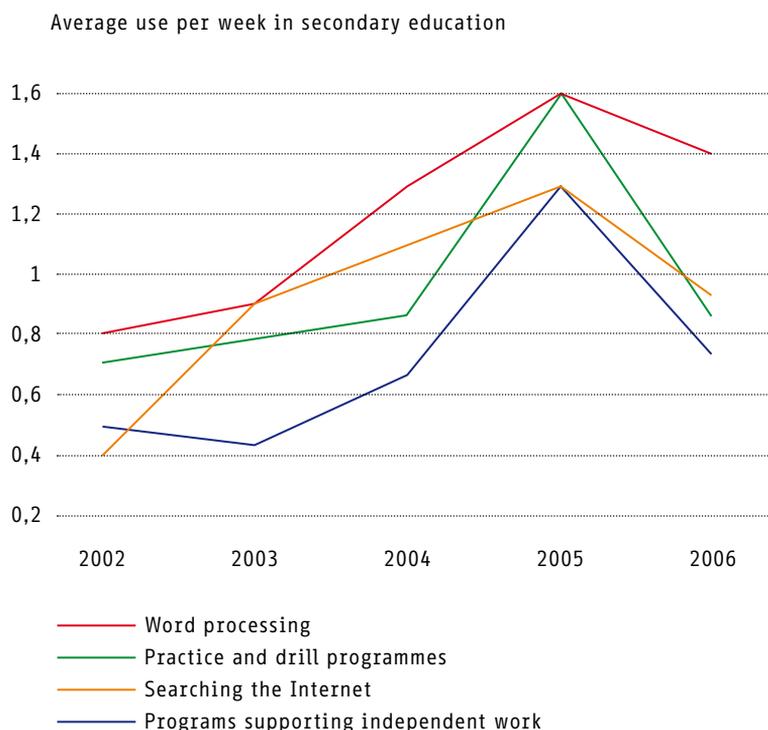


Figure 1.10: Forms of use in secondary education (source: TNS NIPO, 2006)
Average use per week in secondary education

1.7 ICT management

The ICT managers of schools have expressed the ambition to use more ICT applications more often in the future, aiming primarily to improve the quality of education. To encourage teachers to use ICT, at more than 80% of schools, ICT management consistently underlines the value of ICT for education (table 1.2). The majority of schools are offering content-based support. At most schools the exchange of knowledge is encouraged and space made available for trying out new learning arrangements with ICT (for example grassroots, a national programme stimulating ICT investments of schools). The number of schools training teachers in ICT basic skills through ECDL (European Computer Driving Licence) and DRO (Digitaal Rijbewijs Onderwijs) as a strategy for encouraging the use of ICT, is quickly decreasing: from 41% in 2006 to 27% in 2007. In secondary education there is more attention to ICT skills in job-performance interviews (40%) and application interviews (53%). Thus far least

attention has been paid to specific teacher-training in pedagogical ICT skills: less than 20% in primary and secondary education.

Stimulant ¹	PE			SE			Average
	'04-'05	'05-'06	'06-'07	'04-'05	'05-'06	'06-'07	PE-SE '04-'06
1 (1) Consistent announcement that ICT is valuable for education	79	81	86	63	80	85	79
2 (2) Content-based support by ICT coordinator/working group	68	69	69	57	56	70	65
3 (3) Encouraging exchange of knowledge and experiences amongst colleagues	52	57	60	56	54	62	57
4 (4) Offering space for experimenting with new approaches slowly	38	51	47	60	61	67	54
5 (6) ICT is a permanent part of integrated quality insurance	47	56	54	--	34	47	48
6 (7) Making compulsory the use of specific applications	--	50	51	31	42	53	45
7 (5) Training in ICT basic skills (ECDL, DRO)	48	41	27	46	44	44	42
8 (8) Taking into account ICT competences when selecting new staff members	18	36	33	30	30	53	33
9 (9) ICT is a subject during job assessment interviews	31	32	34	21	23	40	20
10 (10) Specific training in pedagogical ICT skills	23	18	15	18	21	19	19

¹ Ranking determined on the basis of the average percentage of schools over the last three years. Ranking in 2006 between brackets.

Table 1.2: How are schools encouraging teachers to use ICT? (Sources: ICT education monitor 2004-2005, Educational Inspectorate 2005-2007.

2 ICT Yields

What are the yields from using ICT for learning and to what extent can ICT offer an effective way of improving teaching? Research results can help professionals in education to make balanced choices in using ICT. At the same time, the present overview of research results shows that still much is unknown about what works and what does not work.

2.1 Conceptual framework

In order to acquire a balanced view, ICT yields in education are approached from two angles:

- perceived yields. These are the evaluations of professionals in educational practice about the meaning and the effects of ICT use.
- measured yields. These are the results of practice-based experiments in which use is being made of measuring tools attuned to the goals of the ICT application.

The results of research on ICT yields should help improve learning by means of ICT. The research programme of Kennisnet Ict op school on the effectiveness of ICT in schools uses the conceptual framework as depicted in figure 2.1¹⁴.

¹⁴ Derived from Goodlad, J.I. (1979). *Curriculum inquiry. The study of curriculum practice*. New York: McGraw-Hill

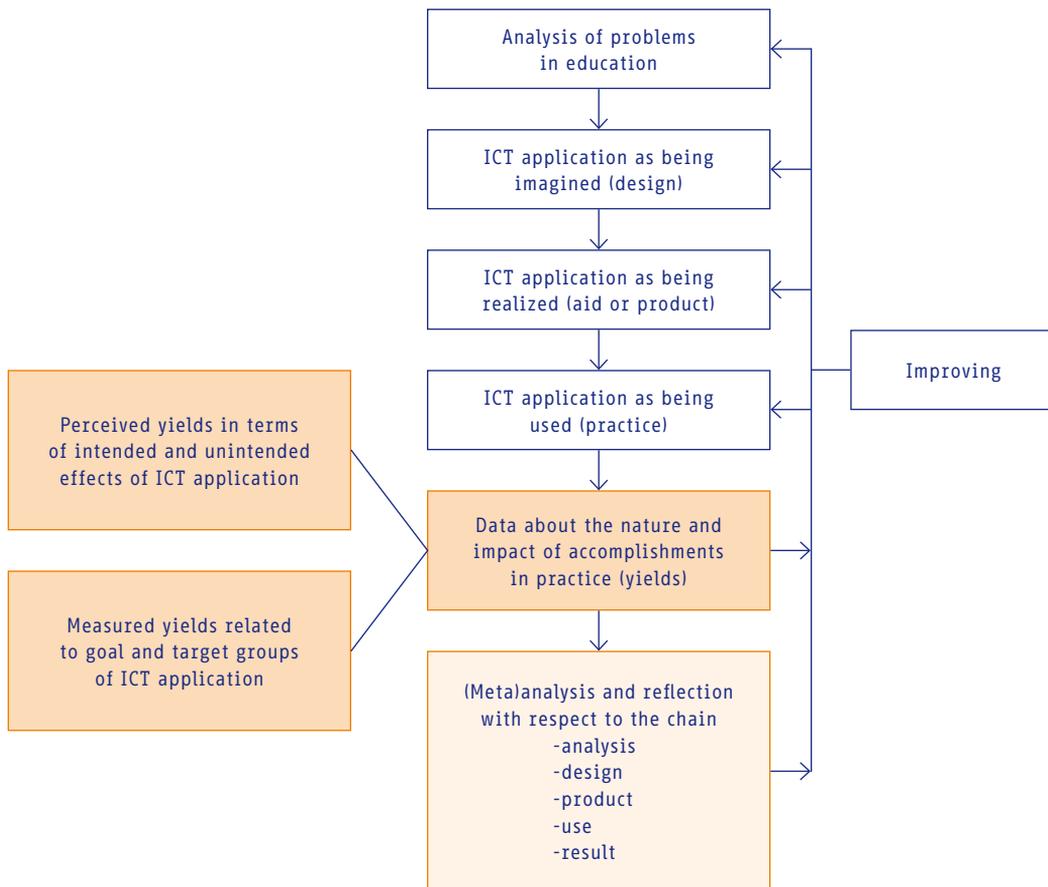


Figure 2.1: The positioning of research on ICT yields (marked in orange) within a chain of quality improvement.

¹⁵ Selection of overview studies on yields of ICT in education, in chronological order (publications are available at www.ictopschool.net/onderzoek/):

- a. Department of Education (2002). *Zin en Onzin*. Zoetermeer: OCV
- b. Kulik, J. (2003). *Effects of using instructional technology in elementary and secondary schools: What controlled evaluation studies say*. Arlington: SRI
- c. Cox, M., Abbott, C., Webb, M. et al (2004). *A review of the research literature relating to ICT and attainment*. London: Becta
- d. Becta (2005). *The Becta review 2005. Evidence on the progress of ICT in education*. Coventry: British Educational Communications and Technology Agency
- e. Lemke, C. (2006). *ICT in schools: what the research says*. Metiri group.
- f. Balanskat, A., Blamire, R. & Kefala, S. (2006). *ICT Impact report. A review of studies of ICT impact on schools in Europe*. Brussels: European Schoolnet.

¹⁶ Drent, M. (2005). In *Transitie. Op weg naar innovatief ICT-gebruik op de PABO*. Enschede: Proefschrift Universiteit Twente. Available in Dutch at www.ictopschool.nl/onderzoek/.

¹⁷ Tondeur, J., Hermans, R., Valke, M. & Braak, J. (in press). *Teacher profiles and types of computer use: the importance of educational beliefs*.

2.2 Research reviews

Various reviews of research on ICT yields¹⁵ show that ICT is contributing more frequently and more systematically to the quality of education. The most important ICT yields are:

- Students learn more, quicker and more enjoyably;
- Better results for both good and weakly performing students;
- Pupils are more motivated and have more self-confidence;
- ICT supports several pedagogical approaches, such as transfer of knowledge, independent studying, and cooperative learning.

ICT yields can rarely be ascribed to using ICT applications alone. In order to profit from ICT, it is necessary that:

- Teachers are sufficiently equipped;
- There is a supportive organisation of schools;
- There are sufficient technical facilities;
- The ICT form that is being used fits in with the school's vision on education.

Research convincingly shows that there is a clear relation between ICT yields and the extent to which teachers are equipped to integrate ICT into education (Balanskat et al., 2006; Cox et al., 2004; Becta, 2005; Drent, 2005¹⁶). Furthermore, forms of ICT use should be attuned to the vision of the school on the way learning processes are organised (Tondeur et al, in press¹⁷).

¹⁸ Dynarsky, M., Agodini, R., Heaviside, S., Novak, T., et al. (2007). *Effectiveness of reading and mathematics software products: finding from the first student cohort*. Department of Education, Institute of Education Sciences.

¹⁹ Some of these pupils did in fact use ICT programmes, but these were different programmes than those selected specifically for this research.

The key role of the teacher

A teacher capable of using ICT in the right manner, can improve the quality and yield of education. An ICT application does not determine the quality of education by itself. The very same application can, when used in an improper way, have no influence or even negative influence on the pupil's achievements and the quality of education. This may, for instance, be the case when pupils do not spend enough time working with a computer programme, or when pupils work individually on a program intended for pairs. Such user-conditions explain why ICT research results are often ambiguous. Some studies show positive effects of ICT, some indicate no effect, and there are studies which point at negative effects of ICT use.

Not only ICT

Differences in learning results cannot be explained by pupils' use of computer programmes alone. That is the conclusion of a large scale research that has recently been done in the United States¹⁸. In these studies, the learning results of pupils using specific computer programmes for language and mathematics were compared with those of pupils who received traditional teaching¹⁹. The research found no significant differences between the two groups. We may thus conclude that learning results are not determined by using a certain computer programme alone. The researchers did find other effects which explain differences in learning results. Young children, for instance, are affected by the number of pupils per teacher. Also, learning results are influenced by the amount of time spent on a computer programme.

²⁰ OECD (2006). *Are students ready for a technology-rich world?* Parijs: OECD publishing, programme for international student assessment.

²¹ Translation. In Dutch: Kennisproductie met praktijkbetekenis.

²² See www.ictopschool.net/onderzoek/stimuleringsregeling

²³ See www.ictopschool.net/onderzoek/nieuws/Nieuwsbericht.2007-04-02.4103

The right dose

It has already been shown, in research from the OECD²⁰, that there is neither a singular nor a linear relation between using ICT and learning yields. This research points out that pupils with moderate ICT use achieve better than pupils who do not, or hardly, use ICT in school. Excessive ICT use, however, considerably lowers learning results, even more than an absence of ICT use. These results underline that teachers need to be informed about the right dose and mix of ICT use in learning situations. The results of impact studies repeatedly and clearly show that technological facilities such as computers and software are not sufficient in themselves to effect an increase of learning yield. Where the skills and knowledge of the teacher are lacking, it is difficult to conceive of any effective goal-directed learning using ICT.

2.3 Yields

Kennisnet Ict op school supports research on ICT yields in education. Since the beginning of 2007, this type of research has been encouraged as part of the research programme Knowledge production with practical relevance²¹. This research programme consists, among other things, of a fund that stimulates empirical research contributing to insights into ICT yields in learning²².

Language development in young children

One of the first results from this research programme concerns the effects of digital picture books on the language development in pre-school children²³. Pre-school children typically learn two to three new words each day. By using digital picture books with moving images, they on average learn five to six new words every day (figure 2.2).

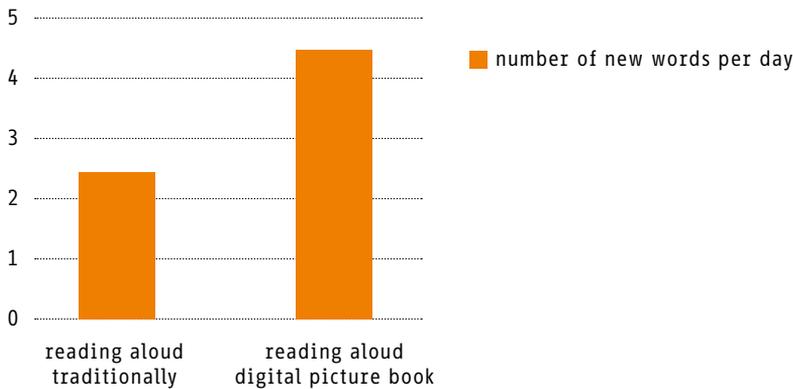


Figure 2.2: Number of new words learned by pre-school children per day when words are read aloud in the traditional way, and when read aloud using a digital picture book (source: Sardes, 2007).

The research results also point out that teachers play a key role and that ICT should be used in combination with other pedagogical aids. Digital picture books are more effective when the teacher also reads aloud from a traditional picture book²⁴. The order of use is important.

It is only minimally effective when children are offered the digital picture book first. It is much more effective when the traditional picture book first is used first, and the child made to repeat learned words by means of the computer. The pupil learns more, and the teacher saves time.

Digital picture books

When children use a digital picture book they listen and look at the story on the computer, and answer questions. Digital picture books work best in combination with the traditional picture book. The teacher alternates reading in groups from the traditional picture book with looking individually at the images on the computer.

Children with language deficiencies especially profit from this multi-medial approach. Teachers confirm that pre-school children's understanding of stories increases as does their vocabulary. Practical

²⁴ Broekhof, K. & Cohen de Lara, H. (2007). *Levende boeken: zo werkt dat*. Utrecht: Sardes.

experience shows that digital picture books save teachers a significant amount of time. The profit in learning is realised in twenty to thirty minutes per day. After reading from the book in the group of pre-school children, the children can repeat the story as many times as they wish on the computer. As a result, they learn more. This research thus shows that digital picture books can significantly raise the effectiveness of language teaching in young children.

Simulations in secondary school

A computer simulation consists of an imitation of (part of) reality. Simulations can help pupils gain conceptual knowledge and do this by helping them to learn by researching. Such research-based learning by means of computer simulations encourages both experimental approach and cooperative learning. Research shows the importance of adequate support from teachers. Research-based learning by means of simulations cannot replace other forms of learning, but it can supplement it²⁵.

Promoting expertise

Several studies on promoting the expertise of teachers in pedagogical use of ICT point to a number of essential rules of thumb²⁶, most importantly:

- **Practicality:** Promoting expertise should be directed towards practical effects in class. Teachers and pupils thus experience the results directly in daily practice.
- **Cooperation:** the creation of a community of good practice. Many teachers learn most from and with each other.
- **Experimentation:** there is nothing wrong with a systematic approach, but it is important to offer enough space for teachers to experiment and to develop their own ideas.

²⁵ Jong, T. de & Joolingen, W. van. (2006). *Wat weten we over computersimulaties in het VO*. Zoetermeer: Kennisnet Ict op school.

²⁶ a. Eck, E. van, Kral, M., Slighte, H., Volman, M. (2006). *Samen Deskundiger*. Amsterdam: SCO-Kohnstamm Instituut, Hogeschool van Arnhem and Nijmegen, and Vrije Universiteit Amsterdam. Available in Dutch at www.ictopschool.net/.

b. *Samen deskundiger in de praktijk*. Zoetermeer: Kennisnet Ict op school (2006). Available in Dutch at www.samendeskundiger.nl.

c. *Kookboek samen deskundiger in de praktijk*. Zoetermeer: Kennisnet Ict op school (2006). Available in Dutch at www.samendeskundiger.nl.

- **Facilitation:** school management can further support expertise by making facilities available. It is equally important that school management and teachers develop together a widely shared vision on ICT in education.

Costs of digital learning materials

Digital learning materials can significantly cut costs in school books in secondary education and in lower secondary professional education. Little yield is to be expected, however, when digital learning materials²⁷ are merely used to cut costs, without support and extra investment in the expertise of teachers. This has been shown in a study on the costs, chances, and threats of digital learning materials²⁷. In this study practical examples have been analysed in order to ascertain how schools implement digital learning materials and what such tools mean for school costs. Using digital learning materials shifts the costs. Although significant savings can be made in the purchase of school books, the school will need to invest in effective and efficient use of digital learning materials. The school will have to invest especially in the promotion of teacher expertise and in further specific expertise within the school organisation: in management, maintenance, and security. Research also shows that digital learning materials should be attuned to the school's education vision; otherwise the school runs the risk that ICT investments fail to yield significant results. It is rare to find a school in which beliefs about the arrangement and organisation of learning determine what digital learning materials should be used.

Digital learning materials

Research on the costs to schools of digital learning materials reveals three approaches.

The pragmatic approach is that in which digital learning materials are used only incidentally. In this approach there is only a weak relation between vision on education and use of digital learning materials. In the second approach digital learning materials are combined with a

²⁷ Institute for Research of Government Expenses (Instituut voor Onderzoek van Overheidsuitgaven). (2006). *Digitale leermiddelen: kosten, kansen en bedreigingen*. Leiden: IOO. Available in Dutch at www.ictopschool.net/onderzoek.

diversity of teaching methods. Schools gradually come to recognize the need for a consistent vision on ICT use.

The third approach starts with a vision on arrangement and organization of the learning process. The requirements for digital learning materials are then derived from this vision.

The research results indicate that implementation of digital learning materials always requires an extra financial investment. If schools choose to use these materials pragmatically costs will increase, and there are few profits to be expected.

The second approach, which steers a middle course, will also require extra financial investments. These costs could be compensated for through more efficient operational management. The third, conceptual, approach offers the most opportunities, but also the greatest number of threats.

As digital learning materials gain a more prominent place in education, the costs in textbooks decreases. However, without good managerial leadership, costs of digital learning materials can quickly increase – without much in the way of educational profit.

One laptop per pupil

More and more schools are interested in developing educational concepts which rely upon permanent access to digital learning materials. One of those concepts is the 'laptop-per-pupil' (LpP) concept. On behalf of Kennisnet Ict op school, results of LpP have been collected in a number of schools which have gained experience with this concept in the last few years²⁸. As a strategy for implementation, most schools choose to enable a small group of teachers to experiment freely with the possibilities and difficulties of the LpP strategy.

The schools that have been studied are characterized by a positive attitude at the management level. Teachers are encouraged to investigate new directions and to participate in projects. Amongst the results of the LpP concept are:

²⁸ Kokkeler, B., Graaf, S. van de, Waard, M. de, Kanters, E. (2007). *Laptop per leerling*. Leusden: BMC. Available on: www.ictopschool.net/onderzoek.

- Pupils cooperate more often;
- Teachers teach in a more creative and attractive way;
- Pupils learn more enjoyably;
- Preparation of classes is easier and shorter as soon as all learning material is available;
- It is easier to adapt to topical events;
- Teachers and pupils can communicate with each other more easily.

Experienced disadvantages are:

- The work load of the teacher increases, because learning material often has to be personally developed by the teacher, and because contact with pupils is more intense;
- Parents and teachers do not always know where children ‘digitally hang out’;
- Laptop batteries quickly run out;
- Laptops are often available only in school;
- High investments in employees and equipment is required

Analysis of practical examples shows that a unilateral approach to hardware and software is risky in the sense that it may result in a very short-term use of the LpP strategy. Any lasting effect requires other initiatives, such as the development of a shared education vision and investment in teacher expertise.

ICT literacy

By comparison with other countries²⁹, there is little systematic interest in ICT literacy in the Netherlands. ICT skills are skills that are important for every citizen. These comprise information skills such as searching, selecting, interpreting, and processing information. But they also include knowledge and awareness of, and a certain attitude towards, social aspects of ICT use (netiquette), healthy computer use, digital bullying, copyright,

²⁹ See, e.g.,

a. Belgium, Flanders: www.ond.vlaanderen.be/beleid/nota/beleidsplanICT2007-2009.pdf;
 b. Norway: www.itu.no/ituenglish/1093980667.4/1180002836.34;
 c. United Kingdom: www.ks3ictpilot.com;
 d. Europa: www.coe.int/T/E/Human_Rights/Media/hbk_en.html;
 e. Verenigde Staten: www.ictliteracy.info/index.htm;
 f. Australië: www.fadvassessments.com/site.pl/about/news/04/04/2005.

safety, and the influence of manipulation by means of digital media. These competencies are sometimes known as ‘media literacy’.

In 2006-2007 an explorative study sought to investigate the effects of a program on media literacy called ‘My Media World’³⁰. This study focused on the ICT literacy of children in primary school of 9-11 years of age³¹. The results of a pilot indicated that the ICT literacy of pupils increased when they performed designated tasks in school or at home. Most pupils found the software programme ‘My Media World’ enjoyable and instructive³².

2.4 Opinions

One out of every three pupils in primary and secondary education believes that use of the Internet helps them perform better at school. Their parents are equally optimistic about ICT (figure 2.3). The remaining pupils and parents think that the Internet does not contribute to better results in school, or cannot perceive its results. It is specifically the parents who are uncertain about the contribution of the Internet to performance at school.

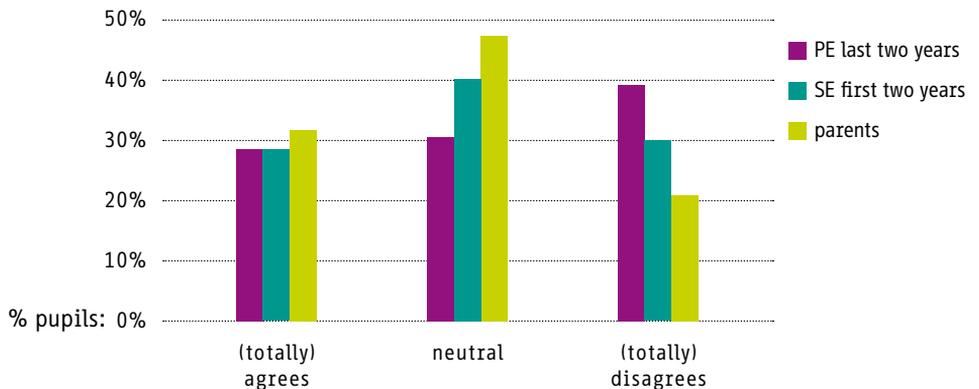


Figure 2.3: Opinions of pupils and their parents about the thesis: *The Internet makes me/my child perform better at school* (source: IVO, 2007).

³⁰ Translation. In Dutch, the programme is called ‘Mijn Media Wereld’.

³¹ Kruijs, L., van de (2007). *Mediawijs in het basisonderwijs*. Graduation thesis Hogeschool van Amsterdam: Institute of Media and Information Management. Available in Dutch at www.ictopschool.net/onderzoek.

³² Research-based directions for use of the Internet as a source of information for learning have been brought together in the brochure ‘*Wat we weten over... webwijsheid in het PO en VO*’. Kennisnet Ict op school (2007). Available in Dutch at www.kennisrotonde.nl.

Ict Management

Managers of schools in primary and secondary education by and large agree (90%) that ICT contributes to the attractiveness of education for pupils. The percentage of managers who think ICT fulfils an important role in making education more attractive has increased in the last three years in primary and secondary education, by 20% and 30% respectively (figure 2.4).

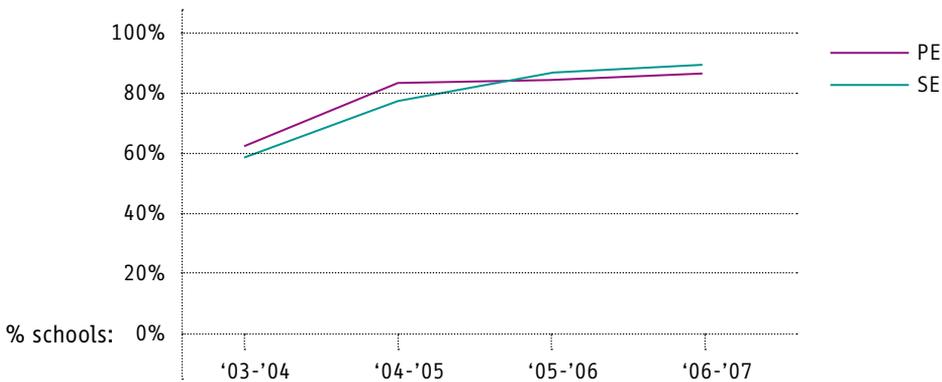


Figure 2.4: Percentage of schools where ICT management thinks that ICT makes an important contribution to making education more attractive for pupils. (Source: TNS NIPO, 2003-2005; Educational Inspectorate, 2005-2007).

Schools

The contribution of ICT to education can, according to schools, also express itself in the promotion of independent learning, in a more efficient organisation of teaching, in offering a richer learning environment, and in an educational organisation more flexible and adaptive to pupils' needs (table 2.1).

Some schools also profit from ICT as support for the promotion of cooperative learning, tailor-made testing, and communication between teacher and pupil. More and more schools utilize ICT for remedial purposes. In primary education, this applies to 78% of the schools (74% in 2006), and in secondary education 71% (58% in 2006).

Contribution from ICT: ¹	PE			SE			Average
	'04-'05	'05-'06	'06-'07	'04-'05	'05-'06	'06-'07	PE-SE '04-'06

Commonly occurring ICT results

1 (1)	Offering more attractive education for pupils	83	83	85	77	86	89	84
2 (2)	Creating richer learning environments	73	72	75	67	80	84	75
3 (3)	Encouraging independent learning	77	72	73	67	77	79	74
4 (5)	Greater flexibility in, and individualizing of, the learning process	63	56	66	47	66	57	57
5 (4)	Providing more efficient organisation of education	58	56	60	--	53	54	56
6 (6)	Making the education package adaptable and tailored to needs	64	56	64	34	50	55	54

Rarely occurring ICT results

7 (7)	Promoting cooperative learning	38	30	32	43	36	42	37
8 (8)	Allowing tailor-made testing	--	24	25	--	24	23	24
9 (9)	Intensifying communication between teacher and pupil	16	6	9	27	14	28	17

¹ Ranking determined on the basis of the average percentage of schools over the last three years. Ranking in 2006 between brackets.

Table 2.1: Percentage of schools which experiences a (relatively) major contribution of ICT to educational goals (sources: TNS NIPO, 2003-2005; Educational Inspectorate, 2005-2007).

Figure 2.5 illustrates the relationship between the added value of commonly occurring and that of rarely occurring ICT results. This figure shows, in primary and secondary education, that the rarely occurring results emerge in schools already making optimal use of the commonly occurring results. Schools that make use of rarely occurring results are pioneers. These pioneers show that further added value is to be had in tailor-made testing, cooperative learning, and intensifying communication between pupil and teacher.

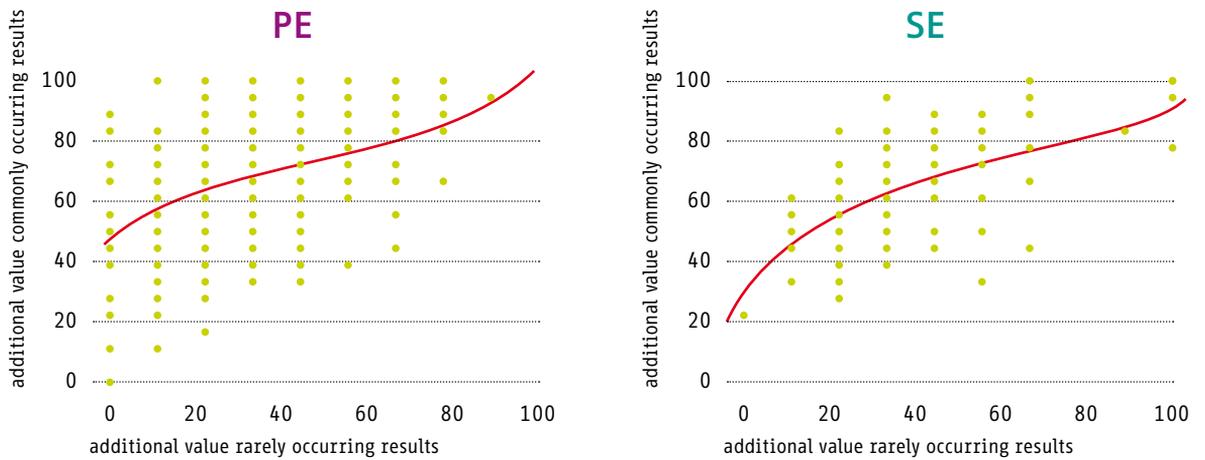


Figure 2.5: Relationship between experienced added value of ICT in commonly occurring and rarely occurring results.

Schools are very satisfied with investments in ICT: 80% to 90% of school managers in primary and secondary education are (very) satisfied with the results of investments thus far (TNS NIPO, 2006).



3 Vision and Leadership

Vision and leadership are required to help shape ICT policy in schools. To what extent do schools develop their own vision? Is ICT use guided by good leadership and is it well coordinated? What do teachers think about ICT use in schools, and what do they think about their own role in that process, now and in the future?

3.1 Vision

In primary education almost three-quarters of all schools have developed a vision on the use of ICT centrally. In secondary education six out of ten schools have an explicit vision on ICT (figure 3.1).

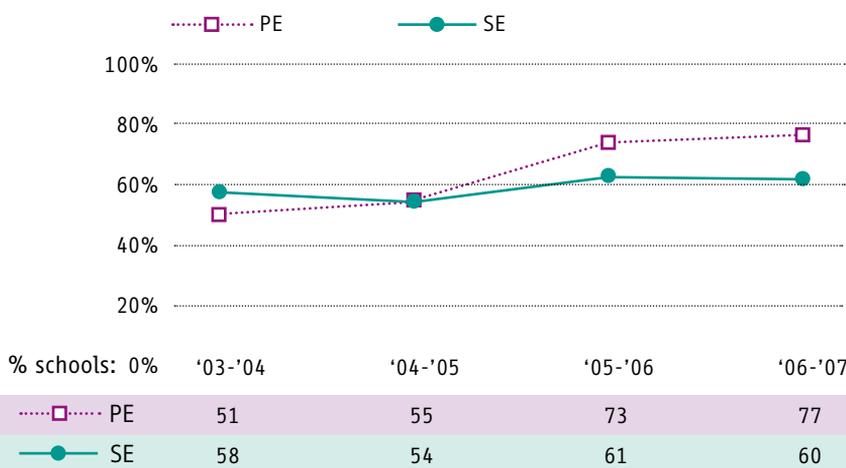


Figure 3.1: Percentage of schools which have, according to ICT management, developed a vision on ICT centrally (source: TNS NIPO, 2003-2007).



To a considerable extent, the attitudes within a school towards the structuring and organisation of learning processes determines which ICT application will or will not tie in with the educational objectives. The ICT yield is related to the match between educational vision and choice of ICT. A mismatch between educational vision and ICT application means, in practice, that teachers use educational materials not developed for the learning situation in which they are deployed. A study asking teachers to work with a random software programme revealed that teachers aborted the programme if it did not fit well enough with their ideas on education.

ICT policy plan

More than half of all schools in primary and secondary education have developed their vision on ICT in the form of an ICT policy plan which is subsequently implemented by the management. One third of all schools have an ICT policy plan that is no longer in use.

The majority of managers believe that there is an ICT vision in their school. This does not tie in with the opinion of most teachers. More than half of the teachers in primary education and 70% in secondary education express a great need for a school management that, together with the team, takes responsibility for developing a broadly supported vision on the use of ICT in education (TNS NIPO, 2006).

3.2 Leadership

Another aspect crucial to the successful use of ICT is the presence of leadership within the school. Leadership is important first and foremost in the process of vision development. The development of a vision on the use of ICT in practice means setting the direction for school development by identifying an aspirational goal, the striving for which is seen as valuable by all involved. That leadership is of crucial importance within the school organisation is reflected by studies in the field of effective innovation in schools and education³³.

³³ Goodson, I.F. (2003). *Professional knowledge, professional lives: studies in education and change*. Philadelphia: Open university press.

³⁴ Hargreaves, A. (2004). *Teaching in the knowledge society: education in the age of insecurity*. Philadelphia: Open university press.

³⁵ Bolt, van der L, F Studulski, A van der Vegt, D. Bontje (2006). *De betrokkenheid van de leraar bij onderwijsinnovatie: een verkenning op basis van literatuur*. Utrecht: Sardes.

Once the picture of the kind of education aimed for is established, and the role of ICT in that picture clarified and broadly supported by team members, good management is essential in obtaining harmonisation with the remaining elements of Four in Balance. In short, a balanced coherence between these elements requires clear leadership if use of ICT in education is to be effective and efficient.

Elements of Leadership

A great deal is known about the characteristics of good leadership. The most important aspects are:

- Developing a vision, and to inspire others on the basis of such vision;
- Establishing shared goals and objectives;
- Setting high expectations in quality of education;
- Encouraging the professional development of teachers;
- Developing a structure that encourages participation and involvement.

Coordination

An indication of the presence of ICT leadership can be, according to teachers, derived from the extent in which ICT use is coordinated. In secondary education, nine out of ten teachers say that there is little to no content-based coordination in the use of ICT at their school (figure 3.2). At these schools, individual teachers have to determine themselves whether or not they should use ICT. Coordination at these schools involves merely the technical facilities being put under the control of an ICT coordinator or systems manager. In primary education, much more than in secondary education, agreements are made between teachers about the pedagogical use of ICT. According to one third of these teachers, it is important that the whole school team respects the agreements that are made within the school about the pedagogical use of ICT. In secondary education such agreements are rare.

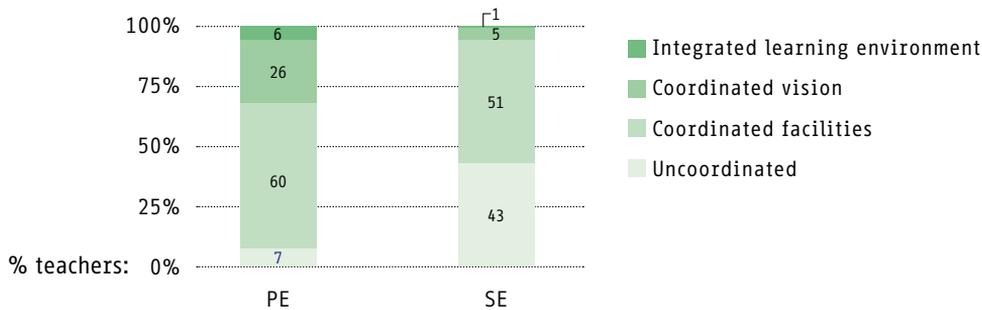


Figure 3.2: Classification of teachers regarding the way in which ICT is coordinated within their school (source: ITS, 2007).

Explanation of the labels:

- > *Uncoordinated*: it is the responsibility of the teacher to determine whether or not ICT is used for teaching.
- > *Coordinated facilities*: the school has an ICT coordinator for ICT facilities, and teachers usually make their own choices with respect to what learning material is used and in what way ICT is deployed.
- > *Coordinated vision*: there are agreements within the school regarding the pedagogical use of ICT in most elements of the curriculum. People find it important that all teachers respect these agreements.
- > *Integrated learning environment*: there are school-wide or section-wide agreements regarding the pedagogical use of ICT in almost every element of the curriculum. The way ICT is used in school matches the ideas of the school team about teaching and learning. ICT makes up an integral part of the teaching techniques of all teachers.

3.3 Teachers

The vision of teachers on the structuring of education and the role of ICT in accomplishing that can be depicted in a profile consisting of four components. Two of those components are related to a general profile of teaching philosophy. They refer to the extent in which schools direct themselves towards (1) the transfer of knowledge and (2) the construction of knowledge. The other two components indicate to what extent ICT is being used, for both didactical approaches.

Transfer of knowledge refers to learning situations in which, for instance, the teacher determines what elements of the subject matter are learned, and when. The subject matter is presented in small increments.

When the pedagogical aim is the construction of knowledge, the learning situation may be wherein, for instance, pupils of different grades helping each other. The evaluation of results not only involves what pupils learn, but also the way in which they learn.

Figure 3.3 shows that teachers combine these components in their teaching. A teacher does not exclusively focus on either transfer of knowledge or construction of knowledge, but mixes both approaches. There is a similarly mixed approach in the use of ICT.

Transfer of knowledge has an important place in primary education as well as secondary education, but primary schools use ICT in this approach more often than secondary schools. Construction of knowledge is more important in primary education than in secondary education. In secondary education ICT is used equally often for transfer of knowledge and construction of knowledge.

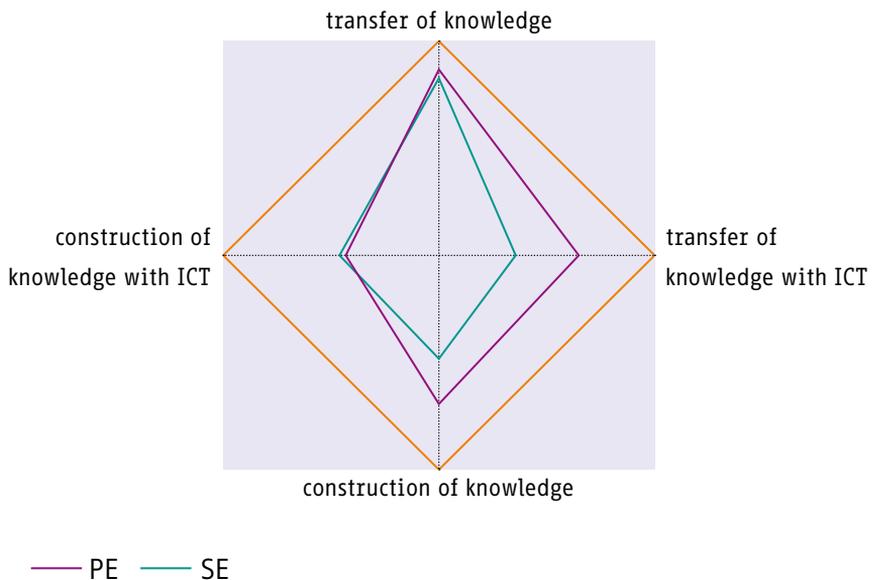


Figure 3.3: Pedagogical profile of importance given by teachers to transfer of knowledge and construction of knowledge and the role of ICT in each (source: ITS, 2007).

Transfer of knowledge

Teachers expect that attention to the transfer of knowledge approach will remain as high as ever. More than 80% of the teachers in primary and secondary education organize teaching aimed at transfer of knowledge on a daily to weekly basis (see figure 3.1). But figure 3.1 also shows that 16% to 18% of teachers expect to be spending less time on transfer of knowledge in the future, while 7% to 12% of them expect to be using more pedagogical working methods aiming at construction of knowledge. Not only those teachers desiring to attend less to transfer of knowledge, but also those hoping to attend more to it, believe that ICT may be a useful tool for their purpose. In the one camp, teachers think that ICT use will limit attention to transfer of knowledge. In the other camp, teachers hope to use ICT for spending more time on transfer of knowledge. The function of ICT in teaching depends largely on the underlying vision with respect to the organization of education.

Description		Now	Future		Use of ICT	
		Daily/Weekly	Less	More	Less	More
Average % teachers	PE	88	18	12	14	8
	SE	83	16	7	12	4

Table 3.1: Overview of transfer of knowledge and use of ICT, now and in the future (data drawn from ITS, 2007).

Construction of Knowledge

More than half of the teachers in primary education, and one out of five in secondary education, organize teaching aimed at construction of knowledge on a daily to weekly basis (table 3.2). Almost no teachers expect to attend less to knowledge construction in the future. On the contrary, almost half of all teachers in primary education and 40% in secondary education expect to attend more to knowledge construction in the future. Almost half of the teachers wishing to attend more to construction of knowledge (48% in primary education, 40% in secondary education). 22% of the teachers in primary education, and 19% in secondary education expect to be using ICT for that purpose.

Description		Now	Future		Use of ICT	
		Daily/Weekly	Less	More	Less	More
Average % teachers	PE	58	0	48	0	22
	SE	22	0	40	0	19

Table 3.2: Overview of knowledge construction and use of ICT, now and in the future (data drawn from ITS, 2007).

3.4 ICT applications

More teachers wish to use ICT more frequently, both for transfer and for construction of knowledge. Tables 3.3 and 3.4 show that teachers have a short term ambition to:

- Use ICT much more often for learning;
- Use ICT for a broad range of pedagogical applications

Description		Now	Future	
		Daily/weekly	Less	More
I allow pupils to practice study material with the computer	PE	89	0	48
	SE	21	0	68
I allow pupils to use course-specific software	PE	69	0	52
	SE	17	0	67
I let pupils play games which relate to primary objectives	PE	39	0	37
	SE	0	0	33
Average % of teachers	PE	69	0	45
	SE	13	0	56

Table 3.3: Current and expected use of ICT in three years, aimed at transfer of knowledge, displayed separately for teachers in primary and secondary education (source: ITS, 2007).

Description		Now	Future	
		Daily/weekly	Less	More
I give specific assignments for which pupils have to use the Internet	PE	15	0	59
	SE	9	0	60
I let pupils themselves look for sources on the Internet	PE	18	0	59
	SE	10	0	57
When creating papers, I stimulate pupils to use the Internet	PE	32	0	46
	SE	29	1	34
I learn pupils how to selectively use sources from the Internet	PE	29	0	44
	SE	14	0	53
In my teaching pupils make assignments for which they use the Internet and e-mail	PE	11	0	46
	SE	9	0	53
Average % teachers	PE	21	0	51
	SE	14	0	51

Table 3.4: Current use and expected use in three years of specific ICT applications aimed at construction of knowledge, according to teachers in primary education and secondary education (source: ITS, 2007).

In conclusion, use of ICT is not restricted to specific approaches to learning, e.g. transfer of knowledge or construction of knowledge. ICT supports both. Teachers combine construction and transfer of knowledge in their teaching, and expect to use ICT for both purposes.

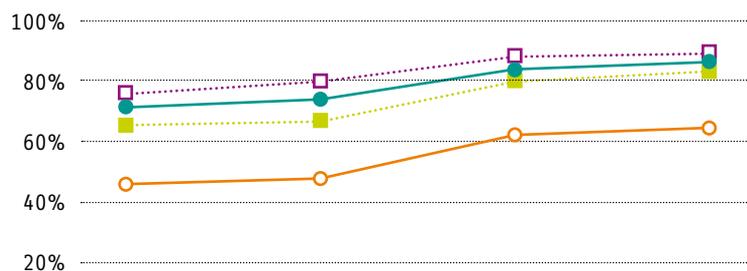


4 Professional Development

The use of ICT in learning processes demands specific skills, both of teachers and of pupils. This chapter deals first with the expertise of teachers in the use of ICT in education. It then deals with the skills of pupils and problems which occur when they use the Internet for learning.

4.1 Expertise of teachers

Teachers are increasingly technically skilled in operating computers. According to ICT management, about nine out of ten teachers have sufficient basic skills for the use of standard applications, such as Internet and word processing (figure 4.1). Pedagogical skills are also improving. More than eight out of ten teachers in primary education and almost two thirds in secondary education are sufficiently skilled in the use of ICT in their teaching.



% teachers:	0%	'03-'04	'04-'05	'05-'06	'06-'07
PE basic skills		78	80	89	90
SE basic skills		74	76	83	88
PE pedagogical		67	70	81	84
SE pedagogical		46	48	62	65

Figure 4.1: Percentage of teachers with sufficient mastery of ICT skills according to ICT management (source: 2003-2004: ICT Education Monitor; 2005-2007: Educational Inspectorate).

The number of teachers who, according to ICT management, are moderately or poorly informed about the possibilities of ICT, has decreased to 19% in primary education, and to 39% in secondary education. ICT managers

believe that teachers in their schools are well informed about the possibilities of ICT in education (figure 4.2).



Figure 4.2: Percentage of teachers moderately or poorly informed about the possibilities of ICT, according to management (source: TNS NIPO: 2001-2007).

Teachers are less confident than are ICT managers in their competency in the use of ICT in teaching. About half of all teachers consider themselves competent in the use of the computer as a pedagogical aid (table 4.1). Fewer than half of all teachers believe that they derive additional pedagogical value from ICT at their level of competence in the use of ICT in their teaching.

ICT skills	PE		SE	
	'05-'06	'06-'07	'05-'06	'06-'07
Use of computer as a pedagogical tool	48	48	34	49
Organisation of lessons in which ICT is used	31	35	39	47
Use of educational software	51	54	36	44
Assessing the usability of software	43	46	44	49
Use of electronic learning environments	24	24	28	39
Use of the pupil-monitoring system	45	56	33	37

Table 4.1: Percentage of teachers with (very) advanced levels of ICT skills (source: TNS-NIPO, 2005-2007).

4.2 Pupils

Pupils in primary and secondary education today have grown up familiar with the use of instant messaging, chat, e-mail, and games. Pupils acquire the skills necessary for handling a computer mainly outside school. Using a computer at home contributes more to the ICT skills of a child than school (Kuhlemeier & Hemker, 2005; Haan & Huysman, 2002; Ten Brummelhuis, 1998³⁴). Most pupils (96%) have computer facilities at their disposal at home (Duimel & Haan; CBS, 2006³⁵).

Increasingly younger

Pupils are becoming conversant with ICT application at an ever younger age. In 1999 one quarter of all pupils were able to use a search engine on a computer. In 2007, nine out of ten pupils in the age-range 11-15 have this skill (table 4.2). Parents of pupils are also reasonably skilled in the use of the Internet. Fathers are usually slightly more skilled than mothers.

Internet	1999 PE last class	2007 PE last two classes	2007 PE classes 1-3	2007 mother	2007 father
I can surf the Internet	29	83	88	90	93
I can use a search engine	25	88	89	93	94
I can download a file from the Internet	15	53	80	63	84
I can chat	17	41	65	21	34
I can make my own homepage/ profile	--	43	61	8	23
I can use MSN	--	81	87	47	51
I can maintain a weblog	--	25	45	9	21
I can use a (web)cam	--	53	66	25	37

Table 4.2: Overview of tasks which pupils in primary and secondary education, in their own opinion, are able to perform without assistance (sources: ICT monitor, 1999; IVO, 2007).

³⁴ a) Kuhlemeier, H. & Hemker, B. (2005). *Computergebruik thuis en de Internetvaardigheden in het voortgezet onderwijs*. Pedagogische Studiën 82, p.115-136.

(b) Haan, J. de & Huysmans, F. (2002). *Van huis uit digital. Verwerving van digitale vaardigheden tussen thuismilieu en school*. Den Haag: SCP.

(c) Brummelhuis, A.C.A. ten (1998). *ICT-monitor 1997-1998: voortgezet onderwijs*. Enschede: Universiteit Twente. Available in Dutch at www.ictopschool.net/onderzoek/ICT-monitor_1998-2000.

³⁵ (a) CBS (2006). *De digitale economie*. Den Haag: CBS. Available in Dutch at www.cbs.nl.

(b) Duimel, M. & Haan, J. de (2007). *Nieuwe links in het gezin. De digitale leefwereld van tieners en de rol van hun ouders*. Den Haag: SCP.

No computer at home

If pupils have no access to a computer at home, the most usual explanation is a socio-economic one (OECD, 2006). A number of municipalities in the Netherlands have decided to make computer facilities available to these families, as part of poverty policy and as a way of tackling social deprivation. Research into the provision of computers shows that home ownership of computers does contribute to reducing the level of disadvantages experienced by these pupils in terms of digital skills when entering secondary education (Emmelot and Felix, 2006³⁶)

Difficult

Teachers find it difficult to use the Internet for educational purposes. Teachers are unsure how to coach their pupils. They have the impression that pupils are able to produce good-quality written assignments, but are unsure whether pupils actually learn something from the information they have collected from the Internet (Kuiper, 2007).

Many pupils have difficulty reading texts from websites on the Internet in any critical way, and find it hard to judge whether results from search engines are usable. These skills, however, are crucially important for effective use of the Internet for learning³⁷.

³⁶ Emmelot, Y. en C. Felix (2006). *De digitale kloof overbrugd: onderzoek naar de (potentiële) effecten van de regeling PC-voorziening van de gemeente Amsterdam*. Amsterdam: SCO-Kohnstamminstituut.

³⁷ An overview of recent insights in using the Internet for learning, and help in using the Internet for educational purposes can be found in the brochure 'Wat weten we over... webwijsheid in PO en VO'. Published by Kennisnet Ict op School, Available in Dutch at www.ictopschool.nl.

5 Educational Software and Content

What software do teachers and pupils use? Are they satisfied with the available software? What needs do pupils and parent have?

There is no accurate information about the use of educational software and content actually used by teachers and pupils. There is, however, information about the availability of educational software and content from NICL, Programmamatrix, Samenzoeken, and the website of Kennisnet.

Schools

The need for usable educational software and content has been amongst the most important priorities for schools for more than ten years. The precise cause of this persistent demand is unclear, but it relates to a lack of awareness of the easy availability of programs and content, the inability to find software which ties in with the needs of the school, or a mismatch between supply and demand. Other countries are also struggling with the match between the supply of digital teaching material and actual use by teachers and pupils (Becta, 2006³⁸).

Publishers

One quarter of the teachers believe that educational publishers make good use of ICT in the teaching aids they offer. 40% believe that ICT is sufficiently integrated into methodology. More than one quarter of the teachers are only moderately satisfied (figure 5.1). Teachers in primary and secondary education do not differ in their attitudes to the attention paid by educational publishers to ICT in teaching resources.

³⁸ Becta ICT Research (2006). *The Becta Review 2006: Evidence on the progress of ICT in education*. Available at www.becta.org.uk.

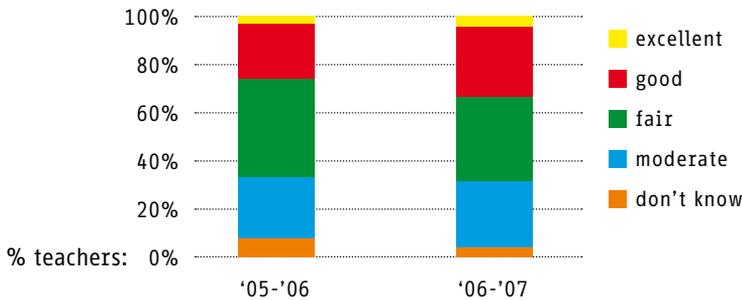


Figure 5.1: Satisfaction amongst teachers in primary education and secondary education with the attention paid by educational publishers to ICT in teaching resources (source: TNS NIPO, 2006).

Despite the relative degree of satisfaction amongst teachers with respect to the ICT content of the packages placed on the market by educational publishers, three-quarters of teachers in primary and secondary education have expressed a need for more usable teaching material and content (TNS NIPO, 2006). ICT management shares this opinion.

School books and the Internet

Only few pupils (15%) and parents (9%) believe that the Internet can replace the school books that are used by pupils now. An even smaller percentage of pupils (14%) and parents (4%) believe that pupils learn more on the computer at home than from school books.

Websites and the Internet

Pupils rarely make use of websites associated with school textbooks. Half of the pupils never consult the website associated with a particular textbook and only 7% regularly visits such a site. Despite the limited use of the Internet for school tasks, 45% of the pupils do not support the thesis that using the Internet for school tasks is boring (34% have no opinion on this matter, and 21% agree (IVO, 2007)).

6 ICT Infrastructure

This chapter deals with developments in the availability of computers and Internet access. It also deals with keeping computer applications up-to-date and the rising popularity of the digital school board. The chapter ends by considering the desires of parents with respect to communication and information exchange with the school.

6.1 Computers and the Internet

Over the last few decades, the public education system in the Netherlands has invested heavily in purchasing infrastructural ICT facilities. Between 1997 and 2005, the Dutch government invested more than € 1.5 billion integrating ICT into education. The main focus for investment in this period was equipment, educational software, and Internet facilities.

Computers in education

The scale of computer facilities has risen by some fifteen times over the last twenty years. At present, schools in primary and secondary education on average have access to one computer to every seven pupils (figure 6.1). With this pupil-computer ratio, the Netherlands occupies a mid-range position internationally, comparable with that of Belgium and Italy. Countries with the greatest availability of computer facilities for pupils are the United States, the United Kingdom, Australia, Korea, Hungary, New Zealand, Austria, and Canada. In 2003 these countries already had at least one computer to every five pupils (OECD, 2006).

Computers at home

Concerning the availability of computers for pupils in their homes, the Netherlands is internationally in the upper level. More than 95% of pupils in the Netherlands have a computer at home. Dutch households are, with regard to computers and Internet access, the best equipped in the EU. The availability of broadband Internet in Dutch households (62%) is considerably greater than in the rest of the EU (on average 23%)³⁹.

³⁹ Eurobarometer E-communications Household Survey (2006). Available at http://ec.europa.eu/information_society/policy/ecomm/doc/info_centre/studies_ext_consult/ecomm_household_study/eb_jul06_main_report_en.pdf.



Figure 6.1: Development of pupil-computer ratio in the past ten years (sources: ICT-monitor: 1998-2000; ICT educational monitor 2001-2004; Educational Inspectorate 2005-2007).

Broadband Internet

Of all primary and secondary schools in the Netherlands, 25% and 41% respectively have a broadband connection to the Internet (TNS-NIPO, 2006). Most secondary schools which do not yet have broadband access to the Internet are interested in it, or are planning to install it. About 30% of the primary schools are planning to switch to high speed Internet access (TNS-NIPO, 2006).

More computers

The average number of pupils per computer has not changed from that in 2005-2006. The distribution in the pupil-computer ratio shows that there is an increasing number of schools which have a pupil-computer ratio of 4-1 or better (figure 6.2). This may be an indication that some schools are aiming to increase the availability of computer applications for educational purposes (see also chapter 2: laptop per pupil).



Figure 6.2: Distribution of pupil-computer ratio in primary and secondary education (based on data from the Educational Inspectorate, 2006 and 2007).

Replacement

The general trend is for schools to invest less in increasing the number of computers and more on quality improvement of the ICT facilities available. According to primary schools managements, 30% of all computers are due for replacement (table 6.1). It is expected that only 21% of these computers will actually be replaced in 2007. In secondary education, however, 20% of all existing computers require replacement and will probably be actually replaced.

	PE				SE			
	'03-'04	'04-'05	'05-'06	'06-'07	'03-'04	'04-'05	'05-'06	'06-'07
Percentage of computers for educational purposes requiring replacement	22	27	21	30	25	24	25	20
Percentage of computers actually replaced in this school year	12	15	20	21	19	16	22	23

Table 6.1: Replacement of computers (source: TNS NIPO, 2005).

Network facilities

Schools are also investing more and more in improving Internet facilities such as the installation of broadband and wireless networks. In secondary education 95% of all computers have Internet access. In primary education 87% of computer equipment is connected to the Internet (Educational Inspectorate, 2007).

Digital school boards

At the end of 2006 11% of all primary schools and 42% of all secondary schools could have a digital school board at their disposal. Of schools that do not have available digital school boards, four out of ten are considering buying one or more in the coming two years (TNS NIPO, 2006).

Satisfaction

Generally speaking, ICT management considers the ICT facilities available in schools sufficient for use in lessons. In 2007 85% of both primary and secondary schools indicated that ICT facilities are (more than) sufficient (figure 6.3). In primary education satisfaction with available ICT facilities has slightly decreased.

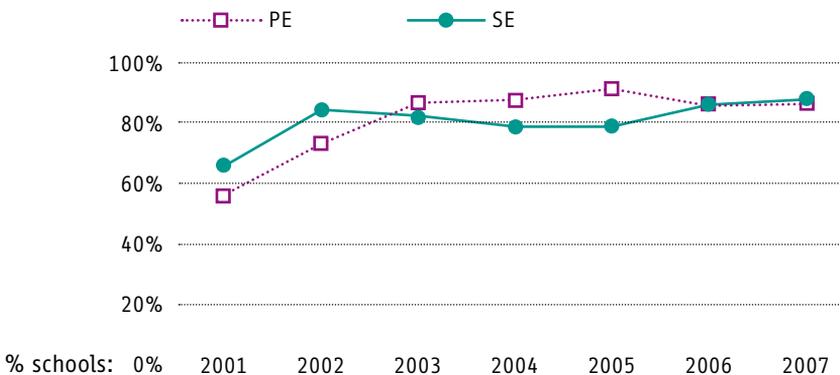


Figure 6.3: Schools that have (more than) sufficient ICT facilities (source: TNS NIPO, 2002-2007).

6.2 Parents

Most parents want more access via the computer to information about the progress of their children at school (figure 6.4).

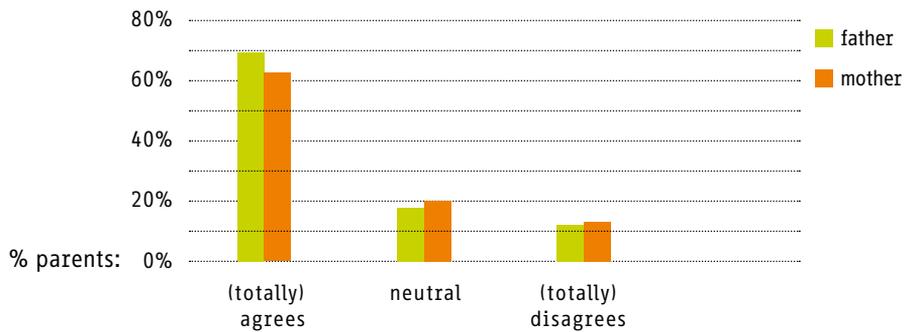


Figure 6.4: Response of parents to the thesis 'I would like more access via the computer to information about the progress of my children' (source: IVO, 2007).

Most parents also think that communication with the school would be improved if they were able to access more information by e-mail and from school websites (figure 6.5).

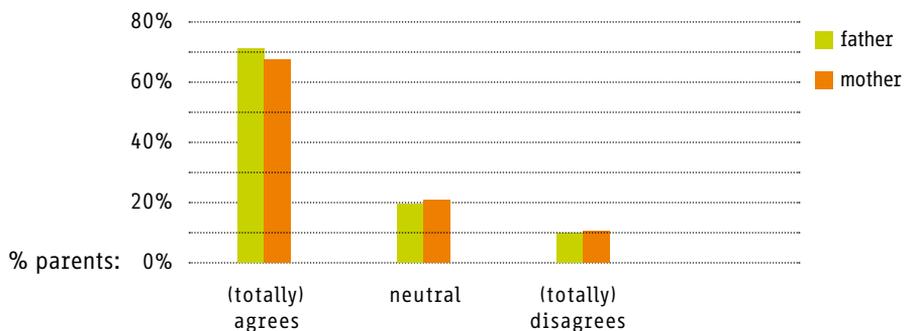


Figure 6.5: Response of parents to the thesis 'The school could improve communication with parents by making information available via e-mail and a school website' (source: IVO, 2006).

7 Support

Implementing ICT in education requires support. What kind of support do teachers and school managers need, and what are the most important bottle necks in the supply of such support?

7.1 Priorities

Teachers and managers aim to improve the quality of education. To achieve this aim, they want to use more ICT in the near future. But teachers and managers disagree about what the best approach is to further this integration of ICT into education.

Primary education

In primary education teachers believe that the most important issue is the improvement of the ICT infrastructure (figure 7.1). Teachers think furthermore that a shared vision within the school team should be high on the agenda. Management believes that, apart from investing in computer facilities, priority should be given to developing the knowledge and skills of teachers. Teachers disagree: they do not believe that their knowledge and skills should be given high priority.



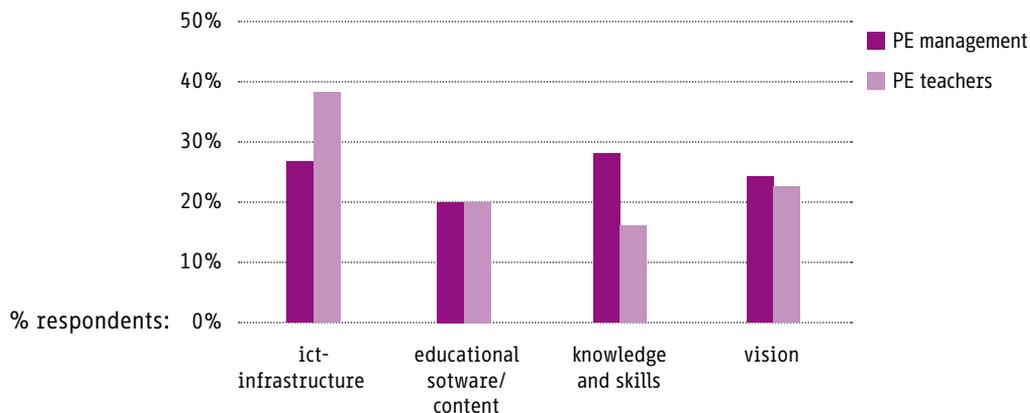


Figure 7.1: Areas of attention of Four in Balance that should have priority according to management and teachers in primary education (source: TNS NIPO, 2006)

Secondary Education

In secondary education teachers think that developing their skills and knowledge has only low priority. They believe that most attention should be given to adequate ICT facilities (figure 7.2). Managers, however, do not give much priority to extra ICT infrastructure. Most attention, they believe, should be paid to the knowledge and skills of teachers.

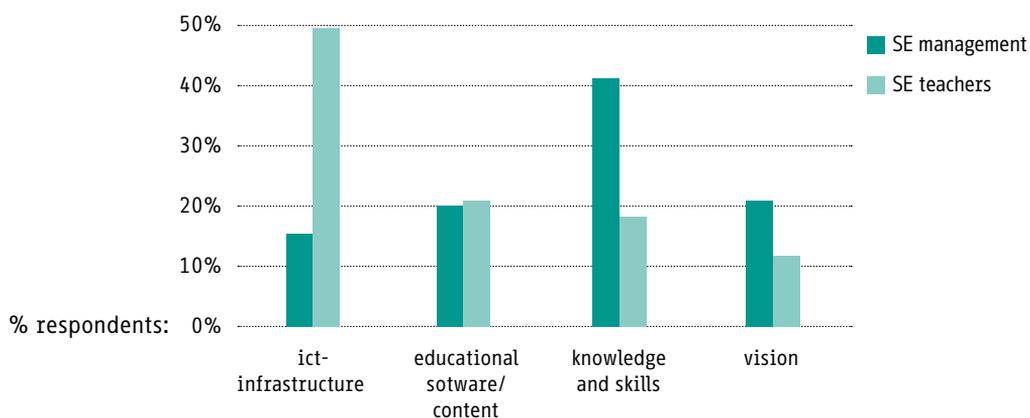


Figure 7.2: Areas of attention of Four in Balance that should have priority according to management and teachers in secondary education (source: TNS NIPO, 2006).

7.2 Support for management

As tables 7.1 and 7.2 show, managers have a need for support. The most important needs are:

- Support in making choices: in developing a vision, selecting good practices, and help in acquiring software;
- Facilities necessary for using ICT: usable software, content, and pedagogical aids

By contrast with the indications of previous years, extra computers are no longer part of the seven most important support needs. New in the top 7 is help in acquiring good software.

Needs ¹		PE			SE			Average
		'04-'05	'05-'06	'06-'07	'04-'05	'05-'06	'06-'07	PE-SE '04-'06
1 (2)	Good practice in ICT and didactics	67	69	71	76	73	71	71
2 (1)	Computer software which enables pupils to work independently	72	72	64	78	68	69	71
3 (3)	More usable material for learning (content)	56	57	61	66	72	66	63
4 (4)	Aids for using computer programs in class	65	56	57	60	53	57	58
5 (5)	A vision, developed by teachers and management, on ICT in education	--	55	48	--	58	46	52
6 (6)	Courses aimed at teaching with ICT applications (pedagogical applications)	49	49	45	45	63	50	50
7 (-)	Help in acquiring computer software	39	42	39	52	60	53	48

¹ Ranking based on the average percentage of schools in the past three years. Between brackets is the position in 2006.

Table 7.1: Top 7 support needs of managers (source: TNS NIPO, 2004-2007⁴⁰).

⁴⁰ Research by ITS in spring 2007 shows a similar ranking in needs for support.

Purchasing computer software is, according to managers, the most important bottleneck in the further integration of ICT into education (table 7.2).

Bottlenecks ¹		PE			SE			Average
		'04-'05	'05-'06	'06-'07	'04-'05	'05-'06	'06-'07	PE-SE '04-'06
1 (2)	Costs of educational software (license)	71	58	69	63	50	36	58
2 (2)	Financing for upgrading ICT facilities	37	46	57	59	61	58	53
3 (3)	Possibility of producing tailor-made programs	32	39	36	50	54	40	42

¹ Ranking based on the average percentage of schools in the past three years. Between brackets is the position in 2006.

Table 7.2: Top 3 bottlenecks in ICT use (sources: ICT educational monitor 2004-2005; Educational Inspectorate 2005-2007).

7.3 Support for teachers

Schools differ in the manner in which they coordinate the implementation and use of ICT. Figure 3.2 gave an overview of the extent to which individual teachers or a school team as a whole choose to use ICT. The organisational context of ICT use within a school was classified as follows:

- **Uncoordinated:** it is the responsibility of the teacher to determine whether or not ICT is used for teaching.
- **Coordinated facilities:** the school has an ICT coordinator for ICT facilities, and teachers usually make their own choices with respect to what learning material is used and in what way ICT is deployed.
- **Coordinated vision:** there are agreements within the school regarding the pedagogical use of ICT in most elements of the curriculum. People find it important that all teachers respect these agreements.
- **Integrated learning environment:** there are school-wide or section-wide agreements regarding the pedagogical use of ICT in almost every element of the curriculum. The way ICT is used in school matches the ideas of the school team about teaching and learning. ICT makes up an integral part of the teaching techniques of all teachers.

Figures 7.3 and 7.4 illustrate that these classifications, from ‘uncoordinated’ to ‘an integrated learning environment’, are also related to other characteristics of computer use. For instance, in schools in which ICT is strongly coordinated, more use is made of ICT. Teachers also know more about what computer applications are available for their own teaching.

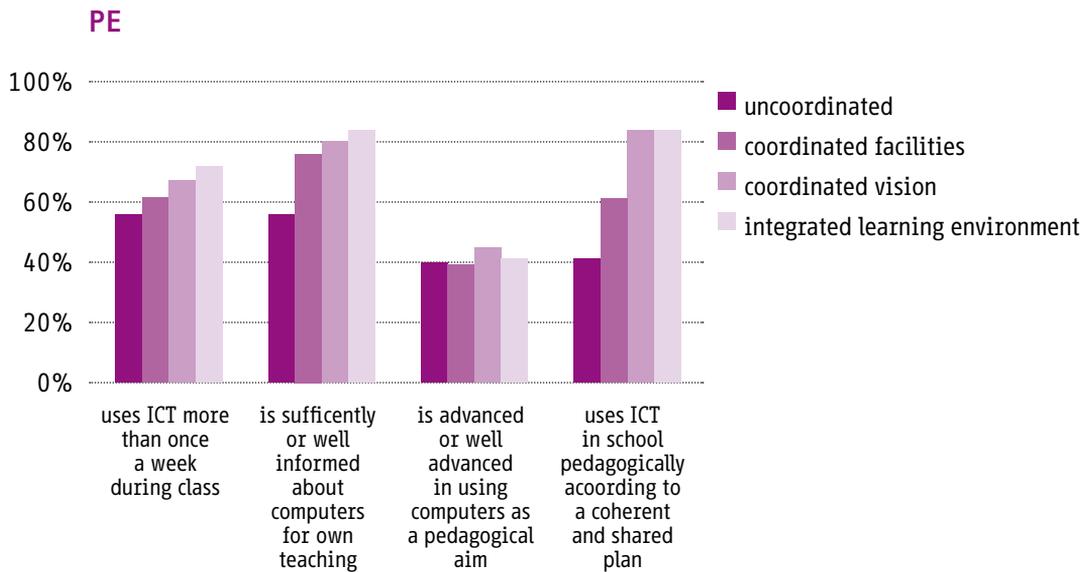


Figure 7.3: Characteristics of ICT use in primary education in relation to the way ICT use is organised in schools as classified by teachers (source: ITS, 2007)

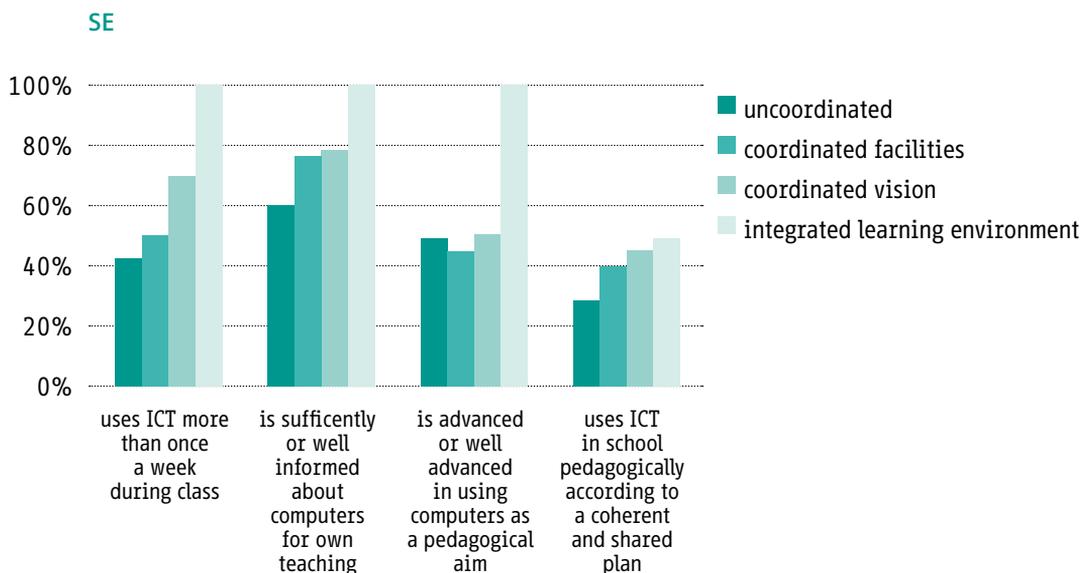


Figure 7.4: Characteristics of ICT use in secondary education in relation to the way ICT use is organised in schools as classified by teachers (source: ITS, 2007).

Figures 7.5 and 7.6 make clear how the support needs of schools are related to these four ways in which ICT is organised in schools. This information may be of value not only when schools need support, but also in their search for the appropriate organisational context in which such support is to be embedded⁴¹.

The results show that it is when the school has committed itself to embed ICT in education that teachers need least professional help when the computer or network fails, (supportive need no.4 in figure 7.5 in primary education, and no.6 in 7.6 in secondary education).

Teacher demand for support in software acquisition is lower when there are better agreements made within the school concerning the type of educational content for which ICT is used (supportive need no. 12 in figure 7.5 for primary education and no.13 in figure 7.6 for secondary education).

⁴¹ Last year a number of schools have experimented with a webbased tool for mapping didactics with ICT, needs for support for teachers, and the organisation of ICT within the school. Schools that want to map their own situation can consult this tool for selfevaluation at the beginning of 2008 on www.ictopschool.net/onderzoek (in Dutch).

There are also supportive needs which barely relate to the way in which ICT is organised within schools; for example, the need amongst teachers for effective pupil-monitoring systems (supportive need no.14 in primary education, no.17 in secondary education).

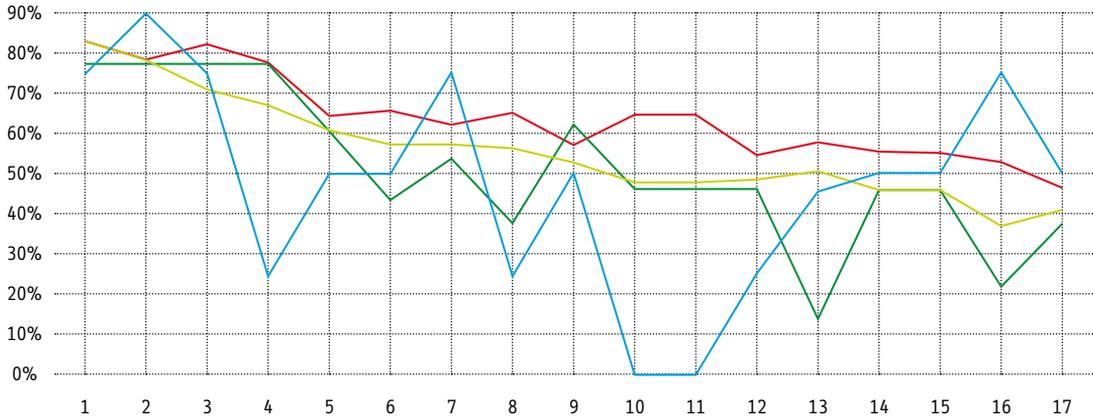


Figure 7.5: Teacher support needs in primary education in relation to the organisation of ICT in schools. The number refers to the ranking in the table. (Source: ITS, 2007).

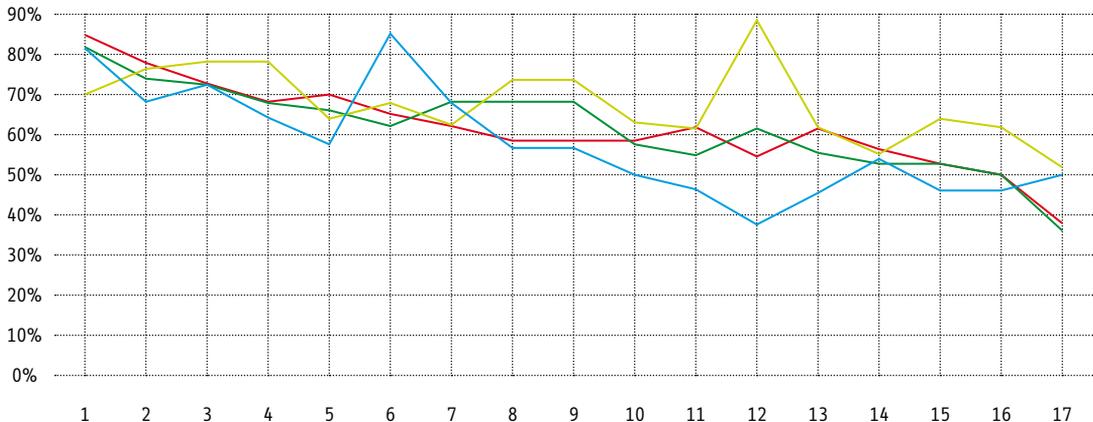


Figure 7.6: Teacher support needs in secondary education in relation to the organisation of ICT in schools. The number refers to the ranking in the table. (Source: ITS, 2007⁴²).

Legend with figures 7.5 and 7.6)

uncoordinated content coordinated technology coordinated integrated learning environment

⁴² Because only a very low number of teachers (n=4) claim to work in an integrated organisation of ICT in schools, data for the category 'integrated' are not very accurate and should be seen as merely indicative.

Legend with figures 7.5 and 7.6

Teacher support needs (rather large and very large) ordered according to ranking in primary education (source: ITS, 2007)

- | | | | |
|--------|--|---------|--|
| 1 (4) | Computer programs with which pupils can work independently | 9 (11) | A computer program which facilitates the correction of tests |
| 2 (3) | Good practice in pedagogical use of ICT | 10 (7) | A school management which develops an ICT vision supported by the teaching staff |
| 3 (1) | More usable digital learning material (content) | 11 (14) | An ICT vision in education developed by both teachers and managers |
| 4 (6) | Instant professional help when computers or networks fail | 12 (13) | Help in acquiring good software |
| 5 (8) | Aid in using computer programs in class | 13 (15) | Opportunity to learn from ICT use in other schools |
| 6 (2) | Extra computers or other computer facilities | 14 (16) | A usable pupil-monitoring system or administrative system which tracks pupils' progression |
| 7 (5) | Swift and secure connection from home with computer facilities at school | 15 (12) | Courses aimed at teaching with ICT |
| 8 (10) | Support in using the electronic learning environment | 16 (9) | Greater reliability of internet connections |
| | | 17 (17) | Better customisation of ICT facilities of the school administration and educational software |

Figures show that teachers and management of both primary and secondary education largely agree about the main support needs. The top three of support need of both types of schools is:

- Computer programs with which pupils can work independently
- Good practice in pedagogical use of ICT
- More usable digital learning material and content

Last year, this top three of main support needs was the same. In addition, especially teachers in secondary education say that they need extra computer facilities.

The above explorative analyses show that schools differ in organisation in the coordination of computer use. Only few teachers say that ICT use in their school is substantially coordinated. Use of ICT usually depends on the preference and interest of the individual teacher. The results collected in the last few years' show that support needs relate to the way ICT is organised within the school. In the coming year, this relation will be studied in more detail.

Four in Balance Monitor 2007

© Kennisnet Ict op school, Zoetermeer 2007

All rights reserved.

Although the greatest possible care was taken in preparing this publication, the author(s), editor(s) and publisher of Kennisnet Ict op school accept no liability for any errors or imperfections.

No part of this publication may be reproduced (including storage in an automated database) or published in whatever manner, except in the case of reproduction of the content of this publication under the license 'name reference, non-commercial, non-derived works' as operated by Creative Commons.



Name reference – Non-commercial – Non-derived Works 2.5 Nederland

The user may:

- copy, distribute, show, present and implement the work

Under the following conditions:

-  Name indication: The user must state the name of Kennisnet Ict op school, with the work.
-  Non-commercial: The user may not use the work for commercial purposes.
-  Non-derived works: The user may not process the work.

- In the event of reuse or distribution, the user must notify the licensing conditions on this work.
- The user may only waive one or more of these conditions following prior permission from Kennisnet Ict op school.

The specification hereinabove are without prejudice to the statutory restriction on intellectual property rights.

www.creativecommons.org/licenses

Imprint

This is a publication by Ict Kennisnet op school.

www.ictopschool.net

www.kennisnet.nl

ISBN 978-90-77647-06-6

