

Human Factors
& Aging Series

Designing Training and Instructional Programs for Older Adults

Sara J. Czaja
Joseph Sharit



CRC Press
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Designing Training and Instructional Programs for Older Adults

Human Factors & Aging Series

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Preface

Our goal in writing this book was to draw on an understanding of today's older adults—including their demographics, their needs, the challenges facing them, and a realistic appraisal of their abilities and limitations—as a basis for how current knowledge about training and instructional design should be shaped and applied to best accommodate this population of learners. With rapidly emerging technologies, including those in the domains of health management and the work sector, as well as the many products that are continually pervading the consumer market that are capable of positively affecting the quality of life of many older adults, understanding the barriers that older people may face in learning to use these resources is imperative.

The literature on training and instructional design is not only extensive but has a relatively long history. Many of the developments in these areas were driven by the desire to improve learning in our educational institutions and the training of our military and industrial personnel. One of the key challenges in writing this book was to distill knowledge from these vast areas that would be relevant to the problem of training and instructional design for older adults. This was necessary in part because there is no theory of training and instruction that is directed solely toward this population of learners. There are stretches throughout this book where it may seem that the older learner has been neglected as we examine in some depth topics fundamental to or related to training and instruction. However, we have tried as much as possible to ensure that these discussions always relate back to the primary subject of this book, the older learner.

We should also comment about the title of this book as, in principle, there is a distinction between training and instruction. The former is usually associated with more formal programs directed at ensuring that people acquire specific skills, whereas the latter has a more general connotation that can encompass household devices and personal or classroom learning. At times throughout the book the context may make it apparent that the discussion is likely addressing training rather than instruction; at other times, it may be the other way around. For the

most part, the terms “training” and “instruction” are used interchangeably. This is because when the focus is on the more general concept of “learning something” these distinctions become blurred, as training and instruction both constitute ways of imparting knowledge and skills to people; thus, the more underlying issue is to understand how learning occurs. With older adults the challenge then becomes understanding how their various limitations (which could arise from normal age-related considerations such as changes in cognitive abilities and motivation) as well as their strengths (such as those that may derive from their lifelong experiences) can affect their dispositions toward and capabilities for learning. Also, as noted or implied throughout the book, designing training and instructional programs for older adults can be especially challenging, as older adults are very heterogeneous and vary tremendously in terms of their backgrounds, skills, knowledge, and abilities.

This book was written with a number of audiences in mind. Given the various consequences that the design of training and instructional programs can have for older adults, this book was written with designers in mind. Each chapter begins with the assumption that the reader does not have extensive knowledge about the subject matter contained therein, and concise recommendations are provided at the conclusion of many of the chapters that can have direct implications for the design of instructional programs and for those individuals who are responsible for the training and performance of older people. However, we feel this book will also be of value to academics, including students at both the undergraduate and graduate levels, who have an interest in the areas of aging, cognition, instruction, and performance, as they may have the opportunity to see these topics tackled from a different perspective. Although the book is not littered with references to scientific works as one usually encounters in the more formal academic literature, a number of references are included and compiled at the end of the book. In addition, works that were not explicitly referred to are listed in the recommended reading sections at the end of each chapter. Overall, we strove to produce a book that would prove readable and enlightening across a wide spectrum of readers.

Finally, many of our insights in this area have been culled from our experiences at CREATE, the Center for Research and Education on Aging and Technology Enhancement, which is sponsored by the National Institutes of Health (National Institute on Aging) and comprises a multidisciplinary and multisite center based at the University of Miami’s Miller School of Medicine. CREATE addresses older adult interactions with various forms of technology in the domains of health, work, and the home, and has provided a wealth of opportunities for investigating issues related to training and instruction of older adults. We extend our

deepest appreciation to all the researchers, students, and staff who have been involved in CREATE as they have contributed immensely to our ability to write this book.

About the authors

Sara J. Czaja, PhD, received her PhD from the State University of New York at Buffalo. She is a Leonard M. Miller Professor in the Department of Psychiatry and Behavioral Sciences, and a Professor of Industrial Engineering at the University of Miami. She is also the scientific director of the Center on Aging at the University of Miami and the director of the Center on Research and Education for Aging and Technology Enhancement (CREATE). CREATE is a multisite center funded by the National Institute on Aging/National Institutes of Health that involves the University of Miami, Georgia Institute of Technology, and Florida State University. The focus of CREATE is on making technology more accessible, useful, and usable for older adults. Dr. Czaja has extensive experience in aging research and a long commitment to developing strategies to improve the quality of life for older adults. Her research interests include aging and cognition, aging and healthcare access, family caregiving, aging and technology, and functional assessment. She has published extensively in these areas. She is a fellow of the American Psychological Association, the Human Factors and Ergonomics Society, and the Gerontological Society of America. She recently served as a member of the National Research Council/National Academy of Sciences Committee on Human Factors and Home Health Care. She is currently a member of the Board on Human Systems Integration for the National Research Council/National Academy of Sciences.

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of domain applications. He is also a research scientist with the Miami Veterans Administration Medical Center, where he is affiliated with the GRECC (Geriatric Research Education and Clinical Center) Laboratory for E-Learning and Multimedia Research. His research interests focus on human-machine interaction, including the assessment of older adult interaction with various technologies. This research is strongly influenced by models of human information processing and the use of human factors approaches such as task analysis and simulation methods as a basis for assessing performance with the aim of developing training and design interventions that can enhance older adult task performance and decision making. His research also addresses human error and system safety and the development of training systems.

Introduction and overview

Emerging demographic and societal trends underscore the importance of the topic of training and instructional design for older adults. These trends include: the aging of the population, rapid developments in technology and the diffusion of technology into most settings, the migration of healthcare practices from professional facilities to the home, changes in work processes and organizations, and changes in instructional practices and technologies. Generally, people of all ages, including older adults, must engage in what is commonly referred to as *life-long learning* in order to use new products and devices and perform tasks at work (e.g., use software applications, job procedures), at home (e.g., medical devices, communication and entertainment products), in service environments (e.g., automatic teller machines, self-service ticket kiosks at airports), and in instructional environments (e.g., online learning programs).

Most people rely on some form of training or instruction when they need to learn something new or brush up on a previously learned skill. This training may occur formally through attendance at a training program or individual training sessions, the use of online software, an instruction manual, or informally with help from a colleague, family member, or friend. The overall goal of engaging in these activities is to ensure that the learners or trainees have a meaningful learning experience such that they can use the material successfully at a later point in time or transfer what they learned to a new situation. Generally, effective training and instructional programs lead to competence in a particular skill area as well as higher motivation, learner satisfaction, and increased feelings of accomplishment. In the workplace, good training design has also been linked to increased productivity, fewer errors, and improvements in safety.

Designing training and instructional programs to promote meaningful learning has been a long-standing challenge, especially for older adults. As discussed in the next chapter, older adults are a very heterogeneous group on a multitude of dimensions including skills and abilities, prior learning experiences, and motivation. Many older people also experience anxiety in new learning situations or have a lack of confidence about their ability to learn something new. However, this does not imply that they cannot learn new skills. Data from our research examining technology-based tasks, and from many others,

presents a fairly positive picture in terms of the continued learning potential of older adults. Older people may take longer or need more feedback or training support than younger people, however, they are able to learn (Chapter 3).

Unfortunately, because of prevailing stereotypes about aging (you can't teach an old dog new tricks), older adults are often bypassed with respect to training opportunities or are offered training programs that are not tailored to meet their preferences and needs. The goals of this book are to present a state-of-the-science summary of the topic of training and instructional design for older adults and, where possible, to present some basic principles and guidelines regarding best practices for designing training and instructional programs for older people. We begin by discussing emerging demographic and societal trends that are relevant to aging, learning, and training, and substantiate the fact that lifelong learning is an important educational reality.

1.1 *Demographic trends*

One of the most important demographic trends challenging the government, businesses, healthcare, families, and society is the aging of the population. In 2009, people aged 65 and over in the United States accounted for about 13% of the population and are estimated to represent about 20% of the population by 2030 (Figure 1.1). The older population itself is also getting older. The number of people aged 85+ years (the

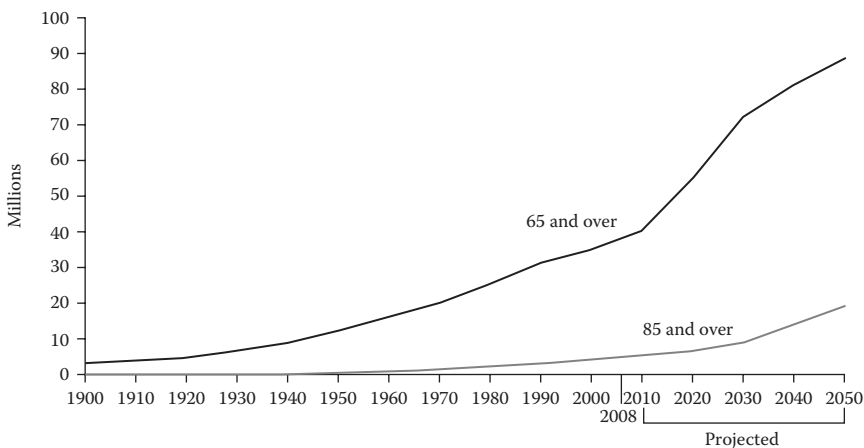


Figure 1.1 Percentage U.S. population age 65 and over. (From Federal Interagency Forum on Aging-Related Statistics, 2010.)

oldest old) was about 5.7 million in 2009 and is expected to increase to about 6.6 million by 2020 (Administration on Aging, 2011). The number of centenarians is also increasing. These trends are paralleled worldwide. In 2006, almost 500 million people worldwide were 65 and older, and that number will increase to about 1 billion by 2030 (National Institute on Aging, 2007). As the population ages so does the population of older adults who need or desire to participate in some form of training or instructional program. Generally, an older learner refers to someone aged 65 or older; however, in some settings such as the workplace, it can refer to people aged 55 and older.

Aging is typically associated with changes in cognition, perception, mobility, and health status. These changes are more pronounced among the oldest old. However, as we discuss in Chapter 2, the population of older adults is very diverse and older adults vary tremendously in educational and health status, literacy, culture/ethnicity, skills and abilities, and of course life experiences. The majority of older adults are also more active than those in previous generations and live independently for longer periods of time. They are also highly motivated to remain productive and engage in learning new skills or new hobbies. For example, recent surveys (e.g., AARP, 2010) indicated that a large majority of older people would like to or need to remain in the workforce on a full or part-time basis. Many are also beginning second careers as they face retirement from their primary occupations. Both scenarios require investments in job and career training programs. In addition, many seniors participate in educational programs to pursue personal interests such as learning a new language, cooking, basic computer or Internet skills, or a multitude of other topics.

All of these issues have tremendous implications for the design of training and instructional programs. For example, age-related changes in cognition have implications for the design of practice protocols and pacing of training (Chapter 3). The demographic diversity of the population has implications for structuring of group learning activities, as do differences in skill levels and literacy. Many of the current generation of older adults also have limited technology experience, which is highly significant given the increased reliance on e-learning. The overarching principle is that older learners vary from younger learners in their needs and preferences, and for them to successfully engage in meaningful learning these needs and preferences must be accounted for in the design of training and instructional programs. At the same time, it is important to recognize that for the most part improving the usability of training and instructional programs for older adults will likely result in improvements of these programs for people of most ages.

1.2 Societal trends

1.2.1 The technology explosion

Coupled with the aging of the population, there are a number of important societal trends that highlight the importance of well-designed training and instructional programs for older adults. One highly significant trend is the technology explosion. Use of technology is pervasive and has become an integral component of work, education, communication, routine services, and entertainment. For example, most workers, including those in non-service sector occupations, use some form of technology in the daily performance of their jobs. Technology is reshaping production processes and the task content of jobs, as well as changing the skill requirements of jobs. Workplace technologies are also evolving and workers need to upgrade their skills and knowledge continually to remain competitive in the workplace. Use of automatic teller machines, interactive telephone-based menu systems, service kiosks, intelligent transportation systems, and “smart” mobile devices is also quite common. In many residences, common home tasks such as using security and entertainment systems and controlling temperature also require learning to use some type of technology.

Technology devices are also becoming more integrated and providing faster and more powerful interactive services. Large and increasing numbers of people have almost immediate direct access to a wide array of information sources and services. Internet use in the United States has become pervasive: 78% of adults age 18+ use the Internet (Figure 1.2) including 42% of those aged 65 and older. In addition, 85% of Americans aged 18 and over own a cell phone including 68% of older adults (Pew Internet & American Life Report, 2011a), and half of adult cell phone owners have apps on their phones for a wide variety of information and functions (Purcell, 2011). Communication via e-mail and social network sites is also quite prevalent. In fact, one of the primary reasons older adults use the Internet is to use e-mail. E-books and e-readers such as Kindles or Nooks are also becoming popular.

Technology is also being increasingly used within the healthcare arena for service delivery, in-home monitoring, interactive communication (e.g., between patient and physician), transfer of health information, and peer support. For example, there are myriad health websites available that provide consumers with access to health information and services and the ability to buy medical supplies, equipment, and even medications or supplements. To use these health websites consumers need to learn numerous skills such as basic mouse and window skills, how to search for relevant websites, filter search results, and navigate within websites.

Finally, technology is influencing the implementation and format of training and instructional programs. *E-learning*, which refers to online or computer-based instruction (Chapter 10), is quickly emerging as a

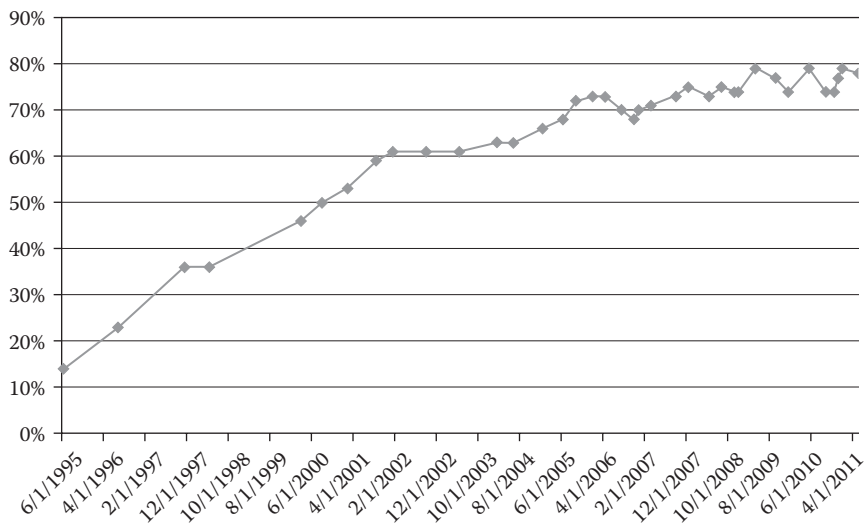


Figure 1.2 Percentage of adults in the United States online, 1995–2011. (From Pew Internet & American Life Project, 2011b, on Internet adoption.)

preferred training method for a variety of situations, such as worker training or learning to use new technologies such as mobile phone devices. Online courses sponsored by organizations such as AARP, SeniorNet, or universities are also quite common. To date there has only been limited research examining whether mature learners can learn effectively via e-learning formats. Also, most e-learning programs involve multimedia formats (audio, text, video, and animation) that may prove challenging for older learners (Chapter 10). This is another fruitful area for investigation.

Overall, technology is used in practically every aspect of everyday living. This technology explosion mandates that to function independently and successfully engage in routine activities, older adults need to interact with some form of technology on a routine basis. This implies that they will need to engage continually in learning and training to operate and maintain technology systems and to keep abreast with existing and emerging technology trends.

1.2.2 Trends in healthcare and the workplace

There are also changes occurring within healthcare that result in a tremendous need for training and instruction. For a variety of reasons, healthcare is increasingly occurring in settings such as the home rather than in professional medical settings. Patients and their families are being asked to assume an increasing role in the management of their own health

and are expected to perform a range of healthcare tasks and interact with a vast array of medical devices and technologies within their home and community settings. This implies a great deal of learning on the part of the patient and family caregivers.

As noted, part of this change in healthcare delivery is a focus on technology. Technology applications are commonly used within home settings to monitor a patient's physical, emotional, or cognitive functioning. With the rapid introduction of electronic medical records (EMRs), many of which have patient portals, consumers also have access to varying degrees of their medical information and are able to perform tasks such as communicating electronically with providers, scheduling appointments, renewing prescriptions, and accessing health management information through links to medical websites. Furthermore, there is an increasing trend to mandate that consumers enroll in benefits and insurance programs through the Internet. The use of all of these systems implies that people not only have to learn to use these technologies, but also new ways of performing tasks.

These changes in healthcare have broad implications for older adults as they are more likely to need and engage in healthcare activities. Generally, the prevalence of chronic conditions or illnesses such as dementia, diabetes, heart disease, or stroke increases with age, and consequently older adults (especially the oldest old) are more likely to need some form of care or assistance. Family members, many of whom are also older adults, are often the primary and preferred source of help for elders with an illness or chronic condition. It is not uncommon for these older caregivers to have a chronic condition also. Having an illness or disability or even the stress from caregiving can have an impact on one's capacity to learn. Furthermore, many older people live alone and have limited access to support. These issues present challenges with respect to developing effective training strategies for use and maintenance of medical devices and technologies and performance of healthcare tasks.

There are also enormous changes in work environments and organizations and these changes, which are expected to continue in the future, have created new knowledge, skill, and ability requirements for workers. For example, ongoing developments in technology are reshaping production processes and the task content of jobs, as well as changing the skill requirements of jobs. In the future, the rapid pace of technological change and the transition to a knowledge-based economy is going to increase the demand for highly skilled and well-educated workers. We can also anticipate that developments in technology will continue to shape what is produced, how material and labor input are combined to produce it, how work is organized, and the content of work. Again, this means that workers will continually need to upgrade their skills and knowledge to remain competitive in the workplace. Issues of skill obsolescence and training

are especially significant for older workers, as they are less likely to have had exposure to technologies such as the Internet, and data suggest that employers invest less in training older workers than younger workers (Czaja and Sharit, 2009).

Other changes in work environments that have important implications with respect to the need for training include changes in organizational structures that now have a focus on decentralized decision making and collaborative work. In these types of structures workers are often confronted with a need to learn entire processes as opposed to specific jobs, and to be able to communicate effectively with diverse teams of people, usually through the use of technology, who may be in distant locations. The prevalence of home-based work and telecommuting is also increasing. Overall, these organizational and job changes generally require that workers need to receive retraining to keep current with job requirements. These changes also raise important issues with respect to how workers, especially the increasing number of older workers, will receive the training and education needed to update their skills.

1.3 Content of the book and approach to the topic

1.3.1 Overview of the content

As noted earlier in this chapter, the goals of this book are to present a state-of-the-science summary of the topic of training and instructional design for older adults and, where possible, to present some basic principles and guidelines regarding best practices for designing training and instructional programs for older people. It should be pointed out that although there is a substantial literature that focuses on adult cognition and adult learning, there are no distinct theories of instructional design for older people. Instead, there are theories, models, and perspectives concerning how people learn or acquire knowledge and skills, and how instruction should be formulated and delivered. There are also some general guidelines and recommendations for training and instructional programs that have been derived from these theories and from empirical investigations. However, there is no set formula for how training and instructional programs should be designed and delivered for all older adults for all learning situations. Our approach is to summarize current thinking regarding training and instructional design and demonstrate, based on existing knowledge about aging, how these findings can be applied to guide the development of training programs for older people. Of course, we also base our recommendations on the rather limited amount of research that is available on training and older adults.

Given the complexity of the topic, this book covers a wide range of issues. Consistent with the general principles of human factors, we believe

that good design is predicated on understanding the characteristics of the target population. Thus, in Chapter 2 we discuss the demographics and the characteristics of older learners and the relevance of these characteristics to the design of training and instructional programs. Chapter 3 provides an overview of what is generally known about training and older adults, which is followed by a general discussion of learning and skill acquisition and includes information on factors that affect the learning and skill acquisition processes (Chapter 4). Important to the concept of initial learning are the topics of retention of what has been learned outside the training situation and the ability to transfer the learned information to a variety of situations (Chapter 5). Chapter 6 focuses on how factors such as a learner's motivation, anxiety, and fatigue have an impact on initial learning of new material and retention and transfer of that material outside the training situation. A learner's motivation for engaging in training is influenced by a variety of factors and is critically important to learning success. Anxiety about ability to learn new skills and concepts, as well as fatigue, also have a pronounced impact on the learning process as they influence capacity for learning. These issues are particularly important for older adult learners.

The next section of the book begins a discussion of approaches to instructional design. Chapter 7 is a lead-in to this section and presents an introduction to the human information-processing system to provide a framework for the material that follows. This chapter also includes the presentation and discussion of a human information-processing model that is more directly relevant to issues older learners are likely to face. Using this framework, Chapter 8 discusses various methods and approaches to instructional design, with special emphasis given to the need for sequencing instructional material properly and the four-component instructional design (4C/IM) model. This is followed by a chapter that reviews more systems-based approaches to designing instructional programs (Chapter 9). We then examine issues with respect to new training and learning formats such as multimedia and e-learning programs (Chapter 10), followed by a discussion of issues critical to the evaluation programs and methods that can be used for program evaluation (Chapter 11). In Chapter 12 we provide examples within domains such as work and healthcare where training is and will continue to be a critical issue for older adults. We also provide a synthesis of the main themes that emerged throughout the book.

1.3.2 Overview of the approach

Given the enormity of the information on the topics addressed in this book and the vast and continually emerging research in this area, we cannot provide comprehensive coverage of the broad range of issues that are

discussed. Instead, we attempt to summarize what is known and how this applies to the development of training programs for older adults. In some cases, such as e-learning and multimedia formats, we also point out where there is a need for more information. Clearly, this book does not provide a prescription for how to design training and instructional programs for all older adults in all learning situations. Rather, our hope is that we have illustrated the importance of this topic for current and future generations of older people and highlighted some of the issues that need to be considered by designers of training programs and researchers in this area.

Finally, the book is intended for a broad audience from designers of training and instructional programs and managers of older workers, to undergraduate and graduate students who have interests in aging, human factors, cognition, and training. Our approach is to make the information accessible to people with varying backgrounds and not be overly technical. Thus the book is not written as a typical academic text with extensive references to the literature. Our intention was neither to present a high-level research exposition on the topic of training and instruction for older adults, nor to provide an overly simplified presentation of this topic. Rather, our goal was to offer something more middle-ground in nature that refers to the literature, and in some cases may even overview some studies. For those who want more depth regarding the various topics we provide recommendations for further reading. Also, for more explicit guidelines concerning designs of printed words, icons, labels, and similar artifacts for older adults, a number of human factors texts are available (e.g., Fisk et al., 2009; Pak and McLaughlin, 2010) that provide useful information. Similarly, guidelines for designing websites so that older adults can more easily interface with them also address many fundamental human factors issues and can be found in a number of sources (e.g., The National Institute on Aging [<http://www.nia.nih.gov/health/publication/making-your-website-senior-friendly>] and the National Library of Medicine [<http://www.nlm.nih.gov/pubs/checklist.pdf>]).

Recommended reading

- Swezey, R.W. and Llaneras, R.E. (1997). Models in training and instruction. In G. Salvendy (Ed.), *Handbook of Human Factors and Ergonomics*, 2nd ed. New York: John Wiley, 514–577.
- Willis, S. (2004). Technology and learning in current and future older cohorts. In R.W. Pew and S.B. Van Hemel (Eds.), *Technology for Adaptive Aging*. Board on Behavioral, Cognitive, and Sensory Sciences, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academies Press, 209–229.

Characteristics of older adult learners

2.1 Overview

The objectives of this book are focused on understanding issues related to learning and training and ultimately to improved design of training and instructional programs for older adults. Our approach to these issues is based on a human factors approach. The discipline of human factors is concerned with understanding interactions among humans and other elements of a system and applies theory, principles, data, and other methods to design in order to optimize human well-being and overall system performance (Human Factors and Ergonomics Society, 2012). A central tenet of human factors is that the characteristics of user populations must be considered in the design of products, tasks, environments, and programs that people use. Consistent with the human factors approach, in this chapter we provide an overview of some empirical evidence about the characteristics of older adults.

We start with a few important caveats. One is that the definition of *older adults* varies depending on the context of the discussion. For example, within the workplace people aged 55 and older are typically considered *older workers*, whereas in much of the scientific literature those aged 65 and older are considered older adults. Today, given the vast numbers of people who are living into their 80s and 90s and beyond, an important distinction is that between younger older adults, those aged 65–80 years, and those aged 80+. Someone in their 60s or 70s is typically very different from someone in their 80s. There are also important differences in characteristics between those who are 80–89 and those who are 90+ years. These distinctions are becoming extremely important as the number of people living age 90 and above is increasing. Another important caveat is that aging is associated with tremendous heterogeneity and all older people are not alike due to differences in genetics and experiences over the life course. A third important caveat is that aging is associated with plasticity. Older adults can experience improvements and gains in physical, cognitive, and functional performance and can learn new skills. They also bring a wealth of knowledge, skills, and experiences to situations.

2.2 *Demographic profile*

2.2.1 *Age, gender, and ethnicity*

As noted in Chapter 1, not only is the percentage of older adults in the population increasing but also the older population itself is getting older. The current population of people aged 90 and older is about two million and is expected to quadruple over the next few decades. By 2050 people aged 65 and older will represent about 20% of the population and those aged 90+ will represent 2%. These trends are being paralleled in other countries throughout the developed world. The increase in the oldest old will continue to have a significant societal impact on healthcare, retirement and pension systems, and living and family arrangements. People in the later decades are more likely to have disabilities such as arthritis, and more significant vision and hearing impairments. Memory impairments also become more likely with increased age. They are also more likely to have mobility restrictions and live alone with limited informal support. As noted throughout this chapter, these changes have implications for the structure, format, and delivery of training and instructional programs and support materials. For example, structural barriers related to outreach, scheduling, and transportation often impede the ability of older adults to participate in community educational programs. In Chapter 10, we discuss the topic of online learning programs as a potential solution to these issues.

In terms of gender, older women outnumber older men, especially in the later decades. In 2009, there were 22.7 million older women and 16.8 million older men, or a ratio of 135 women for every 100 men. The female-to-male ratio increases with age. For example, for the population aged 90 and over, the number of men per 100 women is about 35 (U.S. Census Bureau, 2011). Most women in this older age group are widowed.

Consistent with demographic changes in the U.S. population as a whole, the older population is becoming more ethnically diverse. The greatest growth will be seen among Hispanic persons, followed by non-Hispanic blacks. Currently, individuals from ethnic minority groups are less likely to own or use technologies such as computers. This has vast implications for the design of training and instructional programs. One obvious implication is language. For example, currently many older Hispanic adults have limited fluency in English; thus, to ensure that training and instructional programs are accessible to this population they need to be available in Spanish. The same is true for other ethnic groups. In addition, it is important for instructors to have some background in the cultural/ethnic mores of minority populations. Also, although use of the Internet is increasing among older adults, older minority adults are less likely to have access to the Internet and technology skills. This implies that