Four in Balance Monitor 2013

ICT in Dutch primary, secondary and vocational education
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Foreword

The goals Dutch education has set for itself are ambitious, excellent education provided by highly trained professionals at efficiently functioning schools. Education tailored to pupils' talents, skills and learning styles. Education that brings out the best in each pupil. In a rapidly changing society, these goals have become dire necessities. Education must anticipate these changes and meet the resulting needs while providing the skills and nurturing the talents that society needs in the 21st century. These goals cannot be achieved without the effective and proper use of ICT, which bolsters pupil motivation, improves academic performance and contributes to a more efficient learning process. Effective ICT use can help teachers become more professional. Properly using ICT also leads to better-organized schools, more transparency and better management.

The Four in Balance Monitor 2013 identifies ICT as an integral part of Dutch education. There is a growing need for digital learning materials, and the use of computers in the classroom is steadily increasing. Nearly all Dutch teachers use ICT in one way or another in their teaching, which has been made possible by recent investments in infrastructure. The ICT developments we see in other aspects of society, such as the shift towards cloud computing, are just as evident in education. Teachers and managers are enthusiastically embracing the possibilities ICT offers for better organizing education, such as pupil tracking systems and virtual learning environments. Data from these systems is also used to support pupils, prompt discussions between colleagues and keep parents informed.

Nevertheless, education could be benefiting from ICT much more than it does. There is still a significant difference between how ICT should be used and how it is actually used, and the methods of using ICT are generally insufficient to achieve the goals the users want to achieve. Our knowledge about how, when and why ICT works is continually increasing, and this knowledge can be used to prevent an imbalance. The vision of education is and will remain the basic premise. The ICT applications and infrastructure will have to be molded to that premise so that more and more schools will be able to reap the maximum benefits ICT has to offer. Once schools devote sufficient attention to the basic elements of Four in Balance – and to safeguarding that balance – ICT will be able to work even more effectively for education.
1 Education and ICT

This chapter outlines ICT’s context in education and ICT’s role in society. While the Dutch education system is ambitious and faces challenges, developments in the ICT field are proceeding at a lightning pace.
1.1 Challenges for excellent education

Education is the foundation of society. Only through top-quality education can children reach their full potential. Excellent education not only challenges children to develop their intelligence, skills and creativity, it also helps keep pupils from falling too far behind academically, ensuring that they reach their full potential at their own pace. Top-level education is critical to pupils’ active participation in the society of the future.

The digitization of society demands that people develop new skills. Education will have to provide pupils with these new skills – which have become indispensable in the 21st century – so that they will be able to continue functioning in this new era. In addition to literacy and numeracy, people will have to acquire a variety of skills that include critical thinking, ICT literacy and creativity (Voogt & Pareja Roblin, 2010).
Dutch education has accepted this responsibility and has expressed a clear ambition to rank in the top 5 of the world’s knowledge-driven economies (PO-Raad, 2012; VO-raad, 2011; MBO Raad, 2011). To that end, primary, secondary and vocational education are focusing on three priorities: personalization, professionalization and performance. These three goals are also key to Kennisnet’s long-term plan, which describes how Kennisnet wants to make ICT work for education (Kennisnet, 2012).

**Personalization: Tailoring education to pupils’ specific needs**

One of the most significant challenges facing today’s education is the growth in differences among pupils. Getting the best from each child demands that the more than three million primary, secondary and vocational school pupils receive an education that is increasingly adapted to their individual talents, learning styles and capabilities.

This goal can be achieved by personalizing education to a high degree or by differentiating by group levels. Only institutions that make optimal use of modern equipment, engage in cooperative learning, and differentiate in terms of objectives and instructional needs will be able to meet this demand. The introduction of “tailored education” (passend onderwijs) and the growing attention devoted to gifted pupils only increase the necessity of this development.

**Figure 2: Key figures in Dutch education**

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Institutions</th>
<th>FTEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRIM</td>
<td>7,418</td>
<td>126,900</td>
</tr>
<tr>
<td>VET</td>
<td>69</td>
<td>37,500</td>
</tr>
<tr>
<td>SEC</td>
<td>209</td>
<td>85,300</td>
</tr>
</tbody>
</table>

*Ministerie van Onderwijs, Cultuur en Wetenschap, 2012*
**Professionalization: Better teachers as the key to better education**

Competent teachers are crucial to getting the best out of each pupil. Preparing pupils for the society of the future makes many demands on teachers. Education can only be personalized if classes are led by good teachers who continue to improve themselves and build on their professionalism throughout their careers.

The McKinsey report (2012) raised many issues about education, including a clear statement that the step from good to excellent education hinges on teacher input. In addition to increasing teachers’ professional knowledge base, bolstering their didactic and pedagogical skills is key to improving education (Hanushek & Rivkin, 2010). The Netherlands still has a lot of ground to cover in precisely these areas (CPB, 2011).

The average number of students entering teacher-training colleges has fallen steadily since the end of the last century. The influx of teacher-training candidates from senior general secondary and pre-university education programs decreased until 2008, while the influx from VET programs increased during that same period. In recent years, since the implementation of the mandatory language and mathematics tests, the influx from VET programs has decreased. The rising number of candidates from pre-university programs can be attributed to the emergence of academic teacher training, which combines teacher training with a Bachelor’s degree program in pedagogical sciences (Ministerie van Onderwijs, Cultuur en Wetenschap, 2012).

In addition, the number of uncertified teachers in the Netherlands is climbing. On average, nearly one in five lessons given in secondary schools is given by an uncertified teacher (Regioplan, 2013).
Teachers’ lack of skills has also become a topic for discussion: the Education Inspectorate has determined that at least one in six teachers has insufficient basic skills. At the senior general secondary and pre-university program levels, that figure jumps to more than one in four. Most teachers have trouble with differentiation, tailoring education to different pupils’ needs, and providing feedback. Data regarding the quality of teaching in the classroom is available for only half of our secondary schools (Inspectie van het Onderwijs, 2013).

Those working in the education field are aware of the need for professionalism in education. The agreements concluded between the Ministry of Education, Culture and Science (‘the Ministry’) and the sector councils make teacher professionalism a priority (PO-Raad, 2012; VO-raad, 2011; MBO Raad, 2011). The most important goal is for current teachers to continue raising the level of their professionalism. Another goal is for more teachers to obtain Master’s degrees, which only approximately one in five teachers currently has (Ministerie van Onderwijs, Cultuur en Wetenschap, 2012).

A sharp increase in the number of pupils and the ageing of Dutch teachers have led to concerns not just about teacher quality, but quantity as well (Ministerie van Onderwijs, Cultuur en Wetenschap, 2012). For example, the number of secondary school pupils is rising and will be 950,000 by 2015, up from 900,000 in 2011 (Centraal Bureau voor de Statistiek, 2012). This increase will mean 4,500 vacancies for secondary school teachers in 2015.

Figure 4: Teacher vacancies (Ministerie van Onderwijs, Cultuur en Wetenschap, 2012)
Performance: The Netherlands wants to improve and is capable of doing so

Although the Dutch education system ranks among the best in the world, that position is by no means guaranteed. A recent study by Pearson ranked the Netherlands seventh in its international index of cognitive skills and educational attainment. The Index was based on international test results, graduation rates and the number of students at university. According to the researchers, Finland has the best education system, followed by South Korea and Hong Kong (Pearson, 2012).

Nevertheless, there is significant room for improvement in the Dutch education system. Secondary school pupils are passing their classes in Dutch, English and math with lower scores than was the case just a few years ago, and the absolute scores Dutch pupils achieved in the PISA 2009 survey were lower than they were in 2003. In addition, other well-performing countries have been more successful in improving their educational performance (OECD, 2010; OECD, 2012). Dutch Education is good, but is not getting any better (McKinsey & Company, 2012).

The Dutch education system wants to change this by ranking in the world’s top five, a goal that it is capable of achieving and that it will have to achieve in a difficult economic climate in which austerity measures are also affecting education. This means that performance will have to be coupled with effective organization that will be charged with harmonizing pupil needs with the people and funds that are available.

Figure 5: Pearson index of education (Pearson, 2012)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Finland</td>
<td>1.26</td>
</tr>
<tr>
<td>2</td>
<td>South Korea</td>
<td>1.23</td>
</tr>
<tr>
<td>3</td>
<td>Hong Kong - China</td>
<td>0.90</td>
</tr>
<tr>
<td>4</td>
<td>Japan</td>
<td>0.89</td>
</tr>
<tr>
<td>5</td>
<td>Singapore</td>
<td>0.84</td>
</tr>
<tr>
<td>6</td>
<td>United Kingdom</td>
<td>0.60</td>
</tr>
<tr>
<td>7</td>
<td>The Netherlands</td>
<td>0.59</td>
</tr>
<tr>
<td>8</td>
<td>New Zealand</td>
<td>0.56</td>
</tr>
<tr>
<td>9</td>
<td>Switzerland</td>
<td>0.55</td>
</tr>
<tr>
<td>10</td>
<td>Canada</td>
<td>0.54</td>
</tr>
</tbody>
</table>

Figure 6: Schools’ financial performance, in millions of euros (Centraal Bureau voor de Statistiek, 2013)
**Challenges**

The difficult economic climate will not make it any easier to achieve this goal. In 2007, primary and secondary schools achieved a profit of EUR 285 million. Their profitability gradually decreased in subsequent years, with their result in 2010 being a loss of EUR 190 million. Since then, little has changed in educational institutions’ income and expenditure, and they continue to suffer losses each year. Approximately 80% of total school expenditures relate to their staff, to the tune of EUR 14 billion (Centraal Bureau voor de Statistiek, 2013). The Netherlands spends approximately 6.2% of its GDP on education, slightly less than the average of 6.3% spent by other countries (Ministerie van Onderwijs, Cultuur en Wetenschap, 2012).

![Figure 7: Education spending as a percentage of GDP](image)
1.2 ICT: New possibilities with a high impact

Information and communication technology has an enormous impact on our individual lives and on society as a whole. This impact was heralded by the dawn of the computer age in the 1980s and 1990s, which computerized and changed how we work. Since the 1990s, the impact has grown even more through the massive rise of the Internet, cloud applications and mobile telephones. New applications are making information accessible everywhere and creating new communication possibilities, with social media redefining its component terms. The use of mobile telephones has made it possible for people to be online continuously. Enabled by technology, companies are transitioning en masse to The New Way of Working, and they are using social media to contact their customers directly. There are few products and services that have not changed radically in the wake of technological developments, and many that are entirely dependent on technology. ICT became indispensable to us in remarkably short order.

Infrastructure: The Netherlands leads the pack

This change was prompted by lightning-fast, innovative technology. Computers are faster and more energy efficient with larger storage capacity. Mobile telephones have evolved into smartphones with faster processors, larger screens, and more functionality. In recent years, the speed of both fixed and wireless Internet has increased.

There are few products and services that have not changed radically in the wake of technological developments.
exponentially. This innovation has created more possibilities to use mobile technology for activities such as sharing files, watching films or listening to music using a mobile phone or tablet.

The ICT infrastructure in the Netherlands ranks amongst the world’s best: the Netherlands ranks fourth in infrastructure and its effective use (World Economic Forum, 2013). The Netherlands is in Europe’s top 3, both in terms of Internet speed and the number of Internet users (Akamai, 2013). Many Dutch Internet users have high-speed broadband connections, while 96% of the country’s residents have a computer in their home (Centraal Bureau voor de Statistiek, 2013).

The trend from PCs to mobile devices is clear. An increasing number of Dutch households have laptops for Internet access in addition to their traditional desktops. For example, the percentage of households with laptops increased from 28% in 2006 to 78% in 2012, and while only 12% of Dutch residents had smartphones in 2005, that figure had grown to 59% by 2012 (Centraal Bureau voor de Statistiek, 2013). Tablet computers are owned by one in three young families (Mijn Kind Online, 2012).
Since the jump in Internet speeds has been accompanied by a decrease in the price of smartphones and the ability to link an ever-increasing variety of devices to one another, creating an ‘Internet of Things’, more and more people will use mobile devices to be online continuously.

**ICT use: Always and everywhere**

The ICT infrastructure in the Netherlands is not just good, but heavily used as well, with 94% of the population using a computer at least once every three months. Of that group, 87% use computers daily, primarily at home (99%) and at work (52%). These percentages are extremely high in comparison with other countries (Centraal Bureau voor de Statistiek, 2013).

The Dutch spend more time online, an average of 3 hours and 6 minutes per day (up from 2.7 hours per day in 2010) and profit more from the Internet (Ruigrok | Netpanel, 2012). Most people use the Internet for online banking, searching for information, and online shopping (Van Deursen & Van Dijk, 2012). In the last year, 69% of all Dutch residents have shopped online, a figure far above that for the rest of Europe (Centraal Bureau voor de Statistiek, 2013).

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**Figure 10: Average Internet speed in Europe (Akamai, 2013)**

<table>
<thead>
<tr>
<th>Country</th>
<th>Q4’12 Avg Mbps</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Worldwide</td>
<td>2.9</td>
</tr>
<tr>
<td>1 Latvia</td>
<td>8.9</td>
</tr>
<tr>
<td>2 Switzerland</td>
<td>8.7</td>
</tr>
<tr>
<td>3 The Netherlands</td>
<td>8.6</td>
</tr>
<tr>
<td>4 Sweden</td>
<td>7.3</td>
</tr>
<tr>
<td>5 Finland</td>
<td>7.1</td>
</tr>
<tr>
<td>6 Romania</td>
<td>7.0</td>
</tr>
<tr>
<td>7 Denmark</td>
<td>7.0</td>
</tr>
<tr>
<td>8 Belgium</td>
<td>6.7</td>
</tr>
<tr>
<td>9 Austria</td>
<td>6.6</td>
</tr>
<tr>
<td>10 Ireland</td>
<td>6.6</td>
</tr>
<tr>
<td>11 Norway</td>
<td>6.6</td>
</tr>
</tbody>
</table>

More people will use mobile devices to be online continuously.
Laptops, tablets and smartphones are changing where and when we access the Internet, as well as what we do and what we look for online. People are accessing the Internet more and more while on the train, in the living room or in the bedroom. This makes Internet use more fleeting. Active, concentrated use at a desk is making way for brief visits to social media sites, quick searches, and use during other activities (Ruigrok & Netpanel, 2012).

Figure 11: Use of the Internet on smartphone and tablet according to location (Ruigrok & Netpanel, 2012)

<table>
<thead>
<tr>
<th>Activity</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the living room</td>
<td>80%</td>
<td>91%</td>
</tr>
<tr>
<td>While watching TV</td>
<td>49%</td>
<td>56%</td>
</tr>
<tr>
<td>While travelling</td>
<td>61%</td>
<td>24%</td>
</tr>
<tr>
<td>In bed</td>
<td>50%</td>
<td>48%</td>
</tr>
</tbody>
</table>

Figure 12: Use of various Internet applications 2011 and 2012 (Van Deursen & Van Dijk, 2012)

- Search engines, such as Google
- E-mail
- Chatting
- Internet banking
- Social networking sites
- Shopping or ordering
- Downloading music/films
- Searching for health-related information
- News services
- Taking online courses

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
The methods are also changing. Social media, Skype and WhatsApp are replacing more traditional methods of communication, such as telephoning and texting. Mobile data use is rising sharply, while telephoning and texting are in a gradual decline (OPTA, 2013). The increase in data use is a global trend. Not only are more services being based on data, new technologies are also leading to increased data use. This translates into faster downloads, higher-quality films and games, and more services being offered that use innovations such as GPS, larger screens, touch sensitivity, and various sensors.

Social media are fully integrated into our daily lives. Millions of people all over the world use Facebook, Twitter, and LinkedIn and post messages and reviews, and react to YouTube videos. Facebook has more than a billion regular users, of which 618 million can be found on the site each day (Facebook.com, Key Facts - Facebook Newsroom, 2013). Twitter continues to be an important

Figure 13: Mobile telephone use per month, per connection (OPTA, 2013)

Figure 14: Mobile Internet use by age (Centraal Bureau voor de Statistiek, 2012)
Nearly 8 out of 10 Dutch residents use one or more forms of social media. The explosive growth of Facebook, LinkedIn and Twitter in 2006 and 2007 has subsided, and the number of users has stabilized. Social media are now considered established media (Newcom Research & Consultancy, 2013).

**Young people: Trendsetters in ICT use**

These trends are set by young people, with most mobile Internet devices being used by the 12 to 25 age group. Of all young people in the Netherlands, 86% have mobile access to the Internet and 57% use other devices as well, such as game computers and tablets (Centraal Bureau voor de Statistiek, 2013). Ninety-three percent of Dutch young people between the ages of 12 and 25 use the Internet every day (Centraal Bureau voor de Statistiek, 2013). If a household has a tablet, it will be used relatively often by the children in the household. Most children are permitted to play on their parents’ or baby-sitters’ tablets. Looking at children’s age groups, 54% of children from 0 to 3 years old and 78% of children 4 to 7 years play on tablets. The average age at which children first use the Internet is 3 years, generally to view short films. Drawing games, telephoning by Internet and taking pictures are also popular. Nearly a quarter of children 2 years and older use tablets to make telephone calls. Children are generally older before they begin taking pictures or making short films (Mijn Kind Online, 2013).
Young people’s social media use exceeds the average; nearly all of them have a Facebook account and more than half have a Twitter account. That is far above the figures for older generations. Young people also learn about new social media and online platforms sooner than their older counterparts. Facebook and Twitter are most often accessed using mobile telephones, which provide young people with their primary means of access to social media and online communication with their friends, and even with their parents and grandparents (Newcom Research & Consultancy, 2013).

**Skills: Dutch people are less skilled in ICT than previously thought**

Although in comparison with other countries the Netherlands scores high in the areas of ICT infrastructure and the use of ICT, the Internet and social media, part of the population lacks basic ICT skills. This lack refers not only to general computer skills, but to areas of information analysis and digital security (Van Deursen & Van Dijk, 2012). Moreover, Dutch employees lose 8% of their working hours each day to poorly functioning ICT and their lack of digital skills (Van Deursen & Van Dijk, 2012).
Young people also often lack the skills to use various types of ICT effectively. Young people and children are not capable of automatically using ICT to their advantage, which is assumed when referring to an individual as a digital native. They have no trouble with the technical operation of a computer, but they do not automatically use them effectively. This is a skill they must be taught (Kirschner, 2013).

Young people often overestimate their own media skills. Higher-level skills, such as checking sources and being able to make thorough searches for information, remain critical points. However, most young people are skilled in dealing with the technical aspects of ICT and media. They know how to block undesirable contacts and how to adjust their privacy settings. The widespread use of social media has also had negative consequences. Pupils are vulnerable to distraction by these media, which are also being used as weapons by bullies. Nine percent of all European children have been bullied on the Internet (Livingstone, Haddon, Görzig, & Ólafsson, 2011; Dialogic, 2012). Fourteen percent of Dutch Internet users aged between 9 and 16 were bullied in 2010. Of those who were bullied, approximately a quarter were bullied through the Internet. In other words, 4% of all 9- to 16-year-old Internet users surveyed have been bullied on the Internet (Sonck & de Haan, 2011). Although digital skills in the Netherlands have plenty of room for improvement, the country scores well in a European context. On average, 52% of Europeans have average- or high-level digital skills, while 32% have no digital skills at all. The Netherlands is far above average, with 66% of its residents having average- or high-level digital skills and just 16% having no digital skills at all (European Commission, 2012).
In the previous chapter, we explained the high ambitions and challenges associated with the Dutch education system and the rapid changes in the field of ICT necessitating those ambitions and challenges. This chapter explains the basic elements of the Four in Balance model and how they relate to the added value of using ICT in education.
2.1 The Four in Balance model: Learning output and organizing learning efficiently

Two major issues currently in the spotlight in the field of education are increasing learning output and efficiently organizing the learning process. Research indicates that using ICT in education can help improve learning output. ICT also offers a wide range of possibilities for the secondary process of creating an effective and professional organization. In recent years, the focus within educational institutions has shifted from necessary prerequisites to actually using and benefiting from ICT. This has resulted in more attention being devoted to an integral approach to using ICT in education.

The Four in Balance model is the product of scientific research and has been adjusted and expanded to include the secondary process and its expected benefits (Stichting Ict op School, 2001; Stichting Ict op School, 2004; Kennisnet, 2012). Since its creation, the model has proven its added value in the implementation of ICT in Dutch educational institutions. It describes the issues that these institutions must take into account when implementing ICT use and provides an explanation of the benefits that can result from that use.

In the Four in Balance Monitor 2012, the traditional model was expanded to include the secondary process. Various evidence-based studies are underway to ascertain the value of this expansion. The step towards an integral ICT approach can only be taken if educational and organizational ICT are harmonized and integrated with one another. In this respect, the Four in Balance model offers institutions that want to invest in ICT guidelines for doing so in an integrated manner.

Figure 19: Integral approach to ICT
How an educational institution envisages qualitatively sound and efficient education, how it intends to achieve it, and what ICT’s role will be. “Vision” encompasses the institution’s basic ambitions and describes the role of staff, pupils, and their parents, as well as the basic conditions needed to attain these ambitions.

The competencies that staff must have to make satisfactory use of ICT. They are:

- teachers’ ICT skills; their knowledge of and attitudes towards ICT in both their pedagogical-didactic actions, their work within the school, and their own professional development;
- the expertise of school managers and administrators in using ICT to achieve the educational institution’s ambitions and to help staff become ICT-skilled;
- the expertise of support staff in using ICT to assist pupils, teachers and school managers.

The information, educational content and software used in an educational institution. These are:

- digital learning materials produced especially for educational purposes and general sources of knowledge;
- digital management and accountability information;
- educational software packages and ICT systems such as a virtual learning environment, pupil records, and pupil tracking systems;
- general office software and apps, timetabling software, and HRM tools.

The availability and quality of hardware, networks and connectivity within the institution’s education system. This encompasses fixed and wireless connections, interactive whiteboards, desktops, laptops, tablets, and mobile phones, but also servers, Internet connections and cloud services. Infrastructure also encompasses the management of these aspects.

Figure 20: The basic elements of Four in Balance
Prerequisites for effective ICT use

The basic elements of the Four in Balance model are the premise for the successful implementation of ICT in every educational institution. The basic elements are complementary and mutually dependent. Leadership is necessary to ensure the mutual compatibility between vision, expertise, content and applications, and infrastructure. Leadership forges the link between the four basic elements and can strike the balance between them by making the right choices and engaging in effective cooperation both within and outside the institution. In this context, it is important that managers and administrators account for the choices they make and the consequences of envisaged changes within the organization. The proper culture will also be needed to promote these changes. If the proper balance is struck among the prerequisites for a successful ICT implementation, the use of ICT at educational institutions will create added value.

2.2 How ICT benefits education

ICT improves learning output
Research has shown the benefits that ICT offers education (see Chapter 4). ICT helps teachers prepare lessons, but it can also help them prepare customized learning materials for their pupils. In the classroom, ICT can provide a varied curriculum that is compatible with the pupil’s learning style and abilities. The proper use of ICT, in didactic terms, can ensure an optimal learning process for each pupil.

Properly using ICT in the primary process offers the following benefits:
- increased motivation;
- improved pupil performance;
- streamlined learning process.
These three effects ensure that pupils can learn more and better, thus improving learning output.

ICT improves the secondary process
The term ‘secondary process’ refers to the organization and management of, and reporting on, learning. Various processes can be simplified or computerized, affording teachers more time and opportunities to do what they became teachers for: helping and guiding pupils in their development. Collecting various forms of management information and making it accessible will provide managers and administrators with more data to use in shaping their policies and will offer effective ways to report on their performance, both horizontally (to parents, pupils and society) and vertically (to the Ministry and the Education Inspectorate).

In the education sector, these results still have little in the way of scientific substantiation, but given the possibilities that ICT offers and the way ICT has led to more effective organization in other sectors, we expect the use of ICT in education to result in the following benefits:
- time savings: by computerizing certain tasks and re-using data;
- more transparency: better understanding of the performance rendered by pupils, teachers and institutions themselves;
- more professionalism by using ICT as an HRM tool for self-study (by teachers and other staff);
- better management: more transparency and more possibilities to use funds as effectively as possible.

ICT can be used as a tool to achieve these results, ensuring that managers and administrators are given the information and opportunities to make optimal use of funds to provide a more effective learning process. Based on this premise, this is the Four in Balance model:
Figure 21: The Four in Balance model

- improved learning output
- efficiently organized learning process

- measured benefits
  - increased motivation
  - better pupil performance
  - more efficient learning process
- anticipated benefits
  - time saving
  - more transparency
  - increased professionalism
  - better management

- use of ICT in teaching
- use of ICT in organizing, managing and rendering accountability

- primary process
- secondary process

- leadership
- vision
- expertise
- content and applications
- infrastructure

better pupil performance
more efficient learning process
better management
increased professionalism
more transparency
time saving
better pupil performance
more efficient learning process
better management
increased professionalism
more transparency
time saving

s	time	saving
s	more	transparency
s	increased	professionalism
s
t	better	management

better pupil performance
more efficient learning process
better management
increased professionalism
more transparency
time saving
3 Education and ICT in 2013

The Four in Balance monitor was carried out for the eleventh time this year. The results of this survey provide a clear overview of the status of ICT in education. This chapter is structured around the four elements of the Four in Balance model: vision, expertise, content and applications, and infrastructure. This chapter also examines the benefits of ICT in education and how these benefits are viewed by teachers and managers1.

1Unless otherwise indicated, all data from this chapter were taken from the data collected by TNS NIPO during the 2012-2013 school year (TNS NIPO, 2013; TNS NIPO, 2013).
3.1 Vision and leadership: The start of the successful use of ICT

The effective use of ICT begins with an educational institution’s clear vision of teaching, the didactic use of ICT and its ambitions in these areas. Leadership is needed to make such vision and ambitions a reality.

**Ambition: Most want step-by-step improvement**
Most institutions see ICT as a means of making step-by-step changes and improvements to teaching. Only one in ten primary schools and one in four VET and secondary schools see ICT as more than that and would like comprehensive changes made to teaching. The other institutions use ICT within the current teaching concept.

**Leadership: Managers more positive than teachers**
Achieving ICT ambitions requires leadership. The complexity of the desired ICT use depends on an institution’s goals. Higher ambitions will demand more expertise from teachers, managers and support staff, and more expert attention to content and applications as well as infrastructure. The transition will require more effort on the part of the staff, and a culture will have to be created to support this. Suitable leadership within institutions will be needed to create this culture and provide guidance for the staff. As the results of the Four in Balance monitor show, this leadership is crucial to achieving the institutions’ ambitions. There is a clear relationship between an institution’s ambitions and the quality of its leadership.

![Figure 22: Educational institution’s ambitions](image)

Statistical analysis of the results show that institutions that want to make comprehensive changes have more often made agreements on the didactic use of ICT, as well as with regard to ICT acquisition and management. These institutions have also made more progress in terms of infrastructure; they have more computers and a relatively higher percentage of laptops and tablets. The teachers and managers who work at these institutions are more positive about the use of ICT. They are more likely to view the use of ICT in teaching as a way of saving time and expense.
### Leadership according to teachers

<table>
<thead>
<tr>
<th>Activity</th>
<th>Teachers</th>
<th>Managers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers are given leeway to experiment with ICT in their teaching</td>
<td>61%</td>
<td>91%</td>
</tr>
<tr>
<td>Compliance with agreements regarding use of ICT in teaching are monitored</td>
<td>57%</td>
<td>75%</td>
</tr>
<tr>
<td>Teachers get support in using ICT in their teaching</td>
<td>56%</td>
<td>84%</td>
</tr>
<tr>
<td>State of affairs in ICT use is discussed with teachers</td>
<td>50%</td>
<td>79%</td>
</tr>
<tr>
<td>Management keeps track of how teachers use ICT in their teaching</td>
<td>49%</td>
<td>72%</td>
</tr>
<tr>
<td>Professional development of educational team regarding pedagogical use of ICT</td>
<td>45%</td>
<td>76%</td>
</tr>
<tr>
<td>Management devotes time and funds to facilitating educational plans with ICT</td>
<td>43%</td>
<td>83%</td>
</tr>
</tbody>
</table>

### Leadership according to managers

<table>
<thead>
<tr>
<th>Activity</th>
<th>Teachers</th>
<th>Managers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers are given leeway to experiment with ICT in their teaching</td>
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</tr>
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<td>56%</td>
<td>84%</td>
</tr>
<tr>
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<td>50%</td>
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<tr>
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<td>45%</td>
<td>76%</td>
</tr>
<tr>
<td>Management devotes time and funds to facilitating educational plans with ICT</td>
<td>43%</td>
<td>83%</td>
</tr>
</tbody>
</table>
Primary school teachers are the most positive about leadership and the role of the school board. They award the highest scores on virtually all elements of the survey. Another remarkable result was that VET teachers receive the least support from management and the school board. They score lower in every respect than their primary and secondary school colleagues. The majority of teachers indicate that they are afforded sufficient leeway for experimentation. Half of primary and secondary school teachers receive clear support from the school board. The results for primary education and VET are virtually the same as they were last year. In contrast, a number of elements have improved significantly in secondary education in comparison with last year.

Managers are more positive than teachers about the leadership within their institution. In comparison with teachers, they much more often view the school board as being involved in the use of ICT. The most striking difference in this respect is that 70% of VET school managers indicate that the board devotes time and funds to this goal, while only a small portion (26%) of teachers share that view. The significant difference in opinion between teachers and managers regarding an active and dedicated board is also striking.

Agreements: Management encourages specific agreements but rarely follows through

Agreements regarding the didactic use of ICT help organizations achieve their ambitions – agreements are the links between ambition and implementation. Regardless of an institution’s ambitions, agreements regarding the use of ICT are important because they clarify teachers’ responsibilities in this respect and provide a premise for designing infrastructure, as well as content and applications. Since 2007, the progress in this respect has fluctuated.

The monitor examined not only the agreements about the didactic use of ICT, but also the agreements about its acquisition and management. A significant majority of managers indicated that the latter type of agreements had been made. Approximately three quarters of the managers surveyed indicated that agreements had been made within their institutions covering virtually all subject matter components. These agreements have been made within all VET schools. Agreements regarding the acquisition and management of ICT are often coupled with agreements regarding its didactic use. Nine of out ten of the institutions with faculty-wide agreements on the didactic use of ICT had also made agreements about its acquisition and management.

Teachers indicated that they have a great deal of freedom in choosing how, and how much, ICT to use in their teaching. For example, a significant
majority of the teachers surveyed indicated that, while agreements had been made regarding the didactic use of ICT, these agreements did not apply to all subject matter components. They also indicated that the school board afforded them sufficient leeway for experimentation. Teachers and managers emphasized that, as time has passed, the board has begun assigning a higher priority to facilitating ICT use. On the one hand, more hardware has been purchased, while on the other there is more guidance being offered within schools, for example by appointing information managers and ICT coordinators. This increase, however, has not been coupled with faculty-wide agreements.

There is a clear relationship between agreements concerning the use of ICT and the leadership provided by the school board and management. Managers who work at institutions with a wide range of agreements on ICT use, more frequently indicated that the board was encouraging ICT use and that compliance with agreements made in this regard was enforced. They also attributed a higher level of skill to their staff than did the managers at institutions where responsibility for ICT use is allocated to the teachers.

Teachers and managers emphasized that over the course of time, the school board has begun assigning a higher priority to facilitating ICT use.
3.2 Expertise: ICT won’t work without skilled teachers

ICT cannot be used effectively without skilled teachers and educational support or other staff. Teachers must be capable of working with ICT and, more importantly, using ICT didactically in their teaching. In this respect, a distinction can be made between three key tasks. These key tasks are consistent with the three professional contexts of the Onderwijscoöperatie, the organization of Dutch teacher unions (Onderwijscoöperatie, 2012). Kennisnet has labeled these three key tasks as: pedagogical-didactic actions, working in a school-wide context, and professional development. A comparable distinction can be made for educational support and other staff (Kennisnet, 2012).

ICT cannot be used effectively without skilled teachers.
Skills: Managers consider them insufficient
Managers in particular indicate that teachers’ didactic ICT skills are insufficient. However, managers also indicate that teachers’ basic ICT skills are sufficient. According to them, while 82% of teachers are skilled in using ICT, only 62% of them are sufficiently skilled to make good use of ICT in their teaching. Managers also judged teachers’ use of ICT in their professional development and reports to management as inadequate.
Skills: Teachers more positive about their own ICT skills

Teachers are more positive about their own ICT skills than their managers are. They consider themselves to be well-informed about ICT. They also consider that their skills have significantly improved over the last four years. Interestingly, there is very little difference in opinion among the sectors, although VET teachers are more positive about their ability to communicate with their pupils. Teachers are particularly positive about their skills in using digital pupil tracking systems, with secondary and vocational school teachers being positive about their ability to use ICT to communicate with their pupils. It is precisely in this area, at the interface between primary and secondary education processes, that the teachers are most positive about their skills. This is consistent with managers’ view of teachers’ skills. Teachers have basic ICT skills (they can use e-mail, office applications, and social media) and can use ICT in connection with their administrative duties. They also use these ICT skills in their personal lives, and have acquired experience in these areas. This is why many mangers no longer only emphasize encouraging ICT use in the primary process. They know that teachers will be more enthusiastic if they start out with the things that they are better at: using ICT in organizing their teaching. According to both managers and teachers, the most significant benefit to be gained from ICT skills involves using them in a didactic context. There is much to be learned in the area of didactic skills. Once ICT is being efficiently used in the secondary process, steps can be taken to using ICT efficiently in teaching.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Use virtual learning environment</td>
<td>55%</td>
<td>59%</td>
<td>58%</td>
<td>55%</td>
</tr>
<tr>
<td>For use in teaching</td>
<td>47%</td>
<td>43%</td>
<td>48%</td>
<td>41%</td>
</tr>
<tr>
<td>Use ICT to communicate with pupils</td>
<td>77%</td>
<td>78%</td>
<td>79%</td>
<td>70%</td>
</tr>
<tr>
<td>Use computers as didactic aid</td>
<td>64%</td>
<td>66%</td>
<td>66%</td>
<td>69%</td>
</tr>
<tr>
<td>Use a digital pupil tracking system</td>
<td>50%</td>
<td>61%</td>
<td>60%</td>
<td>62%</td>
</tr>
</tbody>
</table>

Figure 28: Percentage of secondary school teachers who consider their ICT skills to be advanced or very advanced.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Use virtual learning environment</td>
<td>36%</td>
<td>56%</td>
<td>58%</td>
<td>63%</td>
</tr>
<tr>
<td>For use in teaching</td>
<td>39%</td>
<td>43%</td>
<td>51%</td>
<td>56%</td>
</tr>
<tr>
<td>Use ICT to communicate with pupils</td>
<td>65%</td>
<td>72%</td>
<td>72%</td>
<td>68%</td>
</tr>
<tr>
<td>Use computers as didactic aid</td>
<td>56%</td>
<td>63%</td>
<td>65%</td>
<td>69%</td>
</tr>
<tr>
<td>Use a digital pupil tracking system</td>
<td>66%</td>
<td>69%</td>
<td>75%</td>
<td>79%</td>
</tr>
</tbody>
</table>

Figure 29: Percentage of VET teachers who consider their ICT skills to be advanced or very advanced.
3.3 Content and applications: Digital content as an integral part of the curriculum

Skilled teachers will never be able to use ICT effectively unless they have adequate learning materials. The importance of these materials increases in proportion to a school’s ambitions. The occasional use of short films on an interactive whiteboard and the use of online and digital material to supplement the curriculum are giving way to digital content and applications constituting an integral part of the curriculum. This imposes stringent requirements on the digital materials and applications used. Teachers believe that the digital learning materials available are not always compatible with their textbooks. They also doubt the quality of the subject matter contained in digital learning materials. They are not convinced that the materials will add value to their teaching. While teachers are enthusiastic about the materials that are supplied along with textbooks, these materials are often intended simply as a supplement to traditional learning materials.

Figure 30: Percentage of digital learning materials
Digital learning materials: Clear increase

This year has seen a clear increase in the proportion of digital learning materials\(^2\). The Four in Balance monitor shows that the percentage of digital learning materials used in primary schools is 29%, while those percentages are 26% and 44% for secondary education and VET, respectively. These levels are below the desired levels of digital learning materials. Primary school teachers want 48% of their learning materials to be digital, while secondary school teachers set their target in this respect at 46%. The actual percentage in VET is closest to their target percentage of 56%.

Nearly all teachers use digital learning materials. Approximately half indicate that more than 20% of the learning materials they use are digital. Thirteen percent of teachers use more digital than traditional learning materials, with 12% indicating that they use equal amounts of each. Only a handful indicate that they use no digital learning materials, and virtually none exclusively use digital materials.

There are several striking differences between sectors in terms of their use of open and restricted digital materials. Restricted digital materials, which are not freely available and often included with textbooks, are used much more in primary schools than open materials, which are available to the public and can often be used free of charge. In secondary and VET schools, in contrast, open materials are much more popular than restricted.

Most digital materials are obtained by searching the Internet or video banks, or as a result of purchasing a certain textbook. A smaller percentage of teachers create or customize digital materials themselves. Many materials are shared with colleagues, however.

\(^2\)It should be noted that changes were made to the survey questions this year. The choice was made to use questions from the Wikiwijs survey regarding digital learning materials in order to promote the comparability of research into digital learning materials. These make the figures more consistent with the Wikiwijs and SLO surveys. Last year, SLO’s learning materials monitor reported that digital learning materials accounted for 43% of the learning materials in primary schools and 39% of the learning materials in secondary schools (SLO, 2012). The Wikiwijs survey’s figures were 23% in primary schools, 26% in pre-vocational schools, 22% in senior general secondary and pre-university schools, and 38% in VET schools (Wikiwijs, 2012).
Figure 32: Source for seeking, finding or creating digital learning materials

Nearly all teachers use digital learning materials.
### 3.4 Infrastructure: New possibilities at schools

The fourth element of Four in Balance is school infrastructure. In order to continue tracking ICT trends, this year’s survey devoted more attention to mobile devices and cloud applications.

**Devices: Shift to mobile equipment**

The long-term trend of focusing on desktops and interactive whiteboards is coming to an end, with the focus clearly shifting to the use of mobile devices in education. The percentage of laptops is increasing and most institutions have the Wi-Fi connections needed to use laptops, tablets and mobile telephones. Infrastructure is thus developing in tandem with the entire ICT sector, with mobile devices increasingly supplementing and replacing stationary devices.

Primary schools have made the least progress in this respect. Only 15% of computers are laptops and only 1% are tablets. VET schools are much further along, with approximately 36% of their computers being laptops and 4% being tablets.

According to VET teachers, 49% of their pupils use their own devices, in comparison to 25% of secondary school pupils and 7% of primary school pupils.

---

**Figure 33: Average number of interactive whiteboards per classroom (%)**

**Figure 34: Percentage of devices used, by sector**
Taking both laptops and desktops into consideration, there is an average of one computer available for every five primary school pupils. The figure is comparable for secondary schools (one for every 4.9 pupils). Nearly six (5.7) vocational school pupils must share a computer. In this respect, it should be noted that the ‘Bring Your Own Device’ policy has been better embedded in VET. More VET pupils have their own devices and are less dependent on the institution’s computers. Fewer than half of VET classrooms have interactive whiteboards, in contrast with the other two sectors: just over half of secondary school classrooms and three quarters of primary school classrooms have interactive whiteboards.

<table>
<thead>
<tr>
<th>Year</th>
<th>PRIM</th>
<th>SEC</th>
<th>VET</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005/2006</td>
<td>2</td>
<td>2</td>
<td>Unknown</td>
</tr>
<tr>
<td>2006/2007</td>
<td>2</td>
<td>2</td>
<td>Unknown</td>
</tr>
<tr>
<td>2007/2008</td>
<td>2</td>
<td>2</td>
<td>Unknown</td>
</tr>
<tr>
<td>2008/2009</td>
<td>2</td>
<td>2</td>
<td>Unknown</td>
</tr>
<tr>
<td>2009/2010</td>
<td>2</td>
<td>2</td>
<td>Unknown</td>
</tr>
<tr>
<td>2010/2011</td>
<td>2</td>
<td>2</td>
<td>Unknown</td>
</tr>
<tr>
<td>2011/2012</td>
<td>2</td>
<td>2</td>
<td>Unknown</td>
</tr>
<tr>
<td>2012/2013</td>
<td>2</td>
<td>2</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

Figure 35: Number of pupils per computer
Internet and cloud: Institutions embrace new developments

All institutions in the Netherlands have a broadband or other type of Internet connection. By way of supporting the trend towards wireless devices, schools are transitioning en masse to Wi-Fi connections. All VET school managers indicated that their schools have a wireless Internet connection, and a clear increase in these connections can be seen in primary and secondary schools. The number of secondary and primary schools with a Wi-Fi connection rose from 67% to 85% and from 52% to 61%, respectively.

Another ICT trend is the shift from local storage to cloud storage and applications. This year’s Four in Balance survey also examined whether teachers and managers can access their e-mail and files from home. These cloud facilities seem to be a matter of course for both teachers and managers. The vast majority (approximately 80%) of managers can access their e-mail and files from home. The remaining secondary and VET school managers can access their e-mail from home, but not their files. Only 1% of primary school managers reported an inability to access either their e-mail and files from home. The teachers’ reports were comparable. Approximately 67% can access both their files and e-mail from home, while approximately 30% can access only their e-mail. Approximately 1% can access neither their e-mail nor their files from home.
Ambition and infrastructure: Higher ambitions lead to better infrastructure

There is a strong correlation between an institution’s ambitions and its available infrastructure. Institutions with high ambitions often have more computers available for pupils and, on average, more interactive whiteboards per classroom. Institutions that have made agreements regarding all subject matter components with respect to the didactic use of ICT often have more computers available for pupils. These institutions

Figure 38: Active use of data from the digital pupil tracking system to support pupils

Figure 39: Computers used in teaching for more than 10 hours per week
### Table 2: Daily to weekly use of various applications by teachers, in percentages

<table>
<thead>
<tr>
<th>Application</th>
<th>PRIM</th>
<th>SEC</th>
<th>VET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word-processing software, e.g. to write an essay</td>
<td>26</td>
<td>22</td>
<td>47</td>
</tr>
<tr>
<td>Simulation software (e.g. to simulate experiments) or games</td>
<td>6</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Specific software for practice exercises</td>
<td>78</td>
<td>18</td>
<td>34</td>
</tr>
<tr>
<td>Software associated with a particular textbook</td>
<td>78</td>
<td>32</td>
<td>45</td>
</tr>
<tr>
<td>Virtual learning environment (VLE)</td>
<td>39</td>
<td>49</td>
<td>48</td>
</tr>
<tr>
<td>Digital testing</td>
<td>6</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Digital pupil tracking system</td>
<td>60</td>
<td>67</td>
<td>59</td>
</tr>
<tr>
<td>Internet to find information</td>
<td>86</td>
<td>79</td>
<td>82</td>
</tr>
<tr>
<td>Internet to communicate and/or collaborate</td>
<td>66</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>Social media</td>
<td>26</td>
<td>29</td>
<td>28</td>
</tr>
</tbody>
</table>

The Internet, specific software, and method-linked software are the applications most used by teachers.

### 3.5 Use: Clear increase in ICT use in the classroom

There has also been a clear increase in the use of computers in the classroom. In 2012, this increase was most pronounced in primary and secondary schools. The increase in primary schools was higher than in previous years, while the increase in secondary schools was consistent with the increase that occurred between 2007 and the end of 2009. This has fluctuated at VET schools, though the rising trend continues.

The Internet, specific software, and methodology-related software are the applications most used by teachers. Approximately 80% of teachers use these applications daily to weekly. Digital tests, simulations, and social media are the least-used applications.
Content and application: Widely used in the secondary process

In addition to using ICT in their teaching, teachers are using more and more content and applications to help them organize their teaching. For example, 94% of primary school teachers actively use a digital pupil tracking system to support their pupils. These systems are used for such purposes as preparing individual lesson plans, monitoring and discussing progress, and tailoring lessons to specific needs and talents. They also use the data when communicating with parents. They use ICT to provide parents with insight into their child’s performance. One third of the time, this communication takes place in combination with social media.

Administrative systems have become an inherent part of the secondary process. Approximately 95% of institutions have a digital pupil tracking system, 89% have a digital pupil records system, and 85% have a digital system for tracking pupil absences. Furthermore, nearly all secondary and VET institutions have a digital scheduling system (98%) and a virtual learning environment (92%). These rates are around 30% for primary schools. Remarkably, only a small percentage of

![Figure 40: Use of administrative systems several times a month or more often by managers in all sectors](image-url)
In addition to using ICT in their teaching, teachers are using more and more content and applications in organizing their teaching.

Managers use administrative systems a great deal in their work. These systems are primarily used for external communication and internal management reports. VET schools make more daily use of administrative system data for preparing management reports than do primary and secondary schools. VET schools also more frequently use administrative system data to report to the Ministry and the Education Inspectorate. Primary schools make the least use of data from these systems.

Figure 41: Teacher use of ICT to communicate with parents and pupils
3.6 Benefits: Teachers and managers believe in the added value of ICT

 Nearly all teachers and managers are convinced ICT adds value to education. They view ICT as adding particular value to:

 • the improvement and transformation of education;
 • the professional development of teachers;
 • insight into pupil performance.

 Impact on the primary process: Managers more enthusiastic about ICT than teachers

 Most teachers and managers are convinced that the use of ICT has an extremely positive impact on teaching. The survey showed, for example, that they believe that digital learning materials better motivate pupils than traditional learning materials. Digital learning materials often provide incentive, sometimes involve elements of play, and are geared towards the life experience of the current generation. All of these qualities motivate pupils to learn more. In addition, digital learning materials are easier to keep up to date and distribute to pupils. The use of ICT also gives teachers the chance to offer pupils differentiated lessons and exercises.

 Generally speaking, managers are rather more enthusiastic than teachers about the added value of ICT. The majority of managers are positive about how the use of ICT saves teachers time, and this enthusiasm runs especially high among

 Managers assert that institutions cannot be organized efficiently without ICT.

<table>
<thead>
<tr>
<th>Teachers</th>
<th>Managers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRIM</strong></td>
<td><strong>SEC</strong></td>
</tr>
<tr>
<td>Using ICT leads to a better understanding of pupil performance</td>
<td>87%</td>
</tr>
<tr>
<td>Using ICT results in time saved for teachers</td>
<td>64%</td>
</tr>
<tr>
<td>Using ICT leads to better pupil results</td>
<td>64%</td>
</tr>
<tr>
<td>Using ICT allows for more time to develop skills in areas other than language and mathematics</td>
<td>59%</td>
</tr>
<tr>
<td>Using ICT creates more time for individual attention to each pupil</td>
<td>52%</td>
</tr>
<tr>
<td>Using ICT stimulates pupils’ creativity</td>
<td>48%</td>
</tr>
</tbody>
</table>

Table 3: Added value for primary process
primary school managers. Managers are also more positive than teachers about ICT’s role in differentiating between pupils. They believe that ICT use results in a better understanding of pupil performance. This understanding constitutes a first step towards differentiation and customized education.

Impact on the secondary process: ICT is a given
A secondary process without ICT has become unimaginable. In fact, nearly every facet of school operations is supported by ICT. Teachers and managers are very positive about the use of ICT in these processes. Managers assert that institutions cannot be organized efficiently without ICT, but that the use of ICT does not automatically result in efficiency and financial savings. Using ICT in the secondary process also involves high ICT investment costs, and it takes time before ICT use translates into improved efficiency.

<table>
<thead>
<tr>
<th>Impact on secondary process</th>
<th>PRIM</th>
<th>SEC</th>
<th>VET</th>
<th>PRIM</th>
<th>SEC</th>
<th>VET</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICT is essential and helps teachers in their professional development</td>
<td>88%</td>
<td>73%</td>
<td>74%</td>
<td>93%</td>
<td>93%</td>
<td>86%</td>
</tr>
<tr>
<td>ICT makes it easier for society, parents, and pupils to assess the school’s quality</td>
<td>59%</td>
<td>61%</td>
<td>49%</td>
<td>72%</td>
<td>79%</td>
<td>72%</td>
</tr>
<tr>
<td>Using ICT leads to lower school management expenses</td>
<td>37%</td>
<td>40%</td>
<td>49%</td>
<td>24%</td>
<td>24%</td>
<td>32%</td>
</tr>
<tr>
<td>Using ICT leads to lower teaching expenses</td>
<td>24%</td>
<td>24%</td>
<td>32%</td>
<td>96%</td>
<td>91%</td>
<td>86%</td>
</tr>
<tr>
<td>Using ICT leads to a better understanding of school performance</td>
<td>97%</td>
<td>98%</td>
<td>96%</td>
<td>97%</td>
<td>98%</td>
<td>96%</td>
</tr>
</tbody>
</table>

Table 4: Added value for secondary process
4 Benefits through balance

The anecdotal evidence that ICT benefits education continues to accrue, demonstrating the added value ICT has to offer in terms of teaching, organizing, and increasing professionalism. But there continues to be a great deal of unused potential in each of these areas. Schools often miss opportunities to improve their productivity and the quality of the education they provide. This chapter summarizes the current views on the benefits of ICT, analyses the causes of underuse, and provides guidelines for deriving more benefits from ICT in the future.
4.1 Results

The previous chapters illustrated the enthusiasm with which schools are embracing ICT. Viewed over a number of years, ICT use has increased in all sectors of education. The use of ICT is essential to preparing pupils for their future careers and their role as citizens in an ICT-rich and digital society. Research is providing increasingly convincing evidence that ICT – when used well, in a properly focused and allocated manner – contributes to pupil motivation, performance, and speed of learning. ICT applications support teachers’ performance in the classroom and assist management with organizing schools cost-effectively. In this respect, ICT offers possibilities in terms of administration, organization, coordination and staffing.

Education information systems play an exceptional role. These digital pupil tracking systems assist with testing and digitally recording learning performance. They lighten the administrative burden in schools. A simple mouse click shows how an individual pupil or group of pupils has performed over a series of years. These systems assist with monitoring the results of the education provided, which is a significant source
of professional feedback for teachers and school management. Research shows that the use of these digital information systems in schools triggers a performance improvement mechanism that results in these institutions making the most of the education they offer (Van Geel and Visscher, 2013). ICT also offers school organizations opportunities for both internal communication and for the exchange of information between schools and parents. Adequate information provision reduces pupil absences and increases parents’ involvement with the school and their child’s education (Van Gennip, & Wester, 2012).

Last but certainly not least, ICT contributes to teacher professionalization. This starts with teacher training, with individual students being supported by VLEs (virtual learning environments), knowledge banks and digital coaching. A fine example of digital coaching is the provision of feedback through an earpiece. The coach provides the student teacher with feedback while the student is actually teaching, enabling him to immediately correct his mistakes. After just a few sessions, this type of digital coaching enables teachers to create a better learning environment, deal better with pupils, and exert more authority over their classrooms (Coninx, 2013). The use of technology in teacher training increases the level of professionalism new teachers have when starting their careers.

Adequate information provision reduces truancy and increases parents’ involvement with the school.

Figure 43: ICT communication with colleagues and parents
Digital learning networks afford teachers the opportunity to share experience and knowledge with their colleagues in order to improve their professional competency.

ICT is also valuable to teachers who have already made inroads on their careers. Digital learning networks afford teachers the opportunity to share experience and knowledge with their colleagues in order to improve their professional competency (De Laat, 2012). In this case, ICT support consists primarily of web-based tools for exchanging learning materials and platforms for collaborating on new concepts (Nieuwenhuis & Vink, 2013; Van Halen & Weijers, 2013).
Obviously, the term “ICT” encompasses a wide variety of applications for a broad range of purposes. The benefits of ICT can be better understood by making connections between the application field and the nature of the results. This is summarized above in Figure 45.

Despite the societal necessity for ICT and its demonstrable benefits to education, ICT continues to be underused at many schools. That means that the benefits ICT has to offer are not being fully realized. If we want to derive more benefits from ICT, we have to know the causes underlying imbalance and underuse. The basic elements of the Four in Balance model illustrate the most important characteristics of balance and imbalance.
4.2 What does ‘in balance’ mean?

Four in Balance is intended to help schools that use ICT make choices that will improve the quality and productivity of the education they provide. As discussed in Chapter 3, schools have high ambitions with regard to the use of ICT. Unfortunately, schools are often unsuccessful in making the improvements that they intend to make. Despite substantial investments in laptops, interactive whiteboards, and wireless networks, education is not improving in terms of effectiveness and efficiency.

Learning materials are another obstacle. For many years now, teachers and managers have fostered their ambition to use more digital learning materials. Although the amount of digital learning materials available continues to increase, the difference between desired and actual use continues to be significant (see section 3.3). Thanks to research, we are coming to learn more and more about how best to coordinate the four basic elements. The essence of success in this regard is keeping vision, expertise, content and applications, and infrastructure in balance with one another. But what does that actually mean?

![Diagram showing the four basic elements: vision, expertise, content and applications, and infrastructure.](image)

Figure 46: Education-driven and technology-driven innovation
Educational needs as a premise

One significant conclusion resulting from research is that schools derive the most benefit from ICT if they begin with a vision (what do you want?) and then tailor the other three basic elements to that vision. In previous publications, we referred to this as ‘education-driven innovation’ (Four in Balance Monitor, 2010). The reverse of this sequence – starting with infrastructure or applications (or content and applications) that an institution uses – could be referred to as ‘technology-driven’ or ‘materials-driven’ innovation.

The theory that more computers, more digital learning materials, and faster connections will motivate teachers to use ICT rests on a stubborn misconception. Better material provisions do not automatically lead to more or better computer use. If teachers are not convinced that ICT will benefit their teaching, making ICT equipment and facilities available has little chance of achieving success (Fullan, 2011; Ten Brummelhuis & Van Amezingen, 2011). In fact, if schools focus intensively on getting wired but ignore how they will benefit from achieving that goal, they may even find themselves encountering teacher resistance to using ICT. This has occurred in other countries (Plomp, et al., 2009).

Successful and permanent ICT use is generally the result of premising that use on educational needs. By way of explanation, Ertmer and Ottenbreit (2009) assert that the willingness to use ICT is closely tied to how teachers define ‘good teaching’. It is unlikely that teachers will readily use ICT applications that clash with their principles in this regard, and they will not want to continue using applications that do not clearly demonstrate whether and how they improve pupil performance (Erstad, 2009; Hattie, 2009). Teachers’ interpretation of what teaching should be is part of their identity and professional stability. Changing this interpretation will require a gradual process of growth. An approach premised on educational requirements has the best chance of success.

Managers and administrators can play an important role in this regard by convincing hesitant teachers to take that last step and showing them how effective ICT can be (Timperly, 2008). In that context, managers and administrators are responsible for creating the prerequisites and culture to enable teachers to use ICT effectively, for example by developing an ICT policy plan (Vanderlinde, van Braak, & Dexter, 2012; Vanderlinde, Dexter, & van Braak, 2012). Leadership means involving teachers in this change, motivating them and developing a shared vision with them (Vanderlinde, 2011; Waslander, 2011). This is true not just for the trendsetters, but also – and more particularly – for the hesitant majority (Fullan, 2011; Schut, 2010).

An approach premised on educational requirements has the best chance of success.
4.3 Causes of imbalance

The Four in Balance elements cannot be viewed independently of one another; they are clustered in pairs. Together, vision and expertise constitute the human factors, while the material factors comprise content and applications (which form a single element) and infrastructure. Before ICT can be used productively, investments must be made in the people who will be using it, based on a vision of teaching shared by the entire school team (Vanderlinde & Van Braak, 2013). These vision-based investments serve as the premise for the remainder of the prerequisites. Management’s expertise and leadership play a crucial role in this process.

Where the human factors are concerned, the educational vision serves as the primary guideline. There are a wide variety of visions; the most concise classification distinguishes only the two extremes (OECD, 2012): teacher-driven education and self-organized education. Teacher-driven learning includes the forms of education in which pupils are mainly guided in learning through knowledge transfer by the teacher. The teacher transfers small amounts of knowledge to the pupil, who processes that knowledge through practice and repetition. The self-organized learning end of the spectrum includes the forms of education in which the pupils themselves are responsible for the content and organization of what they learn. They are afforded the leeway to interpret their knowledge in partnership with other pupils and to actively search for solutions. Between these two extremes, teacher-driven learning and self-organized learning, there are dozens of more transitional learning methods. A clearly recognizable learning method that lies between these extremes are the methods of education based on autonomous learning. The curriculum is fixed in this method, but pupils learn at their own speed and internalize the learning materials at their own level.

Teacher-driven learning is currently the dominant form of education, but we are seeing an increasing need for learning methods that devote more attention to pupils learning autonomous and taking responsibility for their own learning (Van Gennip & Rens, 2011).

The fact that ICT can support every teaching method does not equate to every ICT application being suitable for every teaching method. This means that it is important to ascertain the nature of the support ICT offers, starting with the learning materials. The infrastructure can then be tailored to the learning materials, which we classify as being one of three types.

The first type of learning material focuses on computerizing the learning process: practicing and training until an answer can be automatically produced. These learning materials are aimed at instructing the pupil in the subject matter and at the pupil’s practicing. Examples of this are mathematics training with Nintendo DSi or Slim Stampen. Previous studies have shown the effectiveness of these types of programs (Luyten, 2011; Van Rijn, 2012).
The second type of learning material takes pupils’ individual performance and characteristics into account. Adaptive learning materials provide pupils with feedback and hints and adapt to their level and cognitive structure. One example of this is Bereslim, a program in which an intelligent agent in the form of a bear gives pupils advice when they need it and draws them back into a lesson when their attention begins to wander. Bus (2012) described the effectiveness and impact of this type of program.

The third group we distinguish includes personal learning environments. These are self-guided, interactive digital systems that support learning. Pupils are permitted to structure their learning environment in accordance with their own understanding and needs. Personal learning environments provide access to personalized information, such as class schedules, grades, and attendance. It is a virtual classroom, as it were, that does not require the pupil to come to the school. In this learning environment, pupils have personal contacts, as well as access to all types of subject matter, at their fingertips, with everything being tailored to their personal needs: contact with teachers and fellow pupils and digital learning materials, such as books and exercises, links to instructional films, simulations, online games and open materials.

While ICT can support every teaching method, not every ICT application is suitable for every teaching method.
Figure 48 illustrates the relationship between the human and material factors. These basic elements are brought into balance on the dark blue horizontal line. The points under this line are learning situations in which the technology supports applications other than those required by the teaching method. The points above the line are those in which the teaching method is inadequately supported by the available ICT applications. These positions are important because they enable the transition from one type of learning to another.

The highest and lowest points illustrate a severe imbalance between educational vision and available materials. This contributes little to the sustainable use of ICT because the material prerequisites are so incompatible with the educational vision: in short, it is a mismatch.

4.4 A future with more benefits from ICT

It is clear that ICT will fulfill a crucial role in the education of the future. The wide variety of ICT applications means that ICT has added value to offer every methodology. The ambition of three quarters of educational institutions is to use ICT to change education (see section 3.1). Other ambitions include, for example, transitioning from teacher-driven to autonomous learning.

The challenge for schools is to choose materials that are consistent with their educational vision, taking into account both current and desired teaching methods. We explain this in more detail in Figure 50, which illustrates several possible combinations and developments.
Figure 48: Balance between human and material factors
In balance

The educational institutions on the horizontal line in the middle of Figure 48 are ‘in balance’, having made their vision a reality: they want to use ICT as a tool to increase the benefits of existing working methods.

For schools that place a high value on teacher-driven education, this may mean using ICT for instruction and practice. ICT can add value during classroom instruction, for example through the use of multimedia materials on interactive whiteboards, perhaps in combination with interactive media such as digital voting systems. Teacher instruction also has many of the characteristics of routine work. This particular form of knowledge transfer is especially suited to computerization using video recordings, for instance in combination with pupil practice programs and intelligent feedback systems. Experience with this type of application demonstrates that instruction and practice can also be provided outside the classroom (for example, by assigning as homework: Flipping the Classroom), which affords the teacher more time to provide extra explanation in the classroom and enables pupils to work together, making education more efficient.

Secondary schools and VET schools in particular are fertile fields for distance education, where a single teacher can offer simultaneous instruction in multiple locations through an online connection. Research has shown that teachers need not adapt their teaching style to use this type of instruction and that pupil performance remains consistent (Heijmen, 2012). Areas with declining populations or small-scale education programs can maintain course availability in all subjects for all pupils, even when teachers are scarce. Some practice applications are available in game form for mobile devices and are so appealing to pupils that they use them even in their free time, expediting their progress and improving their performance (Sandberg, 2013).

Institutions that primarily focus on autonomous learning will generally benefit more from adaptive learning materials. These learning materials ensure that pupils are provided with knowledge and exercises that are compatible with their development. The role the teacher plays for pupils is then less often that of an instructor and more often that of a supervisor or coach.

If schools focus on self-organized learning, ICT applications are expected and required to provide alternative forms of support, and a personal learning environment can fit the bill. For teachers, this means a change in the balance, with less emphasis on instruction and more on coaching and supervision.

For schools that place a high value on teacher-driven education, this may mean using ICT for instruction and practice.
Institutions that primarily focus on autonomous learning will generally benefit more from adaptive learning materials.
Education-driven or technology-driven transition
Some institutions are opting to change their educational approach step by step (see Figure 50). Their best chance of success in this regard is to base this transition on their educational vision rather than on technological possibilities.

The speed and scope of the change depends on the degree to which the school team support that change. Analyses of successful change programs show that the change is generally prompted by a pioneer who introduces a new ICT application on a small scale. These pioneers are generally inspired by ideas they discover outside their own school that they then want to try out themselves. They are prepared to take the risk of success or failure. Their chance of success with their colleagues increases when an ICT application is similar to what they are accustomed to and consistent with the educational approach that the school wants to utilize in the future.

A pioneer can prompt a change, but cannot see it through to completion on his or her own. That requires not only the support of colleagues, but management support in the form of the provision of supportive prerequisites. These prerequisites do not simply comprise training and material facilities; it is at least as important that school management establish that the applications are delivering as expected (Fransen, Bottema, van Goozen, Swager, & Wijngaards, 2012).

Transformation
A small proportion of institutions want to use ICT to comprehensively change teaching (see section 3.1). These schools have a great deal of confidence in technology and/or their own capacity for change. These schools subscribe to the theory that a butterfly can only come from a caterpillar – that permanent transformation is not effected in one fell swoop, but is rather a process of developmental stages. Comprehensive changes in teaching using ICT are complex processes that demand not only management expertise, but an enormous amount of time and effort from teachers.

4.5 Conclusion
The goals for Dutch education are remarkably ambitious: we want excellent, effectively structured education which brings out the best in our pupils and which anticipates the skills that will be necessary for them to live and work in the 21st century. Institutions are struggling with the question of how they will be able to achieve their ambition of raising education to a top-quality level while meeting the needs of their pupils and satisfying the demands placed on them by society, particularly in an age rife with financial difficulties. ICT is viewed as an important tool for transforming their ambitions into reality.

Three quarters of the schools surveyed indicated that they are changing the education they provide and that this process involves investigating the possibilities ICT has to offer. What the entire education sector must do in this respect is to minimize mistakes by acquiring knowledge about how ICT can work for education. There is a never-ending supply of new applications, but these are often coupled with myths regarding their potential benefits. One example of this is the expectation that young people who frequently use ICT have also automatically acquired the skills necessary to find, understand and use information (Kirschner, 2013). A lack of understanding of what ICT can and cannot do is hindering schools from making good choices. It is therefore critical that they are provided with empirically proven learning materials as soon as possible. This will assist them in making realistic choices, which will result in ICT being used to improve the quality and productivity of the education they provide.
Figure 50: Education-driven and technology-driven transition
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