



DIGITAL EDUCATION AND LEARNING



Digital Skills

Key to the Smart Society

Second Edition

Alexander van Deursen
Jan van Dijk

palgrave
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Digital Education and Learning

Series Editor

Michael Thomas, Liverpool John Moores University, Merseyside, UK

Much has been written during the first decade of the new millennium about the potential of digital technologies to produce a transformation of education. Digital technologies are portrayed as tools that will enhance learner collaboration and motivation and develop new multimodal literacy skills. Accompanying this has been the move from understanding literacy on the cognitive level to an appreciation of the sociocultural forces shaping learner development. Responding to these claims, the Digital Education and Learning Series explores the pedagogical potential and realities of digital technologies in a wide range of disciplinary contexts across the educational spectrum both in and outside of class. Focusing on local and global perspectives, the series responds to the shifting landscape of education, the way digital technologies are being used in different educational and cultural contexts, and examines the differences that lie behind the generalizations of the digital age. Incorporating cutting edge volumes with theoretical perspectives and case studies (single authored and edited collections), the series provides an accessible and valuable resource for academic researchers, teacher trainers, administrators and students interested in interdisciplinary studies of education and new and emerging technologies.

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ISSN 2753-0744

ISSN 2753-0752 (electronic)

Digital Education and Learning

ISBN 978-1-349-96161-0

ISBN 978-1-349-96162-7 (eBook)

<https://doi.org/10.1057/978-1-349-96162-7>

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ABOUT THIS BOOK

We are experiencing a transformative moment in human history. The world around us is becoming not just digital but intelligent, powered by artificial intelligence, interconnected through the Internet of Things, and guided by algorithms that shape what we see, think, and do. From the phones in our hands to the sensors in our devices, digital media now weave through every aspect of our daily lives. They influence how we learn, work, communicate, and even understand ourselves and others. In this complex media landscape, digital skills are central to participation, opportunity, and empowerment. And yet, while digital media advance at breathtaking speed, the human capacity to use them effectively often struggles to keep pace. This book begins with the question of what it means to be digitally skilled in a smart society. From this question unfolds a journey through seven essential digital skills. Three of these skills relate to mastering the medium itself, how we choose, operate, and navigate digital media. Four focus on mastering content, how we locate and evaluate, communicate, create, and strategically apply online content.

Chapter 1 introduces the comprehensive digital skill framework and traces the evolution through history, from oral societies to the early days of computing and the Web to today's algorithmic, data-driven society. It shows how digital skills have accumulated and expanded, and why they are now indispensable for everyone, regardless of background or profession.

Building on this, Chapter 2 explores how the seven skills apply to internet and intelligent media that define our era: online platforms, social

media, AI-driven platforms, and smart connected devices. This is where digital skills meet the world of automation, data analytics, and personalization. It is the heart of the book, bridging scholarly insight and practical relevance.

Chapter 3 turns theory into evidence. Drawing on empirical data from survey research and task-based performance tests, it examines the actual levels of digital skills across populational groups. Who has the skills needed to benefit from internet and connected intelligent media, and who is being left behind? The findings expose gaps across age, education levels, income groups, traditional literacy, and social capital, offering a sobering picture of digital inequality that persists beneath the surface of connectivity.

Chapter 4 widens the lens. Digital skills do not exist in isolation; they are embedded in a broader social context. This chapter investigates how digital inequalities intersect with traditional forms of inequality and shape economic, educational, political, social, cultural, spatial, and institutional participation. It asks: Are disparities in digital skills simply a reflection of existing divides, or do they represent a new and growing layer of social inequality? How do AI, automation, and algorithmic bias further complicate these patterns?

The second half of the book turns toward solutions. Chapters 5 and 6 explore two complementary strategies for addressing and improving digital skills. The first considers the design of digital media and platform interfaces to be more inclusive, transparent, and user-friendly. The second focuses on people: education, training, and lifelong learning as pathways to digital empowerment. From classrooms to workplaces and from self-directed learning to peer collaboration, these chapters show how digital skills can be cultivated across life stages and contexts. They also highlight the importance of reaching those most often excluded from digital progress: older adults, people with disabilities, migrants, and individuals with limited literacy.

Finally, Chapter 7 looks ahead and brings together insights and implications for policy, outlining how governments, institutions, and industries can foster digitally skilled societies. It identifies strategies and partnerships that can ensure that digital transformation becomes a force for inclusion rather than division.

This book can be considered as both a roadmap and a call to action. It invites readers—scholars, students, practitioners, educators, developers, and policymakers—to rethink what it means to be skilled in a world

shaped by internet and intelligent media. It argues that digital skills are not a fixed checklist of technical skills, but the capacity to think critically and act strategically and meaningfully with and through digital media. In a world where every innovation reshapes what is asked of and what it means to be humans, developing digital skills is more than just preparation for the future. It is the key to shaping it.

PRAISE FOR *DIGITAL SKILLS*

“Van Deursen and Van Dijk are widely published and influential scholars of information and communication technology, power, network society, and digital divides. Here they follow up their 2014 book *Digital Skills: Unlocking the Information Society* a decade later, with *Digital Skills: Key to a Smart Society*. While digital media and technologies, increasingly including AI, are pervasive, appropriate skills are not, representing another dimension of the digital divide. Thus this interdisciplinary book provides reviews, analyses, and measures of required and appropriate skills for equitable, responsible, effective, and participatory digital media use, from work to entertainment, economics to creativity, and health to relationships. Van Duersen and Van Dijk discuss implications for interventions, accessibility, and interface design; strategies for education and informal learning by students, adults, and workers; and policy implications that consider the multidimensional nature of the digital media environment. This exciting, detailed, and thoroughly grounded book should be required reading in all disciplines related to the contemporary digital technology world.”

—Ronald Rice, *Distinguished Professor, Arthur N. Rupe Endowed Professor, Social Effects of Mass Communication*

“This excellent book combines wisdom from years of innovative research with insightful solutions to address the digital skills so critical for participation in society today, especially in an age of AI. With useful

concepts and measures for future research, the authors also offer nuanced, evidence-based recommendations for human-centered design, education, and public policy, targeting diverse needs for different populations. This is a must-read for scholarship and practice.”

—Karen Mossberger, *Professor Emerita, School of Public Affairs (SPA)*

“Digital skills determine who can participate, and who is left behind, in an increasingly digital society. This book shows how digital skills not only reflect social inequalities but actively amplify them, especially in the age of AI, where people no longer simply use tools but interact with agents. Rejecting one-size-fits-all solutions, it argues for targeted, context-sensitive interventions and sustained collaboration between researchers, practitioners, and policymakers. A must-read for anyone committed to inclusive and meaningful digital participation.”

—Leen d’Haenens, *Professor, Institute for Media Studies (IMS)*

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ABOUT THE AUTHORS

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Prof. Dr. Jan van Dijk is a Dutch emeritus professor of communication science and the sociology of the information society at the University of Twente in The Netherlands, where he continues to be active in research and teaching. He is internationally recognized for his pioneering work on the digital divide, the social aspects of digital media, and digital democracy. Van Dijk's influential books include *The Network Society*, *The Deepening Divide*, *Digital Democracy*, *Digital Skills*, and *The Digital Divide*, which explore how unequal access to technology and digital

skills reinforces broader social inequalities. Throughout his career, he has advised various governments and the European Commission on information and communication technology policy and remains a leading voice in understanding the societal impacts of digitalization.

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Introduction

1.1 DIGITAL INEQUALITY AND THE APPROPRIATION OF TECHNOLOGY

In the 1990s, researchers and policymakers began to draw attention to what became known as the *digital divide*: the gap between those who had access to computers and the internet and those who did not. At the time, simply having an internet connection was assumed to unlock numerous social and economic opportunities, whereas a lack of access was understood to place individuals at a substantial disadvantage. However, by the early 2000s, conversations surrounding the digital divide began to fade from the political spotlight. As internet access and device ownership expanded rapidly, especially in developed countries, many assumed that the core issue had been addressed. With the majority of people connected in some form, policymakers began treating the digital divide as a problem of the past.

The initial framing of the digital divide had a key limitation: it presented internet access as a binary condition and suggested a stark separation between two opposing groups (“haves” versus “have nots”). In reality, people engage with technology in very different ways. Some individuals use digital tools fluently and frequently across all aspects of daily life, whereas others use them only occasionally, superficially, or not at all. Recognizing this, scholars have increasingly moved away from the term digital divide in favor of *digital inequality*, a concept that better

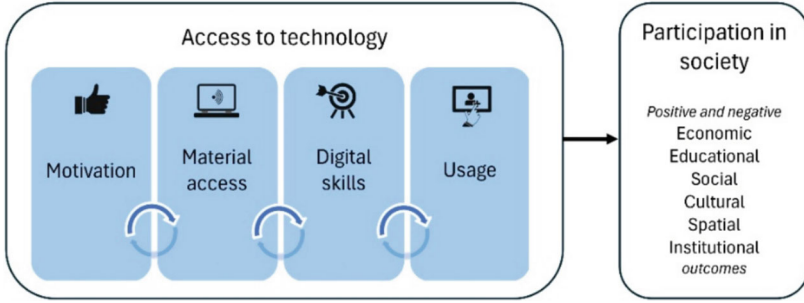


Fig. 1.1 Process of technology appropriation (after Van Dijk, 2005)

captures the nuanced spectrum of differences in how people use technology. Research over the past two decades has reignited concerns about these disparities, as they are aligned with existing social inequalities related to income, education, age, and race (Scheerder et al., 2017). In response, many national and international policy agendas now emphasize the importance of *digital inclusion* and focus not only on physical access to the internet, but also on improving digital skills or encouraging broad and beneficial use.

To illustrate the dimensions along which digital inequalities occur, we draw on the Resources and Appropriation Theory (Van Dijk, 2005, 2020). Chapter 4 discusses this macro-structural theory in detail. In general, the theory posits that categorical inequalities within society lead to an unequal distribution of resources, which in turn results in unequal access to technology. At the heart of the theory is the process of technology appropriation, which identifies four types of access with a successive and cumulative nature: motivational, material, digital skill, and usage access. See Fig. 1.1.

Motivational Access

Motivation is the first stage in the process of appropriating new technologies. It is not only crucial for the decision to purchase or start using technology but also influences the willingness to become familiar with it and invest effort in developing the necessary skills. In the 1980s and the 1990s, phenomena such as computer anxiety and technophobia were quite common. Fear of new technologies affected a significant portion of

the population, and critical or negative views of their impact on individuals and society were widespread. In the second half of the 1990s, driven by the breakthrough of the World Wide Web, these fears began to subside. By the early 2000s, the internet established itself as a central feature of modern culture. Within the following decades, it became a familiar part of everyday life in developed nations. Even older adults, who often perceive the internet as difficult, are increasingly motivated to use digital media, recognizing its many benefits in their daily lives. Unfortunately, the rise of artificial intelligence (AI) seems to reinstate computer anxiety, as AI applications are often perceived as complex, opaque “black boxes” that generate uncertainty. In popular media, public figures frequently voice concerns that AI can spiral beyond human control and has devastating consequences for individuals and society. Consequently, motivation levels may diverge across different segments of the population, influencing both the use of technology and the process of becoming familiar with it. This, in turn, affects the next stages of appropriation: acquiring digital media depends on motivation, and developing digital skills requires sustained effort and persistence. When using digital media feels easy and helpful in meeting people’s goals, motivation grows, creating a cycle of greater confidence and engagement.

Material Access

The second stage of appropriation, gaining material access, became the dominant focus of public opinion and policy discourse in the late 1990s and the early 2000s. With widespread campaigns to provide computers and internet connectivity to schools, libraries, and low-income households, many policymakers began to believe that the digital divide was on the verge of being resolved. This perception gained traction particularly after computer and internet ownership rates in many high-income countries surpassed 90 percent of the population. However, physical access is still far from universal as worldwide rates remain below 70 percent, ranging from 98 percent in Northern Europe to 29 percent in Eastern Africa (Statista, 2025). More importantly, this reductionist view of the digital divide neglects the other forms of access shown in Fig. 1.1 (motivation, digital skills, and usage) and overlooks that material access extends beyond mere physical connection to include the quality, functionality, and diversity of digital devices, as well as the types of software and connectivity that people use. These material access factors influence the

depth and quality of digital engagement and, in turn, the outcomes that people derive (Van Deursen & Van Dijk, 2019). The ability to afford the costs associated with access to high-quality material, such as faster internet connections, updated hardware, premium software, and technical support, varies significantly across socioeconomic groups. Consequently, even among those with basic access, their actual experience of using digital media differs substantially. Furthermore, AI and Internet of Things (IoT) applications and devices have introduced new forms of material access inequality. New advanced technologies tend to be adopted first by higher-income populations, expanding material access differences, even as overall device ownership grows.

Digital Skills

The third stage of technology appropriation involves the digital skills necessary to master them. Various related terms, such as *digital literacy*, *media literacy*, *digital competence* (or combinations like *digital literacy skills*), are used in academic and policy discourse. *Literacy* is the most widely used in related compound nouns. In its classical form, “a literate person is able to read, write, and understand his or her native language and express a simple thought in writing” (Bawden, 2001, p. 220). Over time, this definition has expanded to encompass the wide range of abilities required to function effectively in information-rich environments. When the cultural and contextual dimensions of information use are considered, literacy assumes a deeper and more socially embedded meaning. De Castell and Luke (1988, p. 159), for example, define literacy as “having mastery over the process by means of which culturally significant information is coded.” This view emphasizes that literacy is not merely a technical skill but also a means of participating in a broader social and cultural sense-making system. Building on this, Anttiroiko et al. (2001) distinguish between two dimensions: *knowledge* and *skills*. Knowledge refers to an individual’s understanding of how the world is structured and how systems operate, whereas skills involve the practical application of this knowledge, consciously or unconsciously, in everyday life. From this perspective, knowledge provides a conceptual foundation, whereas skills enable individuals to navigate and act effectively in digital environments. In our view, skills capture the interactive, task-oriented, and procedural behaviors that characterize effective digital media use more

accurately. Digital media use is not a passive activity; it requires individuals to navigate complex digital interfaces, interact with applications, communicate with others in real time, evaluate vast quantities of information or collected data, and perform tasks ranging from simple searches to financial transactions and content creation. A possible exception are smart devices equipped with autonomous or semi-autonomous functions. These technologies can update software, adjust settings, filter content, and implement personalized adjustments with minimal or no user intervention. Such automation may create the deceptive impression that digital skills are becoming less essential as devices increasingly manage tasks “in the background” and make decisions on our behalf (Van Deursen & Mossberger, 2018). However, as we will show later in this book, the absence of skills to operate these devices and interpret and use the data they generate limits the extent to which their advantages can be realized. Their use still stands in contrast to the relatively passive forms of media engagement, such as reading books or watching television, which rely primarily on cognitive and interpretive skills. This book identifies and focuses on seven distinct but interrelated types of skills that serve as the core analytical framework for the following chapters: strategic media choice, operational, formal, information, communication, content creation, and strategic media use skills. Each of these skills contributes to an individual’s overall capacity to engage meaningfully and effectively with digital media.

Usage Access

The fourth and final stage of technology appropriation is *usage*, which refers to how individuals engage with digital media in their daily lives. Patterns of digital media use can vary widely, encompassing dimensions such as frequency and duration of use, type and diversity of the activities performed, and level of engagement (e.g., from passive consumption to active productive contributions). It is important to recognize that not all media use is conscious or active. In today’s connected and intelligent media landscape, usage often involves automated or ambient interactions, such as personalized recommendations from streaming platforms and social media feeds, where AI determines which posts appear first, navigation apps that automatically reroute based on real-time traffic, smart home devices that continuously collect data, and fitness trackers that synchronize in the background.

Outcomes

The four stages of appropriation interact in complex and dynamic ways, ultimately leading to positive or negative outcomes of digital media use. These outcomes can enhance or diminish a person's position in society or access to resources, as captured by the term digital inequality. For example, a person might increase their financial resources by selling products online or lose them through online fraud, expand professional opportunities through networking on social platforms or damage their reputation with an ill-considered post, use AI tutors to learn new languages or develop unnatural speech patterns if the AI's training data is flawed, and become healthier by following a workout program recommended by a smartwatch or develop anxiety from obsessive health monitoring. As resources also influence each stage of access, traditional forms of inequality are closely intertwined with inequalities in digital media use, thus creating a recursive cycle of inequality. Economic resources are needed to purchase a tablet with internet access, social resources to receive support in using it, and cultural resources to navigate the overwhelming amount of online information. Individuals who fall behind in terms of motivation, material access, digital skills, and usage are likely to be disadvantaged in every societal domain (whether recognized or not). This is further discussed in Chap. 4.

1.2 DIGITAL SKILLS IN THE MEDIA LANDSCAPE OF SMART SOCIETIES

The central message of this book is that digital skills are fundamental to the technology appropriation process. They enable the conversion of digital media use into meaningful and beneficial outcomes related to living, working, studying, and engaging in leisure activities. Digital skills act as a gateway to more complex, beneficial, and empowering forms of media use and shape how, why, and to what extent digital media are used. For example, individuals with only basic skills may limit their media use to routine tasks, such as checking emails, browsing news, or consuming entertainment. In contrast, users with more advanced skills, such as information evaluation, content creation, and strategic decision-making, are more likely to engage in high-value activities such as online learning, political participation, entrepreneurship, or professional networking. Furthermore, digital skills are necessary for active media use

and maintaining agency in increasingly automated digital environments. Users with greater digital skills are more likely to recognize algorithmic bias, manage data flows, and configure intelligent systems to support decision-making processes to better serve their needs. In contrast, those with lower digital skills may become passive recipients of AI-driven decisions, potentially reinforcing their dependence or making misinformed choices. The importance of skills in such developments is reflected in the title of this book: *Digital skills as key to a smart society*.

A smart society (also referred to as an intelligent society, super-smart society, or Society 5.0) represents the vision of a society that harnesses digital technologies to enhance the quality of life across all areas. In this vision, data, AI, and smart technologies are embedded in infrastructure and services to support automated, adaptive, and intelligent decision-making. Beyond human information processing, such as searching for, interpreting, and communicating data, these systems can augment, guide, or replace human judgment in certain cases. AI can detect patterns and predict trends at a scale and speed beyond human capacity, whereas certain autonomous systems can make operational decisions without direct human intervention. The skills to use AI tools in ways that foster productive human-AI collaboration ensure that decision-making processes are not only more efficient but also align with the desired outcomes. Human-AI interaction requires advanced digital skills; individuals must understand how information is produced, curated, and potentially manipulated within algorithmic systems while exercising critical and ethical judgment regarding the appropriate scope of AI automation.

Given the complexity of a smart society, the necessary skills do not emerge spontaneously but require deliberate cultivation. Experience may contribute to the development of basic operational skills, but it does not adequately support the acquisition of more advanced information, communication, content creation, or strategic media use skills. These skills must be developed before meaningful engagement with digital media can begin. Once used, these skills must be continuously adapted to the requirements of each medium. For instance, searching for information in a library differs significantly from using a search engine or requesting information through conversational AI tools. As digital media become increasingly embedded in everyday life, differences in digital skills are magnified, reflecting and reinforcing existing social, economic, and cultural inequalities. The uneven distribution across demographic and

social groups can create unequal opportunities for education, employment, civic participation, and social engagement, further entrenching disparities in smart societies.

With growing differences in digital skills and digital media use, scientific research has brought the issue of digital inequality back into focus. Many national and international policy agendas emphasize the importance of *digital inclusion*. The term digital inclusion carries a more positive connotation than digital divide or digital inequality and highlights the importance of participation in a digital society. Similar to digital divide, this term should not be interpreted as a simple binary of inclusion or exclusion. Beyond inequalities in the ownership of devices and connections, the emphasis has shifted toward improving digital skills and encouraging use of the internet. Importantly, digital inclusion policy initiatives tend to frame the internet primarily in terms of websites and social media platforms. While these aspects are undeniably important, researchers and policymakers must recognize that society is experiencing rapid technological development. The media landscape in which we operate is becoming increasingly complex. Figure 1.2 simplifies the underlying layers of media to show the complexity and highlight the aspects that digital skills must address.

In Fig. 1.2, we distinguish between input, structure and texture, form, and media. Media refer to the material or method used to convey meaningful formats and platforms (forms). Formats and platforms are built on structure and texture that define the rules by which input is organized before being presented in a form. The bottom layers represent an analog media landscape and entail:

- *Input*: Text, numbers, audio, or video.
- *Structure and texture*: Rules that organize input, such as grammar for text or formulas for numbers.
- *Form*: Transmission of meaningful formats, such as speech, photographs, graphs, films, or written articles.
- *Media*: The way formats are shared, such as through television, radio, newspapers, or magazines.

The upper layers represent digital media. From the inside out:

- *Input*: Digits, pixels, and other raw digital data.

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