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A. J. A. M. van Deursen[a]; J. A. G. M. van Dijk[a]
[a] University of Twente, Enschede, the Netherlands

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Measuring Internet Skills

A. J. A. M. van Deursen and J. A. G. M. van Dijk
University of Twente, Enschede, the Netherlands

Research that considers Internet skills often lacks theoretical justifications and does not go beyond basic button knowledge. There is a strong need for a measurement framework that can guide future research. In this article, operational definitions for measuring Internet skills are proposed, applied in two large-scale performance tests, and tested for reliability and validity. The framework consists of four Internet skills: operational, formal, information, and strategic Internet skills. The framework proves to be a powerful means for understanding the complexity of the Internet skills that people employ when they use the Internet. The reliability of the framework is supported by obtaining similar results from two studies focusing on different contexts. The validity of the framework is investigated by comparing the results with external standards that also provide an indication of Internet skill levels.

1. INTRODUCTION

An important 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, 2006). This gap has most often been framed in the term *digital divide*. Although the prevailing research approach mainly focused on this 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 (e.g., DiMaggio & Hargittai, 2001; Mossberger, Tolbert, & Stansbury, 2003; Van Dijk, 2005, 2006). One of the factors that appears to be important in all of these conceptualizations is the differential possession of Internet skills. Because of the growing amount of information on the Internet and people's increasing dependence on information, the importance of Internet skills for participation in several social areas such as labor, education, and social contacts has also increased (Steyaert, 2002). One's level of Internet skill has a strong effect on the Internet use of individuals once they have attained physical access to the Internet (Hargittai, 2003; Livingstone, Van Couvering, & Thumim, 2005; Mossberger et al., 2003; Norris, 2001; Van Dijk, 2005; Warschauer, 2003).

Correspondence should be addressed to A. J. A. M. van Deursen, University of Twente, Faculty of Behavioural Sciences, Department of Media, Communication and Organization, Cubicus Building, PO Box 217, 7500 AE Enschede, The Netherlands. E-mail: a.j.a.m.vandeursen@utwente.nl

It is being progressively recognized that Internet skills are not equally distributed in society. Despite the importance of this issue, very few measurements are available. Most measurements are taken in small educational settings or as part of computer classes. They measure only the attainment of norms and goals of the particular course, not a certain level of Internet skills according to a generally accepted definition. Almost every general measurement administered for large populations is done by means of survey questions asking respondents for an estimation of their own Internet skill level. This method has significant problems of validity (Hargittai, 2003; Merritt, Smith, & Renzo, 2005; Talja, 2005). Dunning, Johnson, Ehrlinger, and Kruger (2003) found that people with poor performance often overestimated their expected performance caused by a lack of meta-cognitive judgments to realize their own incompetence, or that they knew too little to realize that they did not know a lot. They also found that people that performed well tended to underestimate their expected performance. The only way to obtain a direct measure of Internet skill is by directly testing that skill. There are only a few serious scientific tests of Internet users' skills (e.g., Hargittai, 2003).

The most important reason for the lack of serious Internet skill tests might be that the literature concerning these skills is not consistent in the terms used and in the underlying concepts applied. In fact, operational definitions have rarely been defined, and most of the Internet skill research applies limited definitions that do not extend beyond so-called button knowledge. Most studies lack theoretical justification and fail to cope with the full range of skills necessary. Because the concern about Internet skills is increasing in policy discussions, there is a strong need for an operational framework that can guide future research. The purpose of this article is to provide a methodological contribution to Internet skill research. We propose a framework that contains definitions for four types of Internet skills. The framework has been applied and tested twice in large-scale studies. The subsequent research questions are as follows:

1. Is the proposed framework appropriate for the measurement of Internet skills? Are the performance tests derived practicable in terms of operational definitions and efforts required (as compared to, e.g., self-assessments in surveys)? What are the results of performance tests based on the proposed framework in studies using Internet assignments on different topics of interest?
2. What are the reliability and the validity of the framework as a particular type of scientific measurement? Are the results in agreement with known observations of Internet skills of the population under investigation using other methods such as self-assessments and measures of Internet experience? When they show complete disagreement this would raise doubts as to the reliability or validity of the framework.

2. A FRAMEWORK FOR MEASURING INTERNET SKILLS

Only a few frameworks for measuring Internet skills have been proposed by sociological scholars. These frameworks are applicable on multiple facets of both

computer and Internet use. Bunz (2004), for example, created the Computer–Email–Web Fluency Scale for measuring computer skills, e-mail skills, and Internet skills. Hargittai (2007) proposed several dimensions, each of which contributes to the users' ability to make the most out of their time spent on the Internet: communicating, group discussions, using tools, finding content, web navigating, assessing source credibility, seeking assistance, privacy issues, security issues, and customization. A problem with most of the studies that attempt to measure Internet skills is that they often use tasks or questions that are not clear on the gradient of difficulty. The results obtained are therefore more clearly an indication of the level of Internet use, rather than the level of Internet skill.

Eshet-Alkalai and Amichai-Hamburger (2004) proposed a more theoretical grounded and empirically investigated framework, consisting of the following:

- Photo visual literacy: "Reading" instructions from graphical displays.
- Reproduction literacy: Utilizing digital reproduction to create new, meaningful materials from pre-existing ones.
- Information literacy: Evaluating the quality and validity of information.
- Branching literacy: Constructing knowledge from nonlinear, hypertextual navigation.
- Socioemotional literacy: Understanding the "rules" that prevail in cyberspace and applying this understanding in online cyberspace communication.

In this framework, a variety of complex cognitive, motorical, sociological, and emotional skills, which users need to function effectively in digital environments, are included. For measuring Internet skills among populations at large, however, most interesting are sociological studies that use a range of Internet skills that are somehow dependent on each other. Mossberger et al. (2003) defined Internet skills by considering technical competence, the more narrow set of skills to operate the Internet, and information literacy, the skills to recognize when information can solve a problem or fill a need and to effectively employ information resources. Both Steyeart (2002) and Van Dijk (2005) introduced three general types of skills applicable on both computers and the Internet. Steyaert distinguished between

- Instrumental skills. The operational manipulation of technology.
- Structural skills. They relate to the structure in which information is contained.
- Strategic skills. The basic readiness to preactively look for information, information-based decision making and scanning of the environment for relevant information.

According to Steyeart, Internet skills are mostly about new instrumental skills, whereas underneath, the traditional information and strategic skills are generic to all media. In the transformation toward an information society, they significantly gain importance. Van Dijk (2005) considered information skills as characteristic for the information society. He changed Steyeart's definition to

- Operational skills. The skills to operate computer and network hardware and software.
- Information skills. The skills to search, select, and process information in computer and network sources. In a further specification of information skills he proposes the following division:
  - Formal information skills: the ability to understand and to handle the formal characteristics of a computer and a computer network—the Internet—such as file structures, menu structures, and hyperlinks.
  - Substantial information skills: the ability to find, select, process, and evaluate information in specific sources of computers and networks according to specific questions and needs.
- Strategic skills. The capacities to use these sources as the means for specific goals and for the general goal of improving one's position in society."

The first discussed Internet skill definitions (e.g., Bunz, 2004; Hargittai, 2007) can easily be extended and therefore adapted to the rapid shifts in this technology. However, these definitions can not be used to measure Internet skills more in-depth, something that both Steyeart (2002) and Van Dijk (2005) consider important and necessary when assessing Internet skill levels. Despite the sequential and conditional nature of the frameworks proposed by Steyeart and Van Dijk, they claimed these skills can and should be measured separately (starting with instrumental or operational skills). This could provide opportunities to investigate how these skill levels are distributed among social segments in the population. With these frameworks serving as a starting point, an extended literature overview is required to provide specific Internet skill definitions. From this overview, in section 2.5 an operational framework is derived that can be used to measure Internet skills in-depth.

2.1. Operational Internet Skills

Besides the definitions of Mossberger et al. (2003), Steyeart (2002), and Van Dijk (2005), there are many other terms that indicate a set of basic skills in using computer or Internet technology. Examples are technological literacy (Carvin, 2000); the ability to utilize common IT tools, including hardware, software, and Internet tools like search engines; and technical proficiency (Søby, 2003), the basic component of digital literacy, including a foundational knowledge of hardware, software, applications, networks, and elements of digital technology.

Steyeart and Van Dijk referred to the operationalization of the European Computer Driving License as being narrowly focused on operational skills. To provide an operational definition for operational Internet skills, two studies appear useful. Bunz (2004) developed an instrument to assess people's fluency with the computer, e-mail, and the Internet to fill the existing void that exists between previously developed computer literacy or experience scales and the ever-faster development of Internet technology. To measure web fluency, Bunz used items related to using a web browser, opening web addresses, identifying host servers from the web addresses, using back and forward buttons to

move between web pages, and using search engines. Larsson (2002) created a Digital Literacy Checklist developed after Gilster's (1997) definition of the concept "digital literacy." This checklist is a self-assessment that covers a range of topics, including Internet skills: familiarity with a web browser, bookmarking, browser preferences, various file formats on the web, Telnet, download audio files, HTML, Internet formats, download files, FTP, and personal news feeds. Revere (2005) created a Digital Literacy Self-Assessment in which the Internet skills part considers using a browser; saving web pages; customizing web browsers; bookmarking sites; and knowing the difference between a search engine, subject directory, and a meta-search tool.

It is not clear what criteria are used to add items in these and other checklists. Other operational Internet skills appear absent, for example, the skills to use web-based forms.

2.2. Formal Internet Skills

The second types of skills are the formal Internet skills.[1] Every medium has particular formal characteristics that have to be known and mastered. Formal skills relate to the structures on which a medium is built. The Internet is the most obvious example of hypermedia, requiring the skills of browsing and navigating. Users must have the skills to use the different web and menu layouts that are offered on the web. With the latest Internet browsers it is possible to offer websites in almost every thinkable design. Often these websites or interfaces may seem perfectly usable to the developers but prove different in actual usability tests. Unfortunately, research is usually conducted from a technical perspective. The skills of the general Internet user are rarely considered.

A primary cognitive condition related to formal Internet skills is disorientation, the most frequently cited problem in hypermedia use (Ahuja & Webster, 2001; Lee, 2005). Most traditional media are linear, giving the user little control over the flow of information. Hypermedia provides a formal structure that enables users to choose their own nonlinear paths instead of the fixed formal structures of print media (chapters, paragraphs, references, etc.). Now, users can move not only forward but also backward and to unknown locations (Kwan, 2001). Without a sense of location, distance, and necessary direction, it is not surprising that users often have a strong sense of disorientation (Conklin, 1987; Kwan, 2001). Not knowing where one is, where to go next, how to get back to a previous site, what path one has followed, or where to look for information are all part of the sense of losing orientation (Edwards & Hardman, 1989; Park & Kim, 2000). Getting lost on the Internet also occurs with sufficient content domain expertise which states that disorientation should be framed in terms of site structure, web links, and web design, independent of the information topics being navigated (Danielson, 2003). Thus, formal Internet skills should be considered medium-related skills, as are operational Internet skills.

[1] Inspired by Van Deursen and Gui (2008).

2.3. Information Internet Skills

Information Internet skills relate to the content provided by the medium. Strongly related to information Internet skills are information literacy (see Bawden, 2001) and digital literacy (Gilster, 1997). Standards and statements regarding these terms are produced by several professional information associations, all derived from the widely accepted definition of the American Library Association (Correia & Teixeira, 2003). According to the American Library Association (1989, p. 1), an information literate person is "able to recognise when information is needed and has the ability to locate, evaluate and use the needed information effectively." Literature relevant to information Internet skills is spread across different areas that tend to stay separate, causing the information not to be well integrated (Jenkins, Corritore, & Wiedenbeck, 2003). Most literature focuses on the search for (online) information that is seen as an action by which users try to fulfil their information needs. For the goal of defining an operational definition for information skills, studies that take a staged approach to explain the process of information searching are most interesting.

Ellis (1989) and Marchionini (1995) proposed a general accepted distinction that was originally developed in the context of traditional information retrieval. However, their models can also be extended to online search engines. Marchionini's model is recursive and appropriate for digital environments. Furthermore, it is not limited solely to the information-seeking process in search engines. The process starts with the problem definition. An identification of the information need can be regarded as the determination or definition of a problem (Brand-Gruwel, Woperies, & Vermetten, 2005). A problem definition is comprehensive when a clear description of the problem and the type and amount of information required for solving it are given. This step is primarily cognitive and affective, respectively, and traditionally foreshadow actions that involve search systems (Marchionini & White, 2007).

After formulating the information problem, sources of information for solving the problem are considered. Interesting sources of information are based on criteria such as reliability, validity, preciseness, completeness, accuracy, availability, novelty, and costs (Brand-Gruwel et al., 2005).

The third step, formulating search queries, gained a lot of attention lately in academic research, highlighting a potential barrier to information for different types of Internet users. The typical Internet user uses only one or a couple of terms per query (Aula & Nordhausen, 2006).

The fourth step, selecting the most relevant information or search results, is a difficult process. When only a few search results are returned, they can be scanned quickly, browsed systematically, or inspected comprehensively. However, when people use broad searching strategies in large-scale search engines, a vast number of often unsuitable results will appear (Livingstone et al., 2005). This problem is reinforced by the fact that information seekers often do not venture past the first page of search results (e.g., Aula & Nordhausen, 2006; Birru et al., 2004; Hargittai, 2003). People must be able to conclude whether the information found has any value and be able to separate relevant from irrelevant documents.

The final step has been described as the ability to make informed judgments about what is found online, "the art of critical thinking," emphasizing the critical

evaluation of what is found on the web (Gilster, 1997). Information is not always of the same quality, and its diversity calls upon specific information skills from users (Steyaert, 2002). It is necessary to check the accuracy of data and the reliability of the sources.

2.4. Strategic Internet Skills

Like Information Internet skills, Strategic Internet skills relate to the content provided by the Internet. Strategic skills relate to the usage gap, as described by Bonfadelli (2002) and Van Dijk (2005), between those who primarily use information and communication technologies and networks for professional and educational development and those who mainly use it for entertainment. Pruulman-Vengerfeldt (2006) related strategic skills to economic, educational, and cultural capitals that increase the value of the Internet. People with better strategic Internet skills will have higher capitals. Although strategic skills hardly depend on operational and formal skills alone, together with information skills they serve as the means to reach a particular goal by one's own initiative.

Because there are very few analytical categories available that help in creating operational definitions for strategic Internet skills, we propose a process that consists of four distinct steps in making effective use of the Internet. This process is based on the classical approach to decision making in which the emphasis lies on procedures through which decision makers can reach an optimal solution as efficiently as possible (Miller, 2006).

We consider the first step as goal orientation. Here this means to be aware of the opportunities that the web offers and subsequently determining the goal of the Internet session. Keeping an eye on this goal and working toward it is difficult, especially in a digital media landscape that offers an enormous number of distracting stimuli.

The second step is taking the right actions on the Internet. Parallel to the decision-making process, this means gathering and combining various information sources (Miller, 2006) to achieve the best means for the goal desired. After the right actions are taken, it is time to make decisions to reach the original goal by using the (often excessive amount of) information retrieved selectively.

After the right actions are taken, it is time to make decisions to reach the original goal by using the (often excessive amount of) information retrieved selectively—the third step. In the decision-making process, this step means developing a set of decision options and evaluate these according to carefully developed criteria (Miller, 2006). The decision-making process ends when an optimal decision is identified and decision implementation can begin (Miller, 2006).

The final step is gaining the benefits. When the right decisions are made, they can be turned into benefits of a personal, social, professional, or educational kind.

2.5. Proposing a Framework for Measuring Internet Skills

Departing from the literature review in the former sections, an extended definition of Internet skills can now be proposed. Although this detailed definition

partly follows the general definition proposed by Van Dijk (2005), some important changes are made. The literature overview in section 2.2 revealed that formal information skills and substantial information skills should not be considered as subcategories of information skills. It appeared that formal skills are strongly related to the characteristics of the medium, like operational skills. Information Internet skills, together with strategic Internet skills, relate to the content provided by the medium. Based on the prior sections, we consider the following subsequent indicators for measuring the level of Internet skills:

Operational Internet Skills

- Operating an Internet browser:
  - Opening websites by entering the URL in the browser's location bar.
  - Navigating forward and backward between pages using the browser buttons.
  - Saving files on the hard disk.
  - Opening various common file formats (e.g., PDF).
  - Bookmarking websites.
  - Changing the browser's preferences.
- Operating Internet-based search engines:
  - Entering keywords in the proper field.
  - Executing the search operation.
  - Opening search results in the search result lists.
- Operating Internet-based forms:
  - Using the different types of fields and buttons.
  - Submitting a form.

Formal Internet Skills

- Navigating on the Internet, by
  - using hyperlinks (e.g., menu links, textual links, image links) in different menu and website layouts.
- Maintaining a sense of location while navigating on the Internet, meaning
  - not becoming disoriented when navigating within a website,
  - not becoming disoriented when navigating between websites, and
  - not becoming disoriented when opening and browsing through search results.

Information Internet Skills

- Locating required information, by
  - defining the information problem,
  - choosing a website or a search system to seek information,
  - defining search options or queries,
  - selecting information (on websites or in search results), and
  - evaluating information sources.

Strategic Internet Skills

- Taking advantage of the Internet, by
  - developing an orientation towards a particular goal,
  - taking the right action to reach this goal,

- making the right decision to reach this goal, and
- gaining the benefits resulting from this goal.

The proposed framework goes beyond the superficial notion of measuring Internet skills and illustrates that the provision of operational and formal skills alone is not enough when using the Internet. Despite the dependent nature of the four skills, they can and should be measured separately (starting with operational skills). The framework is based on the individual's ability, making it relevant for the skills necessary for the general population to function in an increasingly digital environment, specifically the Internet.

3. METHOD

To test the proposed framework, two observational studies are conducted. Because a direct measure of skill can only be obtained by directly testing that skill, both studies use assignments to measure Internet skills. The first study took place in 2007 and used a governmental context for the Internet tasks charged (the Ministry of Internal affairs sponsored the study). The second study was conducted in 2008 and had a more general leisure context that figured more prominently in the population's consciousness.

3.1. Subjects

In both studies, subjects were recruited by randomly dialing telephone numbers in villages and cities in the Twente region. The cities and villages were specifically chosen to reflect the urban, rural, and countryside distribution of the Netherlands. A condition of invitation was that the participant used the Internet at least once every month and for more than just e-mail. This ensured that low-frequency users who are nonetheless familiar with the Internet are included. The invitation policy put people who feared the test at ease. Subjects were promised 25 euro for their participation in a $1^1/_2$-hr research session about their Internet use.

It was not possible to test a random sample of 800 to 1,000 persons from the whole Dutch population because of the major labor intensity of performance tests and the very high travel costs of drawing subjects to the lab nationwide. Ultimately, in both studies 109 subjects performed the tests.

The following sampling procedure with a two-step approach was used. First, a sample was randomly selected from a telephone book. Subsequently, a selective quota sample was drawn for the strata and quota of gender, age (for recruitment divided over four categories: 18–29, 30–39, 40–54, and 55–80) and educational attainment (for recruitment divided over three categories: low; primary school equivalent, middle; high school equivalent, and high; college, and university equivalent), the most important determinants of Internet use (Norris, 2001; Van Dijk, 2005; Warschauer, 2003), and the three variables on which the subjects were recruited. To rate the overall representativeness of this sampling approach, it should be compared to the standards of an experimental study

Table 1: Number of Subjects Over Gender, Education, and Age

Characteristics	*Study 1*[a]	*Study 2*[b]
Gender		
Male	51	57
Female	58	52
Education		
Low	32	34
Middle	37	34
High	40	41
Age		
18–29	25	27
30–39	27	23
40–54	27	28
55–80	30	30

[a] $N = 109$. [b] $N = 109$.

rather than a survey. For an experimental study, the number of participants is high. However, larger-than-average groups are needed, because large social and cultural differences of computer use and experience had to be taken into account. Table 1 contains the number of subjects in both studies and their division over gender, age, and educational attainment.

3.2. Data Collection

In both studies, two methods of data collection were used. Prior to the studies, a 10-min questionnaire was administered to gather information about gender, age (year of birth), education (low–middle–high), frequency of Internet use (hours a week), Internet experience (years), participation in an Internet course, location of respondents' regular Internet use, their social support networks, and socioeconomic status.

After the subjects completed the questionnaire, they were given a sequence of nine assignments (discussed section 3.3), one at a time. The nine assignments consisted of two operational skill assignments, two formal skill assignments, three information skill assignments, and two strategic skill assignments. The experimenter directly measured the assignment completion and the time needed, the main outcomes as in line with previous related work (e.g., Hargittai, 2003).

3.3. Assignments

All the assignments in the first study consisted of actions the government assumed all citizens are able to complete. For the assignments that directed subjects to a specific website, websites that score well on usability were selected. In the second study, more general leisure related assignments were used. All assignments were pilot-tested to ensure comprehensibility and applicability. Furthermore, they were

fact based and had a specific correct action or answer. Open-ended tasks were avoided because of the ambiguity of interpretation of the many potential answers. Subjects themselves decided when they were finished or wanted to give up on an assignment. After a specific, ample period, a deadline appeared when the test leader gently asked the subjects to pass on to the next assignment. All subjects completed the assignments in the same order. If the correct answer was not found, the task was rated as not completed. Appendices A and B contain the assignments of Study 1 and 2, respectively.

To measure operational Internet skills, in the first two assignments, subjects were asked to perform the actions defined in the detailed definition in Section 2. Assignments 3 and 4 were used to measure formal Internet skills by asking subjects to follow multiple links, stay oriented, browse and open search results, and use different website layouts and designs. In Assignments 5, 6, and 7, information Internet skills are tested. In Assignment 5, subjects had to find information in one specific website. Assignments 6 and 7 are open web tasks (no specific website). The full range of information skill indicators defined in Section 2 are required. Strategic Internet skills are measured in Assignments 8 and 9, requiring orientation, combining information sources and decision making.

3.4. Technical Specifications

Both studies were conducted in an office at the University of Twente. In line with previous related work of Hargittai (2003), we used an equally new setting for all subjects. During the assignment completion, subjects used a keyboard, a mouse, and a 17-in. monitor. The PC connected to the Internet on a high-speed university network and was programmed with the three most popular Internet browsers (Microsoft Internet Explorer, Mozilla Firefox, and Opera), allowing participants to replicate their usual Internet use. No default page was set on the browsers and all the assignments started with a blank page. To ensure that participants were not influenced by a previous user's actions, the browser was reset after each session by removing temporary files, cookies, and favorites. In addition, downloaded files, the history, forms, and passwords were removed and the laptop was rebooted.

4. APPROPRIATENESS OF THE PERFORMANCE TESTS

This section starts with a general overview of the empirical results of both studies. The first section reports the average percentage of tasks completed and the time spent on the tasks. In the following sections, how the levels of the four types of Internet skills vary across specific parts of the population is further analyzed. The results indicate whether the framework with its refinement of the definition of the concept Internet skills is useful. To identify factors that influence the levels of the four Internet skills, linear regression analyses are performed, both for the number of tasks completed and the time spent on the tasks. Finally, the results of both studies are compared and evaluated.

4.1. General Overview

Table 2 summarizes the average completion rate of the assignments in both studies. In both studies, most problematic are the strategic skill assignments of which the subjects only completed 25% and 30%, respectively. The time spent on the assignments varies substantially.

4.2. Operational Internet Skills

According to Tables 3 and 4, age is a strong contributor to the level of operational Internet skills, both in Study 1 and 2. Age has high betas, significant both for the number of tasks completed and the time spent on the tasks. Educational attainment also appears as a significant contributor to the number of completed tasks in both studies. In addition, it appears significant to the time spent in the first study. Internet experience is significant for the number of tasks completed in the first study and in both studies for the time spent on the operational Internet skill tasks.

Table 2: Average Number of Tasks Completed and Time Spent

	Average % of Tasks Completed		*Average Time Spent on Tasks (in Seconds): M (SD)*	
	Study 1	*Study 2*	*Study 1*	*Study 2*
Operational tasks	80	73	553 (254)	409 (185)
Formal tasks	72	83	616 (255)	443 (214)
Information tasks	62	53	939 (449)	919 (327)
Strategic tasks	25	30	1,466 (575)	1,628 (534)

Table 3: Linear Regression Results of the Number of Operational Tasks Completed

	Study 1		*Study 2*	
	t	*β*	*t*	*β*
Gender (male / female)	−0.82	−.06	−1.01	−.07
Age (young – old)	−3.13	−.30***	−5.24	−.50***
Education (low – high)	3.86	.32***	2.77	.20**
Internet experience (years)	1.90	.15*	0.43	.03
Time online (hours per week)	0.55	.04	1.80	.15
Followed an Internet course (no / yes)	0.45	.03	−0.53	−.04
Using peers for help (no / yes)	−1.47	−.12	−0.94	−.07
Primary location of use (at home / elsewhere)	1.15	.08	−2.28	−.16*
Working situation (inactive / active)	1.62	−.15	−1.23	−.11
R^2	.52		.55	
F	14.02***		15.46***	

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 4: Linear Regression Results of the Time Spent on the Operational Tasks

	Study 1		*Study 2*	
	t	*β*	*t*	*β*
Gender (male / female)	−1.30	−.08	0.87	.05
Age (young – old)	5.11	.43***	6.77	.57***
Education (low – high)	−2.75	−.27***	−0.92	−.06
Internet experience (years)	−2.56	−.18**	−3.22	−.20**
Time online (hours per week)	−1.44	−.10	−2.02	−.15*
Followed an Internet course (no / yes)	−0.14	−.01	1.00	.06
Using peers for help (no / yes)	1.83	.13	1.66	.11
Primary location of use (at home / elsewhere)	−1.15	−.07	0.62	.04
Working situation (inactive / active)	−1.97	−.16*	1.02	.08
R^2	.64		.65	
F	22.34***		23.09***	

*$p < .05$. **$p < .01$. ***$p < .001$.

4.3. Formal Internet Skills

Regarding formal Internet skills, again age appears to be a significant contributor in both studies on the number of completed tasks and the time spent. In addition, educational level of attainment appears significant for the number of formal tasks completed in both studies and in the first study for the time spent. Using peers for assistance and the primary of location of Internet use also play significant roles on the number of completed formal Internet skill tasks. See Tables 5 and 6.

4.4. Information Internet Skills

The regression results reported in Table 7 indicate that educational level of attainment is a significant contributor to the number of information tasks completed in

Table 5: Linear Regression Results of the Number of Formal Tasks Completed

	Study 1		*Study 2*	
	t	*β*	*t*	*β*
Gender (male / female)	1.06	.08	1.22	.09
Age (young – old)	−2.58	.25**	−3.41	−.35***
Education (low – high)	2.94	−.26*	3.49	.27***
Internet experience (years)	1.56	.13	2.66	.21
Time online (hours per week)	−0.30	−.02	−0.23	−.02
Followed an Internet course (no / yes)	1.00	.07	1.30	.10
Using peers for help (no / yes)	3.08	−.26**	−0.41	−.03
Primary location of use (at home / elsewhere)	2.40	−.18*	−3.19	−.24**
Working situation (inactive / active)	1.26	.12	−1.79	−.17
R^2	.49		.51	
F	12.39***		11.36***	

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 6: Linear Regression Results of the Time Spent on the Formal Tasks

	Study 1		*Study 2*	
	t	*β*	*t*	*β*
Gender (male / female)	−2.17	−.15	−0.71	−.05
Age (young – old)	5.01	.46***	5.08	.48***
Education (low – high)	−1.98	−.16*	−1.50	−.11
Internet experience (years)	−1.68	−.13	−2.31	−.17*
Time online (hours per week)	−1.66	−.13	−1.58	−.13
Followed an Internet course (no / yes)	−0.24	−.02	−1.63	−.11
Using peers for help (no / yes)	1.65	.13	1.24	.10
Primary location of use (at home / elsewhere)	−0.76	−.05	2.73	.19**
Working situation (inactive / active)	−1.07	−.09	1.02	.09
R^2	.57		.55	
F	16.46***		15.64***	

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 7: Linear Regression Results of the Number of Information Tasks Completed

	Study 1		*Study 2*	
	t	*β*	*t*	*β*
Gender (male / female)	−1.35	−.13	−1.05	−.10
Age (young – old)	−0.89	−.12	−0.42	−.05
Education (low – high)	3.12	.36***	2.95	.28***
Internet experience (years)	0.60	.07	1.36	.13
Time online (hours per week)	−1.02	−.11	0.28	.03
Followed an Internet course (no / yes)	0.27	.02	−0.17	−.02
Using peers for help (no / yes)	−0.00	.00	−2.07	−.21*
Primary location of use (at home / elsewhere)	1.12	.11	−0.90	−.08
Working situation (inactive / active)	−0.31	−.04	−0.50	−.06
R^2	.13		.27	
F	2.82***		3.99***	

*$p < .05$. ***$p < .001$.

both studies. Educational attainment is also significant for the time spent in the first study. See Table 8. Age is significant for the time spent on the tasks in the second study. Finally, using help from peers is significant for the number of tasks completed in the second study.

4.5. Strategic Internet Skills

According to Tables 9 and 10, educational level of attainment is a significant contributor to the number of completed strategic Internet skills tasks in both studies. There are no significant contributors for the time spent on these tasks.

Table 8: Linear Regression Results of the Time Spent on the Information Tasks

	Study 1		*Study 2*	
	t	*β*	*t*	*β*
Gender (male / female)	−0.15	−.01	1.58	.15
Age (young – old)	1.84	.23	2.45	.31*
Education (low – high)	−2.06	−.22*	1.60	.16
Internet experience (years)	0.38	−.04	−2.55	−.25
Time online (hours per week)	0.15	.02	0.17	.02
Followed an Internet course (no / yes)	−0.85	.00	1.78	.17
Using peers for help (no / yes)	1.82	.19	1.04	.11
Primary location of use (at home / elsewhere)	−0.75	−.07	0.52	−.05
Working situation (inactive / active)	−1.36	−.16	0.28	.03
R^2	.23		.18	
F	4.67***		3.55***	

*$p < .05$. ***$p < .001$.

Table 9: Linear Regression Results of the Number of Strategic Tasks Completed

	Study 1		*Study 2*	
	t	*β*	*t*	*β*
Gender (male / female)	−0.72	−.06	−1.06	−.10
Age (young – old)	−1.42	−.17	0.15	.02
Education (low – high)	4.24	.42***	4.31	.42***
Internet experience (years)	0.21	.02	0.64	.06
Time online (hours per week)	−1.60	−.15	−0.48	−.06
Followed an Internet course (no / yes)	0.31	.03	−0.11	−.01
Using peers for help (no / yes)	−1.61	−.16	−1.14	−.12
Primary location of use (at home / elsewhere)	−0.61	−.05	−0.94	−.09
Working situation (inactive / active)	1.29	.14	−0.58	−.07
R^2	.30		.25	
F	6.09***		3.75***	

***$p < .001$.

4.6. Evaluating the Performance Test Results

Regression analyses have been conducted to find the independent contribution to the Internet skill levels of all factors, proposing age and educational attainment as most important. The importance of age and education in all types of access to digital technology is observed in almost every empirical study of the digital divide. Comparable results regarding Internet skills are observed in performance tests in the United States (Hargittai, 2003), although this test did not account for the four different Internet skills as measured here. In our studies, age appeared to be a significant contributor to the level of operational and formal Internet skills. Level of education appeared a significant contributor to the levels of operational, formal, information, and strategic Internet skills. The fact that age contributes only

Table 10: Linear Regression Results of the Time Spent on the Strategic Tasks

	Study 1		*Study 2*	
	t	*β*	*t*	*β*
Gender (male / female)	−1.11	−.11	1.35	.14
Age (young – old)	−0.19	−.03	0.14	.02
Education (low – high)	1.06	.13	1.26	.14
Internet experience (years)	0.54	.06	0.96	.10
Time online (hours per week)	−1.23	−.14	0.26	.03
Followed an Internet course (no / yes)	0.47	.05	2.02	.21
Using peers for help (no / yes)	1.20	.14	0.57	.07
Primary location of use (at home / elsewhere)	−0.26	−.03	−0.58	−.06
Working situation (inactive / active)	−0.62	−.08	−0.15	−.02
R^2	.01		.09	
F	.84		1.07	

to operational and formal Internet skills underlines the importance of accounting for skill-related problems in the detailed way we proposed.

The level of Internet skills measured appeared to have a weak relation with years of Internet experience and amount of hours spent online weekly (see Tables 2–9). Internet experience contributed to the level of *operational* Internet skills, but *formal, information,* and *strategic* Internet skills did not grow with years of Internet experience and amount of time spent online. This is in line with other research that reports that measures of experience predict ability poorly (e.g., Chadwick-Dias, McNulty, & Tullis, 2003).

Evaluating these performance test results, we claim that the proposed framework is appropriate to measure Internet skills. At least it is better than other methods to measure these skills (see also the next section). When we compare our findings with conclusions drawn from survey research, it appears that these surveys provide a too flattering picture. They often only focus on operational and formal skills, or they ask Internet skill-related questions that are too general or superficial. They tend to ask for general opinions about the level of skills instead of specific questions about actual behavior (achievements in computer and Internet use). The proposed framework for measuring Internet skills could be a powerful means for understanding the complexity of the Internet skills that people employ when they use the Internet.

The measurement of Internet skills is practicable though rather laborious. The performance tests themselves require 1.5 hr per subject. In-depth quantitative and qualitative analysis of the results lasts equally long. Preparation of the experiment (sampling, reception of subjects, filling questionnaires) and closing it cost about a half hour for each subject. This whole procedure makes this kind of measurement very costly in terms of time and money. It is the main reason why no more than about 100 people can be tested in each project. Because of this, researchers in this field are looking for equally reliable and valid alternatives. The most attractive candidate is posing focussed proxy questions in surveys. They are questions that ask for reports of behavior that indicates a particular skill. For

example, "How often do you look at the second page of search engine results?" The authors are in the process of identifying appropriate questions by using the performance test results to validate these questions posed in a survey after the tests.

5. RELIABILITY AND VALIDITY OF MEASUREMENT

For a legitimate evaluation of the reliability and validity of the developed and tested framework, it is important to realize that test development in this field still is in an exploratory stage. There are no generally accepted touchstones or criteria for measuring Internet skills yet.

The reliability was safeguarded by equalizing all experimental conditions in the two studies. Intraobservation reliability was not relevant, because all dimensions and indices of the Internet skills framework were measured by a single assignment. More assignments for each item of the already extensive performance tests of 1.5 hr were unrealistic. Interobservation was at stake as the two test series used exactly the same kind of assignments for a particular skill, only the topics were different (governmental vs. leisure information). The fact that the two studies produced the same results validates these tests—as motivation or interest for these topics would not have to be conceived as a disturbing factor—and improved reliability. Comparing the results reveals that both studies put forward similar contributors to the four Internet skill levels. Also, the percentages of completed assignments belonging to a specific skill, follow the same pattern in both studies. The two studies agree about their conclusions and can be considered mutually supportive.

Evaluating the validity of the framework we followed the *Standards for Educational and Psychological Testing* (American Educational Research Association, 1999) that are based on the model of validity designed by Messick (1995). Messick proposed a single construct of validity using several types of evidence (content, construct, and criterion). Content-related evidence of validity can be found when the measure concerned represents all known facets of the concept or domain under investigation. The literature review in section 2 has made an inventory of several known theoretical and operational definitions of Internet skills. The proposed framework directly emerges from this inventory—including the attempt to make a well-founded selection—minimizing the chance that the framework falls outside the accepted body of knowledge in this field of investigation.

Construct-related evidence of validity refers to the empirical and theoretical support for the construct under investigation (i.e., Internet skills). We searched for the empirical phenomena that belong to the parts of this construct according to Internet skills theory. The proposed framework consisted of a medium-skill-related part (operational and formal skills) and a content-skill-related part (information and strategic skills) with a particular coherence that is expected to have a cumulative character according to the theory. In both studies, the percentages of completed medium-skill-related assignments are higher than the percentage of completed content skill-related assignments. In addition, there are no subjects that completed any of the content-related skill arguments without also having

completed medium-related skill assignments. The opposite is the case: There are subjects that did not complete any of the content-related skill assignments but did complete medium-skill-related assignments. The cumulative nature of medium- and content-related skills suggested by theory is observable in the results. So we consider the framework valid in this respect.

Construct validity also means that the construct (Internet skill definition) as a whole agrees to a certain extent with other constructs or measures of Internet skills. Currently, there are three competitive measures for Internet skills: indirect measures (years of Internet experience and Internet usage time), self-assessments in surveys, and performance tests. One might expect some correlation between the results of these measures; otherwise one or more of them are invalid. This type of construct validity is called convergent validity. We assume that there will be a modest correlation between these measures but no absence of correlation and no very high correlation either. Although Cohen (1988) argued that criteria for the interpretation of a correlation coefficient are in some ways arbitrary, he considers a correlation between 0.5 and 1 large, between 0.3 to 0.5 medium, and less than 0.3 small. Table 11 reveals that Internet experience correlates positively—mostly with a medium to small strength—with the number of completed skill assignments of all four skills. Amount of Internet use correlates mainly with the medium related skills but also only little. The regression results presented earlier show that the correlations mentioned here do not always measure cause. The factors of age and education appeared the strongest contributing factors, not Internet experience and amount of Internet use.

In a survey prior to the performance tests, subjects were asked to estimate their own level of Internet skills on a 5-point scale. In Study 1, the mean score was 3.58 ($SD = 0.91$) and in Study 2, 3.63 ($SD = 0.91$). Table 12 shows that self-assessments have a high correlation with operational Internet skills. However, correlations with formal, information and Strategic Internet skills are medium to low. Apparently, the subjects had primarily operational skills in mind assessing their general level of skills, showing that these self-assessments provide a flattering picture. In addition, self-assessments appear higher for younger subjects than for older ones, although the performance tests have shown that this only accounts for the medium-related skills, not for the content-related information and strategic Internet skills.

Table 11: Pearsons Correlation Matrix of Internet Experience (IE) and Amount of Internet Use (AIU) with Number of Operational, Formal, Information, and Strategic Skill Tasks Completed

	No. of Operational Skills	*No. of Formal Skills*	*No. of Information Skills*	*No. of Strategic Skills*
IE Study 1	0.50**	0.46**	0.26**	0.32**
AIU Study 1	0.33**	0.27**	*ns*	*ns*
IE Study 2	0.19**	0.34**	0.28*	0.20*
AIU Study 2	0.47**	0.24**	0.24**	*ns*

*$p < .05$. **$p < .01$.

Table 12: Pearsons Correlation Matrix Between a Self-Assessment of Internet Skills With Number of Operational, Formal, Information, and Strategic Skill Tasks Completed

	Operational Skills	*Formal Skills*	*Information Skills*	*Strategic Skills*
Self-assessment Study 1	.539**	.403**	.275**	.309**
Self-assessment Study 2	.555**	.322**	.368**	.311**

**$p < .01$.

Self-assessments seem unable to provide accurate measurements of Internet skills. They also seem to have a systematic bias, for instance, by men rating themselves higher than women. In the first and second study, men ($M = 3.80$, $SD = 0.75$; $M = 3.82$, $SD = 0.85$) rated themselves significantly higher than women ($M = 3.38$, $SD = 0.99$; $M = 3.42$, $SD = 0.94$), $F(1, 108) = 4.55$, $p < .01$; $F(1, 108) = 5.52$, $p < .05$. However, in the actual performance tests we did not observe any significant difference between male and female subjects. It is safe to say that the performance test is a more valid measurement than the self-assessment.

Finally, criterion-related evidence assumes external yardsticks in one way or another. As already argued such a yardstick does not exist for Internet skills. We can only look at secondary types of evidence. A case of (predictive) criterion validity would be a correlation between the results of the performance test or framework and amount and variation of Internet use (more Internet skills are expected to lead to more Internet use and to more advanced types of Internet use). A case of (concurrent) criterion validity would be the concurrent results of more tests of the same framework after each other. This is what we have tried to do in this study. When an increasing number of the same test would lead to the same results among the same population of test subjects a commonly accepted criterion could be built after some time.

6. DISCUSSION AND CONCLUSION

Studies that attempt to measure Internet skills are often limited in the definitions used, the small sample sizes and the survey method for data collection in which skills are measured indirectly or by self-assessments. Most of the survey studies only address operational skills, and to some extent formal skills and generate a much too positive overall picture. The main benefits of our proposed framework are (a) a definition and measurements of several types of Internet skills distinguished by others in the literature, (b) a taxonomy representing a full range of Internet skills, and (c) the idea of a sequential and conditional nature of medium-related skill types and content related skill types in this taxonomy. We have attempted to show that these taxonomies and measurements are appropriate, reliable, and valid.

Our comprehensive framework helps to explain a number of conspicuous empirical results. First, the finding that age is a significant contributor to the levels of operational and formal skills, but not for information and strategic skill levels,

can be explained by the intellectual competencies and substantial knowledge on top of the operational and formal skills that are required to master information and strategic Internet skills. The higher level of operational and formal skills observed among young people does not guarantee the development of these "higher Internet skills." The results show the importance of measuring Internet skills comprehensively, considering the full range of skills necessary rather than solely focusing only on operational skills as most survey research does.

Second, the finding that information and strategic Internet skills do not grow with years of Internet experience and amount of time spent online can be explained by the possession of general intellectual skills—not enclosed in our framework focusing on Internet skills—that we believe strongly relate to information and strategic skills. These skills will not gain from long or heavy Internet use. The relatively weak relation of Internet experience and time spent online with operational and formal skills can also be explained. People often keep repeating similar mistakes when using computers or the Internet. Computer users tend to rely on acquired skills, even when they are aware that they could learn more efficient procedures for achieving the same results (Cahoon, 1998). People learn by trial and error, but when they more or less achieve the goals they had in mind, people will persist in making the same mistakes online. This certainly is the case when there is no one around to point out mistakes.

The difference between Internet skills in the relatively narrow instrumental sense of the operational definitions in this study and the broader intellectual capacities and knowledge that are also required in other, more traditional media deserves further attention. Van Deursen and Van Dijk (2010) are dealing with this substantial issue in another publication.

The Internet skill framework consists of four definitions of Internet skills that mainly focus on the Internet as information and service provider. Communication skills on the Internet required for computer-mediated communication in, for example, e-mailing, chatting, social networking, online discussion, and online dating are not a part of these definitions. Adding these skills would require the adoption of a particular theory of communication. This certainly is one of the next steps required in the investigation of Internet skills.

Finally, another job for further research is to identify survey questions that provide valid and reliable alternatives for the laborious performance tests of Internet skills we have discussed in this article.

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APPENDIX A

Assignments in Study 1

Operational skill assignments

Assignment 1. (max. 12 minutes)

- Task 1.1 Go to the website of the Dutch Tax and Custom Administration (www.belastingdienst.nl).
- Task 1.2 Click on the link 'Download and order' in the menu on the right.
  - Click on the subject 'Marriage', placed in the column 'private'.
  - Click on the link to the brochure 'When you are getting married'.
- Task 1.3 Open the brochure 'When you are getting married'.
  - Save the brochure in the folder 'Marriage' on the desktop of the computer.
- Task 1.4 Use the back-button to go back to the 'Download and order' page.
  - Click on the link 'Declaration 2006' placed in column 'private'.
  - Click on 'Declaration software 2006 (Windows)'
- Task 1.5 Save the file 'Electronic declaration IB 2006 for Windows' on the desktop.
- Task 1.6 Go back to the homepage of the Dutch Tax Administration.
  - Add the homepage to the favourites (or bookmarker).
- Task 1.7 Use the search engine on top of the website using the keyword 'save-as-you-earn deduction'
  - Open the third search result of the search assignment.

Assignment 2. (max. 8 minutes)

- Task 2.1 Go to the Child care allowance website of the Dutch Tax and Custom administration: www.toeslagen.nl/reken/kinderopvangtoeslag/
  - Complete the fields using the information given.

Formal skill assignments

Assignment 3. (max. 10 minutes)

- Task 3.1 Go to the website of the Central Office of Information, postbus51.nl.
  - Follow the options Accommodation / Rent / Rental price/ Rent Subsidy.
  - Choose the option: 'What is rent subsidy and how do I apply for it?'
- Task 3.2 Click on the link 'Applying for rent subsidy'.
  - Go to the homepage of the Allowance website in the new window.
  - Go back to the homepage of Postbus51 in the old window.
- Task 3.3 Perform a search on the Postbus51 website with keyword 'rental price'.
  - Open the first search result.
  - Open the second search result.

Assignment 4. (max. 10 minutes)

- Task 4.1 Imagine that you just moved to Nijmegen. You would like to look up the physical office addresses of the following organisations: IB-Groep, UWV and CWI.

Information skill assignments

Assignment 5. Parking (max. 12 minutes)

- Task 5.1 Imagine that you just moved to Rotterdam. Because it is hard to find a parking spot, you decide to buy a subscription to a parking lot. Find out how much a subscription to the car park named 'Spaanse Kade' costs. Use the homepage of the municipality of Rotterdam (www.rotterdam.nl).

Assignment 6. Theft (max. 12 minutes)

- Task 6.1 Imagine that, during a day at the shopping mall, your passport is stolen. Use a search engine (e.g., www.google.nl or the one you use at home) to find out what type of document you need to apply for a new passport after the old one is stolen.

Assignment 7. Salary (max. 12 minutes)

- Task 7.1 Imagine that you are 25 years old. In between September 1st and December 30th you had a full-time job in a factory (40 hours / week). Your wage was 1275 euro gross every month. This was not much. Use a search engine (e.g., www.google.nl or the one you use at home) to find out whether you were entitled to a higher salary during this period. (Yes, because the salary was lower than _ euro. / No, because the salary was higher than _ euro)

Strategic skill assignments

Assignment 8. Salary (max. 12 minutes)

- Task 8.1 When your employer paid you too little, what financial recourse do you have can you then personally obtain? Sort this out using the Internet.

Assignment 9. Elections (max. 30 minutes)

- Task 9.1 Image that there are national elections soon. You are in doubt whether to vote for the PvdA, the CDA or the VVD. You have the following opinions:
  - You are in favour of using nuclear energy;
  - You are in favour of a high child care allowance;
  - You are against having two nationalities.
- Using the Internet, find out which of these three political parties have your first, second and third preference.

APPENDIX B

Assignments in Study 2

Operational skill assignments

Assignment 1. (max. 6 minutes)

- Task 1.1: Go to the website of the CBR (www.cbr.nl).
- Task 1.2: Click on the link 'Motor' in the menu on the left.
  - Click on the subject 'Motor and scooter', placed in the column 'Brochures.'
- Task 1.3: Open the brochure 'Motor and scooter.'
  - Save the brochure in the folder 'CBR' in My Documents.
  - Close the brochure.
- Task 1.4: Use the back button to go back to homepage of the CBR website.
- Task 1.5: Add the homepage to the Favourites (or bookmarks).

Assignment 2. (max. 5 minutes)

- Task 2.1: Go to the website of Marktplaats (www.marktplaats.nl).
  - Click on the link 'Uitgebreid zoeken.'
- Task 2.2: Complete the fields using the information given.
- Task 2.3: Execute the search function and select a result.
  - Perform the search.
  - Open the third search result.
- Task 2.4: Save the logo of Markplaats in the upper left corner on the desktop of the computer.

Formal skill assignments

Assignment 3. (max. 8 minutes)

- Task 3.1: Go to the website of the ANWB (www.anwb.nl).
  - Follow the options Car / Sell / Selling Occasion.
  - Choose the option: 'Selling my car via Auto Trader.'
- Task 3.2: In both windows, go to the homepage of the site opened.
  - Go to the homepage of the Autotrader website in the new window.
  - Go to the homepage of the ANWB in the old window.
- Task 3.3: Perform a search on the ANWB website with keyword 'beach'.
- Open the first search result.
- Open the second search result.

Assignment 4. (max. 8 minutes)

- Task 4.1: Find the addresses of the following three Museums in The Hague. Use the museums' website:
  - Het Mauritshuis (www.mauritshuis.nl/).

- Het Museon (www.museon.nl/).
- Het Letterkundig Museum (www.letterkundigmuseum.nl).

Information skill assignments

Assignment 5. T-mobile (max. 10 minutes)

- Imagine . . . 8 months ago you subscribed to a mobile telephone contract with T-mobile. Now you would like to take advantage of the new T-mobile iPhone offer. Answer the following question, using the T-mobile Web site (www.t-mobile.nl): Is it possible to subscribe to a T-mobile iPhone contract as a continuation of your current subscription?

Assignment 6. Restaurant (max. 10 minutes)

- Imagine . . . You would like to go out for a luxury dinner in Amsterdam next week. You prefer the restaurant with the most Michelin stars. Answer the following question using a search engine (e.g., Google or the Web site you use at home): What restaurant would you go to?

Assignment 7. Go boating (max. 12 minutes)

- Imagine . . . You bought a rubber boat of 9.84 feet in length. You can reach a maximum speed of 17 mph with this boat. Answer the following question using a search engine (e.g., Google or the Web site you use at home): Are you allowed to use this boat in public waters like the Maas?

Strategic skill assignments

Assignment 8. Shopping in Amsterdam (max. 15 minutes)

- Imagine . . . You and your partner take your son out for shopping in Amsterdam. You would like to go by car, but the ride would cost you 4 Euros for every 12,4 miles, not counting 4 hours of parking in the centre of Amsterdam. Because your son has a train pass (which might offer possibilities for you too), you wonder if this option would be cheaper then using the car. Use the Internet to figure out which option is cheaper.

Assignment 9. Travelling (max. 25 minutes)

- Imagine . . . From March the 7th through the13th of next year you are going on a trip to London with your partner. You would like to book two tickets from a nearby airport (in the Netherlands or just across the border) and a hotel in the centre of London.
  Find out how much this would cost using the Internet, aiming to identify the cheapest options. Consider flight, hotel, and travel expenses to and from the airport in London.