Handbook of Research on Overcoming Digital Divides:
Constructing an Equitable and Competitive Information Society

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Chapter 15
Inequalities of Digital Skills and How to Overcome Them

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ABSTRACT

This chapter focuses on the differential possession of digital skills. Here, four types of Internet skills are distinguished: operational, formal, information, and strategic skills. These types are measured in a number of experimental performance tests among a cross-section of the Dutch population. The tests focus on the use of online government information. The main result of the experimental test is that the average Dutch population performs fairly well in operational and formal Internet skills but much worse in information and strategic skills. However, there are significant differences between people with different age and educational background; no gender differences have been observed. The final sections of this chapter deal with ways to overcome these differences of skill. Two main strategies are discussed: improving the information provision of government Web sites and improving the digital skills of citizens or users by all kinds of educational means.

INTRODUCTION

The First and Second Order Digital Divide

A central issue on the scholarly and political agenda of new media development is the gap between those who have and do not have access to computers and the Internet (Van Dijk 2005, 2006). Obviously, this issue is highly relevant for citizen participation and government information provision because they are assumed to be accessible for all. The split between the 'haves' and 'have-nots' of new media use has most often been framed in the term 'digital divide'. For a long time the prevailing research approach mainly focused on a binary classification of access: having physical access to computers and the Internet or not. After the year 2000 a more refined understanding of the digital divide has appeared that is sometimes called the 'second order digital

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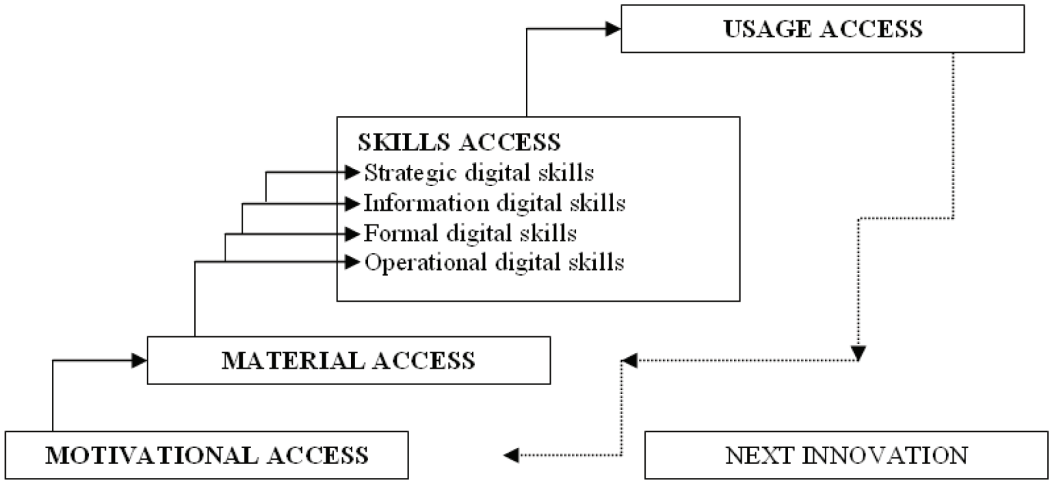
Figure 1. A cumulative and recursive model of successive kinds of access to digital technologies. (Source: Van Dijk, 2005, p. 22 with the adapted range of digital skills from Van Deursen & Van Dijk, 2008)



divide'. It goes beyond the (first order) binary classification of physical access and concentrates on the skills to use digital media and on their usage (e.g., DiMaggio & Hargittai, 2001; Mossberger et al., 2003; Van Dijk, 2006; Van Dijk and Hacker, 2003).

Van Dijk (2005) has provided a framework and model of both the first and second order digital divide making a distinction between four successive types of access that tend to recur with every new medium or innovation.

This succession of types of access was elaborated because media or technology access should be seen as a process with many social, mental and technological causes and not as a single event of obtaining a particular technology (Bucy & Newhagen, 2004; van Dijk, 2005). In this model material access was preceded by motivational access and succeeded by skills access and usage access. When the full process of technology appropriation is completed, according to this ideal scheme, a new innovation arrives and the process starts again, wholly or partly.

The concept of material access comprises physical access and other types of access that are required to reach a complete connection and every content it has to offer such as conditional access (subscriptions, accounts, pay-per-view). The concept skills access was divided in three types of skills that often assume the following order: first a computer user has to acquire operational skills, than s(he) has to develop and apply information skills and finally strategic skills (the capacity to use computer and network sources as means for particular goals in society). Van Deursen & Van Dijk (2008) proposed an adapted version of this succession of skills. They introduced a new type of skill between instrumental (or operational) and informational skills: the formal skills needed to use a medium such as the Internet: the skills needed for browsing and navigating.

Usage access is the final stage and ultimate goal of the process of technological appropriation in the shape of particular applications.

Focus of This Chapter

In this chapter we will focus on the **differential possession of digital skills**. We will start by making an extensive and detailed operational definition

of this concept and the different types of skill distinguished. Then we will measure these types in a number of experimental performance tests among a cross-section of the Dutch population. The results might be instructive for solutions that help to solve gaps of digital skills. These solutions that are crucial for the theme of this book, bridging the digital divide will be discussed in the final part of this chapter.

We will first explain why this focus is important. Even when people have equal access to computers and the Internet, they may not have the skills to engage in a wide variety of uses. In the explanation of different usage of the Internet, the level of digital skills appears to be one of the most important factors. It has a strong independent weight according to contemporary digital divide research (Mossberger, Tolbert & Stansbury 2003; Van Dijk, 2005). Furthermore, this factor is most appropriate for intervention by educational policies and new media design or by the supply of websites and help functions.

Digital skills have gained more prominence in digital divide literature recently due to the recognition that access to, or ownership of a computer is not equal to the capacity to operate and use a computer (Hargittai, 2002; Van Dijk & Hacker, 2003). It is has been shown that these skills influence the take up of online government services (Van Dijk et al., 2007). Even when citizens have equal access to computers and the Internet, they may not have the skills to use the online public services offered to them. The problem of being short of skills becomes urgent when governments suppose that citizens are able to complete about every task on the Internet. Policy advisors often believe that the problem of a lack of connectivity and participation will solve itself over time when the present, mainly elderly generation of computer illiterates has become extinct (Van Deursen, 2007).

It is important that the extension of the concept of the digital divide with skills and usage access gains more footing in the public sector, where the implications are major when access data appear more positive than they actually are. After all, many policy makers at the national and local levels of government in countries with a high Internet penetration think the access problem is solved as soon as the large majority of the population is connected. They tend to believe that the Internet already is a generally accessible channel for both citizen information and communication in these countries. This results in the online distribution of as much governmental information and services as possible. Unfortunately, this policy is characterized by barely funded presuppositions of what citizens want to do and what they actually can do on the Internet (Van Deursen et al., 2006).

It is questionable whether all potential users and information seekers equally benefit from the new opportunities. The use of more traditional service channels, like the telephone and service desks, remains the most important means of interaction, despite the efforts of the government to persuade citizens in using electronic rather than traditional channels (Ebbers et al., 2008). At least in the Netherlands many of the services offered online are hardly being used and only a few services are responsible for the bulk of the eservice usage (Van Deursen et al., 2006; Van Dijk et al., 2007). The observations described force governments to go beyond obvious physical access data and focus on the more refined conceptualizations of a multitude of digital divides recent research has produced.

Previous Scientific Research of Digital Skills

Very little scientific research has been done on the actual level of digital skills possessed by populations at large. Most measurements are done in small educational settings or as a part of computer classes. Almost every measurement of the actual level of digital skills of populations has been done by survey questions asking respondents for an estimation of their own digital skills. This

kind of measurement obviously has significant problems of validity (Hargittai, 2004; Talja, 2005; Merritt et al., 2005). The only way to obtain a direct measure of a skill is by means of a test which measures that skill. There are only a few serious scientific experimental tests of Internet users' skills (e.g., Hargittai, 2002; Eshet-Alkalai & Amichai-Hamburger, 2004).

A number of large-scale surveys have revealed dramatic differences of skills among populations, also among populations of countries with broad new media diffusion (Van Dijk, 2005; Warschauer, 2003). Measurements of real performances only occur in small educational settings or as a part of computer classes. The problem of these measurements is that they are fully normative: they observe whether the goal of a particular course has been reached. A problem for both types of measurements, surveys and course exams is that they mostly use a limited definition of digital skills that does not go beyond operational skills. A deeper understanding is needed to escape the simplification of early digital divide research where only binary classifications were considered. A new simplification might appear: the simple duality of can's and can-nots.

AN OPERATIONAL DEFINITION OF DIGITAL SKILLS

The few general skill studies conducted (e.g., De Haan, 2003; Hargittai, 2002) show large variations of digital skills among different social segments, but fail to explain what these skills exactly comprehend. This is caused by the fact that a lot of interpretations are given to a wide range of digital skills related terms. One should not expect agreement on what constitutes digital skills or why they are required (Martin, 2006). There is a lack of theoretical justification resulting in different operational definitions ignoring the full range of skills concerned.

There are few frameworks available that propose a succession of general types of skill categories that are applicable to both online and offline computer use (Eshet Alkalai, 2004; Steyeart, 2002; Van Dijk, 2005; Van Deursen & Van Dijk, 2008). The framework suggested by Van Deursen & Van Dijk (2008) produces an elaborate system of indications and empirical measurements of four types of digital skills. This framework is applicable in multiple digital domains, both standalone computers or multimedia and networks such as the Internet. It starts with a distinction of four types of digital skills:

- Operational skills: the skills to operate digital media;
- Formal skills: the skills to handle the special structures of digital media such as menus and hyperlinks;
- Information skills: the skills to search, select and evaluate information in digital media;
- Strategic skills: the skills to employ the information contained in digital media as a means to reach a particular personal or professional goal

Based on this cumulative framework operational definitions were elaborated for government online services on the Internet (Van Deursen & Van Dijk, 2008).

Operational skills mean being able to:

- Operate an Internet browser:
  - Opening websites by entering the URL in the browser's location bar;
  - Surfing forward and backward between pages using the browser buttons;
  - Saving files on the Hard Disk;
  - Opening various common file formats (e.g., PDF, SWF);
  - Bookmarking websites;
  - Changing the browser's preferences (e.g., start page);
  - Using hyperlinks.

- Operate online search engines:
  - Entering keywords in the proper field;
  - Executing the search operation;
  - Opening search results in the search result lists.
- Complete online forms:
  - Using the different types of fields and buttons (e.g., drop-down menus);
  - Submitting a form.

Formal skills mean being able to:

- Navigate on the Internet, by:
  - Recognizing and using hyperlinks (e.g., menu links, textual links, image links) in different menu and website lay-outs.
- Maintain a sense of location while navigating on the internet, meaning:
  - Not getting disoriented when surfing within a website;
  - Not getting disoriented when surfing between websites;
  - Not getting disoriented when browsing through, and opening search results.

Information skills mean being able to:

- Locate required information, by:
  - Choosing a search system or place to seek information;
  - Defining search queries that focus on the information problem;
  - Selecting information;
  - Evaluating information sources.

Strategic skills mean being able to:

- Take advantage of the internet, by:
  - An orientation towards a particular goal;
  - Taking the right action to reach this goal;
  - Making the right decision to reach this goal;
  - Gaining the benefits belonging to this goal.

MEASURING DIGITAL SKILLS

Research Design and General Results

To measure these skills a random selection (equally divided over age, gender and education) of 109 subjects was invited to a test laboratory. The sampling result is not statistically representative for the Dutch population – 109 subjects is a large number for an experimental test, not for a survey – but gives a fairly good indication of the performance level of the Dutch population as much trouble was taken to reach sample dispersion. Participants used a keyboard, a mouse and a 17-inch monitor connected to a laptop that provided the three most popular internet browsers (Internet Explorer, Mozilla Firefox and Opera).

Several assignments in the field governmental or political information retrieval strictly following the operational framework described above were prepared. See the Appendix of Van Deursen & Van Dijk (2008) for a complete overview. Subjects' performances were measured both by successful assignment completion and by the time (in seconds) spent on each assignment. According to Table 1, the participants completed an average 80% of the operational tasks, 72% of the four formal skills tasks and 62% of the three information skill tasks. The time spent on the information tasks varies substantially. Most problematic however are the two strategic tasks of which the subjects only completed 25%. Only 11% of the subjects were able to complete both the strategic skill tasks.

Table 1. Average number of tasks completed and average time spend on the tasks (N=109)

	Average number of tasks completed			Time spent on tasks (sec.)		
	M	**SD**	**%**	**M**	**SD**	**Min. / Max.**
Operational tasks (9)	7.2	2.0	80	553	254	167 / 1200*
Formal tasks (4)	2.9	1.0	72	616	255	242 / 1200*
Information tasks (3)	1.9	0.8	62	939	449	257 / 2157
Strategic tasks (2)	0.5	0.7	25	1466	575	437 / 2719

* 1200 seconds was the maximum time allowed for the nine operational tasks together.

Operational Skill Divides

According to Table 2 education, age and experience are the main predictors of the level of operational skill. They are significant both for number of tasks completed and time spent on the tasks.

People with higher age score lower than young people on number of tasks completed ($F(1,107)=11.47$, $p<.001$) and need more time ($F(1,107)=30.95$, $p<.001$). However, this effect is caused by the oldest age group that significantly differs from the other three groups for number of tasks completed and total time spent. The high educated complete more tasks than the low educated ($F(1,105)=17.91$, $p<.001$) and also need less time ($F(1,105)=9.99$, $p<.001$). This effect is mainly caused by the level of the higher educated that significantly differs from both the lower educated ($p<.001$) and the medium educated ($p<.001$). There is no significant difference between the lower and the medium educated for number of tasks completed.

Formal Skill Divides

As presented is Table 3, education and age again are the main predictors for the number of formal tasks completed and for the amount of time spent on the tasks. Additionally, receiving help from others when using the Internet has a negative

Table 2. Linear regression results of the number of operational tasks completed and time spent (N = 109)

	Number of tasks completed		Time spent on tasks	
	t	**Beta**	**t**	**Beta**
Gender (male / female)	-0.82	-.06	-1.30	-.08
Age (young – old)	-3.13	-.30***	5.11	.43***
Education (low – high)	3.86	.32***	-2.75	-.27***
Internet experience (years)	1.90	.15*	-2.56	-.18**
Weekly time online (hours)	0.55	.04	-1.44	-.10
Followed a Internet course (no / yes)	0.45	.03	-0.14	-.01
Using peers for help (no / yes)	-1.47	-.12	1.83	.13
Primary location of use (at home / elsewhere)	1.15	.08	-1.15	-.07
Working situation (inactive / active)	1.62	-.15	-1.97	-.16*
R^2	.52		.64	
F	14.02***		22.34***	

*p<.05, **p<.01, ***p<.001.

Table 3. Linear regression results of the number of formal tasks completed and time spent (N = 109)

	Number of tasks completed		Time spent on tasks	
	t	**Beta**	**t**	**Beta**
Gender (male / female)	1.06	.08	-2.17	-.15
Age (young – old)	-2.58	.25**	5.01	.46***
Education (low – high)	2.94	-.26*	-1.98	-.16*
Internet experience (years)	1.56	.13	-1.68	-.13
Weekly time online (hours)	-0.30	-.02	-1.66	-.13
Followed a Internet course (no / yes)	1.00	.07	-0.24	-.02
Using peers for help (no / yes)	3.08	-.26**	1.65	.13
Primary location of use (at home / elsewhere)	2.40	-.18*	-0.76	-.05
Working situation (inactive / active)	1.26	.12	-1.07	-.09
R^2	.49		.57	
F	12.39***		16.46***	

*p<.05, **p<.01, ***p<.001.

effect on the number of formal tasks completed ($F(1,108)=14.07$, $p<.001$). This is also the case for the location of Internet use; people that use the Internet primarily at home score higher on formal skills than people that most often use it elsewhere ($F(1,108)=8,21$, $p<.01$).

Seniors complete less tasks than younger people ($F(1,108) = 9.93$, $p<.001$). Again, this effect is mainly caused by the oldest age group that significantly differs from the other three groups that do not differ among each other. Also, seniors need more time ($F(1,108)=29.20$, $p<.001$). People with high education complete more tasks than people with lower education ($F(1,108)=14.14$, $p<.001$). There is a difference between the low and the medium ($p<.01$) and the medium and the high level of education attained ($p<.05$). Also, there is a time difference between the three educational levels ($F(1,108)=6.14$, $p<.01$). This effect is caused by the score of the high educated that differs from the medium ($p<.05$) and low educated ($p<.01$).

Information Skill Divides

Regression results in Table 4 indicate that education is the only significant predictor for the number of information tasks completed. Age does not seem to effect the number of information tasks completed ($F(1,105)=2.75$, $p =.05$) or the time needed. The high educated complete more tasks than the low educated ($F(1,108)=10.59$, $p<.001$) and need less time ($F(1,108)=6.21$, $p<.01$). These effects are caused by people with the highest level of education that both for number of tasks completed and time spent score better than people at the other two levels, that show no significant difference. Education is the main predictors for the number of strategic tasks completed. No significant time differences are reported.

Strategic Skill Divides

Again, age does not seem to effect the number of strategic tasks completed ($F(1,108)=2.51$, $p=.06$). See Table 5. The effect of education ($F(1,105)=24.28$, $p<.001$) mainly comes from the high educated that significantly differ from the low educated ($p<.001$) and the medium educated ($p<.001$). There is no difference between the lower and the medium educated ($p=1.00$).

Table 4. Linear regression results of the number of information tasks completed and time spent (N = 109)

	Number of tasks completed		Time spent on tasks	
	t	**Beta**	**t**	**Beta**
Gender (male / female)	-1.35	-.13	-0.15	-.01
Age (young – old)	-0.89	-.12	1.84	.23
Education (low – high)	3.12	.36***	-2.06	-.22*
Internet experience (years)	0.60	.07	0.38	-.04
Weekly time online (hours)	-1.02	-.11	0.15	.02
Followed a Internet course (no / yes)	0.27	.02	-0.85	.00
Using peers for help (no / yes)	-0.00	.00	1.82	.19
Primary location of use (at home / elsewhere)	1.12	.11	-0.75	-.07
Working situation (inactive / active)	-0.31	-.04	-1.36	-.16
R^2	.13		.23	
F	2.82***		4.67***	

*p<.05, **p<.01, ***p<.001.

Conclusions from Measurement

We are tempted to conclude that Dutch citizens have a fairly high level of operational and formal skills. On average 80% of the operational skill assignments and 72% of the formal skill assignments were successfully completed. However, the levels of information skills and strategic Internet skills attained are much lower. Information skill assignments are completed on average by 62% and strategic skill assignments on average by only 25% of those subjected to these performance tests. Unfortunately, there are no standards of comparison since comparable performance tests in other countries are non existent. Anyway, the Dutch government's expectation that every citizen with an Internet connection is able to complete the assignments following tasks the government thinks every Internet user can perform, clearly is not justified.

The level of digital skill performance is quite different among categories of the Dutch population. Educational level attained is the most important correlating factor. All performances, both in number of tasks completed and amount of time spent on tasks with all four types of digital or Internet skills, are significantly different for people with high, medium and low education. Age is the second most important correlating factor. However, this only goes for operational and formal skills. An interesting conclusion is that the so-called 'digital generation' (18-29), that in this investigation also scores relatively high in operational and formal tasks, does not perform significantly better in information and strategic skills than the older age groups, despite the fact that the elderly score lower on operational and formal skills.

A remarkable conclusion is that internet experience only correlates with the number of operational tasks completed and time spent on them. Amount of time spent online weekly only correlates with time spent on formal Internet tasks. It appears that information and strategic skills do not grow with years of Internet experience and amount of time spent online weekly. Taking an Internet course, having a support network, the location and working condition have minor influence on all skill types.

So, one of the most important general conclusions is that operational and formal Internet skills

Table 5. Linear regression results of the number of strategic tasks completed and time spent (N = 109)

	Number of tasks completed		Time spent on tasks	
	t	**Beta**	**t**	**Beta**
Gender (male / female)	-0.72	-.06	-1.11	-.11
Age (young – old)	-1.42	-.17	-0.19	-.03
Education (low – high)	4.24	.42***	1.06	.13
Internet experience (years)	0.21	.02	0.54	.06
Weekly time online (hours)	-1.60	-.15	-1.23	-.14
Followed a Internet course (no / yes)	0.31	.03	0.47	.05
Using peers for help (no / yes)	-1.61	-.16	1.20	.14
Primary location of use (at home / elsewhere)	-0.61	-.05	-0.26	-.03
Working situation (inactive / active)	1.29	.14	-0.62	-.08
R^2	.30		.01	
F	6.09***		.84	

*p<.05, **p<.01, ***p<.001.

are a necessary but not sufficient condition for the performance of information skills and strategic skills when using online government services.

Wider Significance of Measurement Results

These results are valid for, or at least give an indication of the situation regarding digital skills in the Netherlands, a country with one of the highest Internet access rates in the world (84% of households in 2008). Imagine what the result is for countries with much lower access rates. Though we did not find a significant relation with Internet experience, except concerning operational skills, the situation in those countries is expected to be worse. This especially goes for those countries that also have a lower general literacy level than the Netherlands. After all we discovered that educational level is the most important factor explaining the higher digital skills of information retrieval and strategy.

In the experimental tests reported here a large number of assignments that are considered performable, were in fact not completed. The actual level of completion outside the laboratory might be even lower as the subjects where stimulated by the experimental circumstances in the test. Probably they were more motivated to finish the task than they normally would be; in their own environments many of them would have grabbed the phone or run to a service desk or someone else in their social environment to reach the answer. Indeed, other research indicates that users of public websites often give up and turn to the telephone or a front desk (Pieterson & Ebbers, 2008).

An obvious objection regarding these results is that they are not surprising and probably also apply to the use of traditional media. Almost 40 years ago the thesis of the knowledge gap was defended (Tichenor et al., 1970). In this thesis it was argued that people with higher education derive more knowledge from the mass media than people with lower education. So, what actually is the difference between traditional literacy and digital literacy? Our provisional answer is that digital literacy adds to the differences observed in traditional literacy. On the one hand computers and the Internet make things easier as they enable systematic information retrieval from innumerable sources simultaneously. Finding information in a traditional library might be more difficult for

inexperienced information seekers than finding the same information on the Internet. At the other hand computers and the Internet make information seeking and improving literacy more difficult as they assume a number of operational and formal skills to start with. This raises an extra barrier above the skills of reading and writing. Additionally, they require particular information and strategic skills. Otherwise one drowns in the wide ocean of information provided by the digital media. All four skills required taken together probably make the gap between people with different educational, occupational and age backgrounds bigger in the new than in the traditional media.

HOW TO OVERCOME DIGITAL SKILL DIVIDES

Two basic strategies are available for the goal of bridging digital skills divides. One is supply-side oriented and tries to improve the accessibility and usability of information provision in the shape of websites and computer programs or files. The other departs from the user and aims to assist the learning of digital skills by users. In this final section both strategies will be applied to government information and to the accessibility of e-government applications. This does not mean that the government is the only actor that is responsible for solving this problem. Producers of hardware and software, social institutions with a social and educational mission and individual citizens and consumers also have a responsibility in solving the problem of insufficient digital skills.

Improving the Information Provision of Websites

As a side-effect of the measuring of digital skills in using government websites we discovered that many of these sites are organized and structured in ways that make them more inaccessible and difficult to use than needed considering the complexity of the information offered.

First, public agencies tend to maintain their own image and profile when developing and offering sites. This makes interaction between governments and citizens different for every single website. Citizens meet different designs and layouts on every site. We have noticed that this causes problems for the low educated and seniors in particular. They have to engage in amore or less successful learning processes over and over again. One might ask whether it really is necessary that every government institution has its own website design. For citizens, they are all 'government'; within governments image competition should be out of the question. The most important goal should be to provide the Internet as a means for simple information retrieval and service supply.

Second, the organization of government websites and their division of labor regarding information provision needs to be improved. We have observed two problems. In the experimental tests it appeared that government websites that are listed in the search results, do not all contain the information citizens expect to find in these sites. Moreover, similar government information happens to be available on different sites. As long as the information is complete, this is no problem. Unfortunately, this did not happen to be the case. It might be recommended to offer less government websites with specific information following a clear task division and containing information that is continually scrutinized for its quality.

A third observation was that governments try to improve the accessibility and connectivity of their information provision by offering large, government-wide reference portals. This intention is good. However, offering portals that try to create order in the chaos of government websites does not appear to make it easier for citizens either. Usually, their scope of information and their menu design are too broad. The excessive amount of information offered only makes the

relevant sources harder to find for many users as it appeared in the performance tests described here. Instead, subjects immediately grabbed to Google, by far the most important search engine in the Netherlands. When the subjects were allowed to choose the way to find the information themselves they passed all government portals and special sites and turned to Google. The government should carefully consider the added value of a portal, before it gives the orders to develop such a site. Also, portals should profoundly state for what purposes they are made, who offers them and what people might expect. Finally, governments should accept the fact that citizens also use their own search engines and accommodate their methods of information supply to this fact.

A following solution mentioned here might be to offer government websites in two versions, an advanced version for the more experienced Internet users and a relatively simple version for seniors and low educated users. This second version can offer an 'exaggerated' explanation of the operation of the website and the steps one is able to take on this site, among others when one has to go to the more complicated version. Considering design and didactic approach, this version should be equal for every agency. It is important to show a recognizable identical and simple design that leaves out options that are hardly being used. The simple sites with identical designs and menu structures can be linked in a network of government websites that covers all basic information and transaction needs of citizens in a particular country. This might seem a ridiculous revolutionary idea for many government agencies and website developers, but we think this complete restructuring of government information provision using websites would be very helpful for inexperienced users, and, by the way, for more experienced users. Currently, the fragmented and supply-side oriented nature of information provision of government departments, that insufficiently cooperate, strongly reinforces the inaccessibility of this information and the extent of digital skill divides.

A final suggestion is to develop more decision support software that is programmed with information about actual citizen's behavior in decision taking. We have observed that online government information to gain strategic benefits, for example to inform whether it makes sense to lodge an appeal against a decree or a tax assessment, seems to be only appropriate for a small minority of citizens. Taking into account low levels of strategic skills is a difficult challenge for website developers. However, decision support software such as used in intelligent or interactive search systems or in electronic voting guides appears to be very helpful for a large number of users. Such systems and guides can also be developed for other services citizens need.

Improving the Digital Skills of Citizens or Users in General

As almost goes without saying, education is the main solution to overcome digital skill divides among citizens and users in general. The government has a main responsibility here, but societal organizations or support groups with a social, political, cultural and educational mission and individual citizens themselves also have a role to play here. More than education is needed to bridge the digital divide (van Dijk, 2005). However, here we will concentrate on potential educational tasks for governments in building digital skills. First we will mention tasks to bridge operational and formal skills divides, and than we will discuss suggestions to bridge information and strategic skill divides.

Operational and formal skills divides are prominent among seniors and among people with low levels of education. When they get support with computer and internet courses adapted to their speed, cultural preferences, styles of learning and physical inabilities that are growing with age, they are able to cross the threshold of the digital information environment. This is a matter of adult

education provided both by government subsidies and by the self-organization of community centers, organizations for seniors on the web and the like. However, it also is a task for regular education at all levels. Regular education very much benefits from the fact that children and young people in general learn operational and formal skills themselves in practices outside schools. However, this learning by doing could be partial and insufficient for many purposes as many important operations, applications and opportunities are bypassed.

Public libraries, community centers and government buildings such as municipal halls have a special obligation in providing facilities for learning operational, formal and information skills. This means not only providing computer and Internet terminals but also a staff equipped and experienced to help users visiting these buildings and helping them across the thresholds of using a particular electronic service or information source. They should continually walk around the terminals and assist users with questions.

Public and private institutions of adult education should receive more means and a competent staff to meet the needs of computer and internet courses. Citizens should be able to participate in these courses at low cost. The same goes for elementary computer and Internet instruction in the context of education and citizen programs for immigrants. Learning information and strategic skills is much more difficult, but no less important.

In our measurements the level of information skills appeared to be quite low. In general the search process took too many steps and too much time. This is both due to a shortage in information skills with users themselves and to insufficient anticipation on low levels of information skills by suppliers. In depth analyses indicated that defining proper search queries is hard for many citizens, especially the low educated. Too general search queries lead to irrelevant search results that make the selection of relevant sources harder to achieve. In depth analysis of the data also showed that people do not look further than the first couple of search results and do not critically evaluate the search results and their sources at all. Surprisingly, this was also true for the higher educated subjects (Van Deursen & Van Dijk, forthcoming).

Unfortunately, Internet skills in general and the acquisition of information skills in particular have a minor role in regular education at all levels, not only in the Netherlands but in many other countries. Before using computers and the Internet in educational programs, tests should indicate whether students have an adequate level of operational and formal skills. – See the insufficiency of self-learning referred to above – If not, they should be taught first. However, special attention is needed for information skills. Using search engines should be the primary objective. Teachers should achieve special training in didactic and information skills suitable for the Internet. It is important to develop new educational material, designed for Internet use, to be implemented in existing courses of the school curriculum instead of special computer classes. When learning information and strategic skills is implemented in existing courses such as language, history, biology and geography they will be more effectively picked up. Also, teachers will be more motivated to spend additional time and effort.

Citizens above 35 to 40 that did not get the chance to acquire digital skills in education depend on their work and adult education to catch up later. The results of the performance tests reported here can also be applied to the skills of employees that often only receive courses in operational skills, but would also benefit from improved information and strategic skills. Especially in the information jobs this improvement would lead to increased productivity and innovation. Courses for employees should at least train formal Internet skills and the effective use of search engines.

Functional and complete illiterates also need special attention. For them the use of computers and the Internet seems almost impossible. However, special aids such as audiovisual interfaces,

multimedia programs and touch screens can be designed and offered for them. For the disabled, the government should not only make their websites more accessible with special aids. It should also provide additional services (e.g. homecare). Furthermore, voluntary organizations of/for disabled people could give computer classes adapted to the need of special disabilities.

For ethnic minorities the supply of government services should be designed to enable more multicultural choice options. One should also provide more training materials using minority languages and designs inspired by minority cultural experiences.

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KEY TERMS AND DEFINITIONS

Digital Skills Divide: The prevailing research of the Digital divide mainly focused on a binary classification of access. Now a more refined understanding of the digital divide has appeared and several conceptualizations of how to approach digital divide research exist. One of the factors that appears to be important in all of them is the differential possession of so-called digital skills.

Digital Skills: the abilities of operating digital media, handle the structures of new media, search, select, process, and evaluate information in digital media and use digital media as a means to reach a particular goal.

Information Internet Skills: the skills to locate required information.

Operational Internet Skills: the skills to operate an Internet Browser, operate online search engines and complete online forms.

Formal Internet Skills: the skills to be able to navigate on the Internet and maintain a sense of location while navigating.

Strategic Internet Skills: the skills to take advantage by using the Internet.