Part I: Introduction to Home Modifications
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Part II Evaluation and Assessment
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In this course, we are going to learn about creating change in the home environment with one very important intention in mind: making tasks easier and safer to do, so that people can stay in the community and live in their own homes as long as possible. This concept is often referred to as aging in place. Changing the home environment to facilitate aging in place often requires changes in physical design (e.g., addition of handrails and grab bars), as well as changes in the way things are done (e.g., less bending) and the types of services used (e.g., meals, housekeeping, and bathing). This perspective suggests that, as the needs and abilities of older persons change, both the types of services available and the home itself should adapt to meet their needs.

BIO: Jon Pynoos, Ph.D. Jon Pynoos is the UPS Foundation Professor of Gerontology, Policy, Planning and Development at the Andrus Gerontology Center of the University of Southern California. He is also Director of the National Resource Center on Supportive Housing and Home Modification, and Co-Director of the Fall Prevention Center of Excellence which is funded by the Archstone Foundation. He is a recognized national and international expert on housing and aging in place. Dr. Pynoos has spent his career researching, writing, and advising the government and private sector concerning how to improve housing and long term care policies and programs for the elderly. He has conducted a large number of applied research projects based on surveys and case studies of housing and long-term care. He has written and edited six books on housing and the elderly including Linking Housing and Services for Older Adults: Obstacles, Options, and Opportunities, Housing the Aged: Design Directives and Policy Considerations and Housing Frail Elders: International Policies, Perspectives and Prospects. Dr. Pynoos was a delegate to the last two White House Conferences on Aging and was responsible for writing the paper on Supportive Housing and Long Term Care that served as the basis for many of the final recommendations. He is currently a member of the City of Los Angeles Task Force on Aging and the California Commission on Aging. Previously, he served on California’s Board of Nursing Home Examiners and the Governor’s Blue Ribbon Task Force on Homes for Veterans. He is past Chair of the Social Research, Policy, and Practice Section and Vice-President of the Gerontological Society of America and is on the Board of the American Society on Aging. He is a founding member of the National Home Modification Action Coalition. Dr. Pynoos has been awarded both Guggenheim and Fulbright Fellowships. Before moving to USC in 1979, Dr. Pynoos was Director of an Area Agency on Aging/Home Care Corporation in Massachusetts that provided a range of services to keep older persons out of institutional settings. He holds undergraduate, Master's and Ph.D. degrees from Harvard University where he graduated Magna cum Laude.

BIO: Jon Sanford, M.Arch. Jon Sanford is an adjunct Associate Professor of Architecture and Co-Director of the National Institute on Disability and Rehabilitation
Research (NIDRR), funded Rehabilitation Engineering Research Center on Workplace Accommodations within the Center for Assistive Technology and Environmental Access, Georgia Institute of Technology. He is also a Research Architect at the Rehabilitation Research and Development Center at the Atlanta Veterans Affairs Medical Center and the Director of Research for Extended Home Living Services in Wheeling, Illinois, one of the nation’s largest providers of home modifications. Mr. Sanford is one of the few architecturally trained researchers engaged in environmental issues related to accessibility and design for aging and has been well-recognized for his expertise in home modifications, environmental safety, and universal design for over 20 years. His research has focused on accessibility and universal design, including best practices in assisted toileting and bathing; access to toilet and bathing facilities; and design of toilet facilities to facilitate independence among older adults. He has developed several assessment protocols for home modifications, including remote assessments using televideo technology and CASPAR, the Comprehensive Assessment and Solutions Process for Aging Residents. He is currently funded by the National Institute on Aging to develop eCASPAR, a companion database of home modification solutions. In addition, he is currently directing a multi-site, randomized controlled trial to evaluate the efficacy of using interactive teleconferencing to provide remote therapeutic services, including home modification recommendations, to older adults at home.

**BIO: Carrie Bruce, M.A.** Carrie Bruce, M.A., CCC-SLP, ATP is a Speech Language Pathologist and an Assistive Technology Practitioner. She serves as a co-investigator in the Rehabilitation Engineering Research Center on Workplace Accommodations and provides support to other sponsored projects related to accessibility, disability, and design. Ms. Bruce has been working in the field of rehabilitation and assistive technology for ten years, with expertise in modifications related to communication devices and computer access technologies used. Her recent work includes descriptive analyses of assessment instruments with a person-environment fit focus, development of a workplace accommodations assessment, classification of environmental features in informal learning environments, and investigation on universally designed exhibit interpretation.

This course focuses on the changes that take place in the physical environment of a home through home modification. Most of us have already modified our homes for one reason or another to adapt to our changing needs. Perhaps, you have made a minor modification to your home such as lowering a shelf in your kitchen to make things easier to reach. Or, maybe you made a major change such as adding on a bedroom to accommodate a growing family or converting a bedroom to a study to accommodate a smaller family and retirement. These changes are all part of our life cycle process throughout which we adapt our environments to meet our changing needs. Similarly, modifications to accommodate an aging parent, grandparent, or even ourselves, are part of the life cycle process. The only real difference is that these modifications can include special adaptations, such as widened doorways or a roll-in shower, to accommodate various functional limitations, assistive devices, and perhaps a mobility aid or two. However, home modification is not only for older people. Later we will learn more about who can benefit the most from home modification, as well as why it is imperative for people who want to age in place.
What is home modification and what are home modifications? First, we want to be clear: when we say, "home," we are referring to a place where a person lives. It could be an apartment, a mobile home, or a condominium. It could even mean living with a relative or friend. The type of dwelling is not important. What is important is that "home" is a place of residence. This point is important to keep in mind when educating others about home modification. Many people perceive HOME in home modification as only applying to a single family residence. As a result, the application of HOME modifications is often unnecessarily minimized. Modification is both the act of changing something, as well as the result of that change. It is therefore both a process and a product. This first course will introduce you to both the process and the product. Subsequent courses will elaborate on home modifications as a product, with each course focusing on individuals with specific home modification needs.

Home Modification as a Process. As a process, home modification is the confluence of activities and delivery of services, which contribute to the alteration, adjustment, or addition to the home environment through the definition of problems, needs, and/or strategies, identification of solutions, construction or installation of solutions, education of clients in the use of solutions, and evaluation of outcomes. Home modification can be any one or a combination of these activities. As illustrated by Figure 1, it is a cyclical process, which can begin and end at any step. Most importantly, you should use the best available evidence to make decisions at each step (evidence-based practice), and to the extent possible, use the knowledge gained from each step to inform the knowledge base (practice-based evidence). Table 1 below outlines the 5 steps in the home modification process and the purpose of each step. We will discuss the first three steps in more detail later in this course.

Home Modification as a Product. As a product, home modification can be broadly defined as adaptations to the home environment, which make it easier to carry out tasks and maintain independence. This definition can include major and minor changes in the home. When making home modifications, the point is to make the home environment work for you rather than against you. Right now, take a look around your environment. You are probably at home or at the office. No doubt, you are sitting at your computer. Are you comfortable? Does your back or neck ache? Are your eyes beginning to get tired from looking at the computer screen? What could you do to make yourself feel more comfortable? Think about the last time that you made dinner in your kitchen. Think about how the environment makes cooking and cleaning easy or difficult. Think about the work surface in your kitchen. Is it comfortable? If you had to stand in the same spot for a long time, would it be comfortable then? Can you easily reach items in all of your cabinets? Are some too low or too high? Is it safe for you to get things off of shelves that are way up high? What could you do to make your kitchen safer, more comfortable, and more convenient? Take a few minutes. Choose another room in your home and identify potential problems. How would you fix those problems? You have probably just identified numerous difficulties and several modification solutions on your own.
Who Needs Home Modification? While the general population can be at risk when their living environments are dangerous and difficult to use, we can look at specific populations who need home modification based on their abilities and experiences. LaPlante and Miller (1992) reported that in the US, 9.5 million people (4 percent of the non-institutionalized population) experience difficulties performing basic life activities. This number includes children and adults who have experienced difficulties since birth and individuals who experience difficulties as a result of an accident, injury, illness, disease, or changes associated with aging. The proportion of individuals experiencing difficulties increases with age. Approximately 12 percent of the population between 65 and 74 years of age, 26.5 percent between the ages of 75 and 84, and 57.6 percent 85 years and older experience difficulty performing basic activities of daily living.

Everyone can benefit from a well-designed environment. Changing the home environment for safety, comfort, and convenience makes good sense. Yet, most people are more willing to change their behavior before they change the environment. The decision to age in place is not the result of a single event; it is the result of planning to remain as independent as possible in one's own home. But we all require or seek some type of assistance at one point or another. Any one of us could find ourselves dependent upon assistance either very suddenly or gradually over time. With age, abilities decrease gradually and frailty increases. An individual may not want to or maybe cannot do all the things he or she used to do. As a result, people gradually compensate for their decreased ability by eliminating activities, changing the way they do things, relying on make-shift aids, or seeking assistance to help them through the day. It may be just a small amount of assistance such as having someone else run the errands or hiring someone to help around the house, or it may be a large amount of help, which requires a full-time, formal caregiver to assist with toileting, bathing, or cooking. In either case, the availability of services and a supportive environment can facilitate and support aging in place.

When we think of the typical beneficiaries of home modification, the frail elderly generally come to mind. Although the frail elderly can benefit from home modification, five other groups of people can also benefit from modifying the home environment. These factions include: 1. Families who have children with disabilities. 2. Adults with disabilities. 3. Middle age couples planning for their future. 4. Families who bring aging parents into their homes. 5. Parents (or grandparents) with young (grand) children who have to child-proof a house.

Why Is Home Modification Important? Clearly, aging in place in familiar surroundings is what most people prefer. Approximately 70 percent of persons over the age of 65 live in their own homes, 20 percent reside in apartments, 5 percent reside in housing with congregate facilities or services such as meals, and 5 percent live in nursing homes. According to the 1995 National Nursing Home Survey, the number of nursing home residents increased only 4 percent between 1985 and 1995, despite an 18 percent increase in the population aged 65 years and over. An annual survey conducted by AARP has consistently reported that approximately 85 percent of respondents agree with the statement, "What I'd really like to do is stay in my own home and never move." Home modifications are a key element that enables older adults to age in place. In fact,
home modifications can make a big difference in the lives of everyone in a household. The more that older individuals can do things independently, the less others at home will have to do for them. The overall benefits of home modifications are their ability to create a safe, comfortable, and supportive home environment, which enables older adults to overcome activity problems and hazards in their home. They can also make it easier for caregivers to provide assistance.

**What are Common Problems and Hazards in the Home?** Home may be where we live, but homes are not always as livable as they should be. What do you think the biggest problems are for people having difficulty aging in place? Although problems can and do occur throughout the home, researchers and home modification specialists agree that there are three main areas in the home that present barriers to safety and independence. These include: entrances, interior stairs, and bathrooms. As a result, the majority of home modifications are intended to facilitate activities and prevent accidents such as falls while getting in and out of the home, going up and down the stairs, and managing in the bathroom (e.g., toileting, bathing, and grooming).

**Getting In and Out of the Home.** Many homes are built above ground level and have a set of steps leading up to a porch, deck, or landing at the door. Stairs can become an obstacle to small children, persons who are frail, those who have problems with balance, and people who use wheelchairs, walkers, canes, or crutches. Stairs are also a potential safety hazard, accounting for a greater number of falls among older adults than any other single location in the home. According to an AARP report (Kochera, 2002), 14 percent of all falls by older adults took place on stairs, compared with 4 percent, which involved the bathtub, shower or toilet.

**Going Up and Down Stairs in the Home.** Even if they can get into a home, people who use mobility aids such as wheelchairs frequently lose access to rooms or different parts of their homes because hallways or doors are too narrow, furniture obstructs the path of travel, or stairs prevent travel to other floors in the home. In a survey of 1,231 individuals, 65 years of age and older, 68 percent had stairs inside their homes (Wylde, 1995). Among these respondents, slightly more than one-fourth said they experienced difficulty going up and down the stairs and almost 16 percent said there were times when they were nervous about using the stairs. Approximately 41 percent of the respondents who had stairs in their homes indicated that they had to climb the stairs to reach their bedroom, bathroom, or kitchen. Overall, 26 percent lived in homes in which stairs posed a barrier to essential activities such as toileting, bathing, sleeping, or eating. Stairs are also common places for people to have accidents in the home. Unfortunately, the number of multistory homes being constructed is increasing. According to the U.S. Bureau of the Census (1994), 74 percent of the new homes built in 1970 were one story, 17 percent were two or more stories, and 10 percent were split level. In comparison, in 1993, 48 percent of new homes built were one story, 48 percent were two or more stories, and 4 percent were split level. In other words, more than half of the 667,000 new homes built in 1993 had stairs. The proportion of housing stock with stairs being built each year has increased 182 percent since 1970.
Managing in the Bathroom. For many frail older adults who have difficulty rising up and lowering down, including those who use wheeled or ambulatory mobility aids, transferring to the toilet, bathtub, or shower can be extremely problematic as well as a falls risk. While there is often insufficient space for individuals who use wheelchairs to maneuver or get close enough to a fixture, ambulatory older adults with gait and balance problems often lack support (i.e., something to hold onto) to safely lower themselves down onto a toilet or the bottom of a tub or conversely to pull themselves back up from these positions.

The bathroom is also one of the most common places in the home where injuries occur. In 1993, it was estimated that almost 162,000 persons visited a hospital emergency room because of an injury sustained while using a bathtub or shower (U.S. Consumer Product Safety Commission, 1994). Wet, slippery surfaces in a small, cramped space can easily lead to falls, even for persons who do not have functional limitations. Bathroom floors are extremely dangerous when wet. Having something to hold onto, such as a grab bar, can help prevent a fall. Although there may be some cost involved in having grab bars installed properly, the expense is far less expensive and traumatic than the cost of medical treatment.

You have completed the first section of this course. Please complete the Self-Quiz by clicking the button to the right. After completing the quiz, please go on to the next section "Types of HM."

Modifications for Specific Activities
How do you know a home modification when you see it? I hope you are getting the idea that the product side of home modifications is concerned with solutions to problems that often prevent people from aging in place. But what can be done to help people live in safe, comfortable, and usable environments of their choosing? Some of you may be familiar with the terms accessible design (AD) and universal design (UD). Although they are sometimes used interchangeably to identify home modification solutions, they are different approaches to home modifications and have different implications for the usability of the modifications by different individuals. It is beneficial to be able to differentiate between these terms to communicate effectively with all of the various people involved in making decisions regarding the home environment (e.g., clients, caregivers, designers, contractors, case managers). In the next pages, you will find brief definitions of these terms, although, I would strongly encourage you to visit the web sites I have included for more in-depth information about each of them.

Accessible Design. AD is specialized design (including assistive technologies), which supports people with functional limitations. Often, AD is defined by codes and standards such as the Americans with Disabilities Act Accessibility Guidelines (ADAAG) or even local building codes. Even though ADAAG only applies to public buildings and does not have jurisdiction over private housing (and only common areas of multi-family housing), its specifications for accessible design (e.g., types and sizes of grab bars) are often used as the basis for home modifications. In addition, for safety reasons, most local building codes have adopted technical specifications from ADAAG (e.g., maximum ramp slope of 1:12), which mandate how various AD features, such as ramps and grab bars are implemented in the home.
Universal Design. The Center for Universal Design, at North Carolina State University defines universal design as the design of products and environments to be useable by all people, to the greatest extent possible, without the need for adaptation or specialized design. Unlike AD, which is an add-on component to support specific types and levels of ability, UD is everyday design that supports all types and levels of ability. As a result, UD has built-in accessibility. The intent of universal design is to simplify life for everyone by making products, communications, and the built environment more useable for as many people as possible at little or no extra cost. Universal design intends to benefit people of all ages, sizes, and abilities.

To recognize the contribution of both of these approaches to home modification, the American Occupational Therapy Association (AOTA) has adopted an inclusive definition of home modifications in its Home Modification Practice Guidelines, which is more specific than the general definition (i.e., adaptations to the home environment that make it easier to carry out tasks and maintain independence) that we provided earlier. AOTA describes home modifications as: any alteration, adjustment, or addition to the home environment through the use of specialized, customized, off-the-shelf, or universally-designed technologies, equipment, products, hardware, controls and cues, finishes, furnishings, and other features that affect the layout and structure, to improve functional capability of and/or minimize environmental demands on individuals and their caregivers in order to meet the situational needs for promoting performance of daily activities as independently and safely as possible.

Evaluation and Assessment
Finding the Best Fit Solution
Before we talk about selection of best fit solutions, we would like to review a few of the fundamental tenets of home access and usability. First, there is no substitute for good design. Good design, which is aesthetic and functional for all users, can and will eliminate the need for many adaptive, add-on, specialized accessibility products, which are commonly used. Many home modifications would be unnecessary if our homes had originally been based on more appropriate designs. For example, bathrooms in most homes are inaccessible to people with physical limitations and disabilities because the doors are too narrow, the floor space is too limited, the layout of fixtures is ill-conceived, fixtures themselves are often poorly designed, and there are no supporting features. Better initial design would greatly improve accessibility and usability for all of us and reduce the need for modifications later on.

Second, providing accessibility in the home is different from providing accessibility in public and commercial buildings and spaces. Accessibility codes are intended to ensure at least basic levels of usability and access for individuals in public buildings. These codes do not apply to private residences. Unlike public buildings, a man's or woman's home is his or her castle. Homes are highly personalized and decisions about accessibility features and home modifications should similarly be personalized. Also, unlike public environments, which attempt to accommodate the needs of many, homes generally accommodate the needs of a few specific persons. Therefore, home modifications should
be individualized and best suited to meet the needs of the people who will use them. For example, in a public building or a commercial setting, the size and location of grab bars in the area of the toilet are clearly specified by the codes. In contrast, in a private residence, the size of a grab bar, diameter, type of finish, height, and placement are all functions of the needs and tastes of a particular client. Nevertheless, it is important to note that there may be more than one user of home modifications, including not only other residents and caregivers, but also visitors who may come for a meal or to stay over. Third, there is a big difference between home and hospital. Can you remember the last hospital you were in where you really wanted to stay the night? We didn't think so. One of the many reasons why you did not want to stay probably had to do with the institutional look and feel of the hospital environment. If it is not warm and comforting like your home, it just isn't home sweet home. Therefore, it is important to remember that accessibility in the home should appear homelike and tailored to meet the personal needs and tastes of the users. Although accessibility codes and generic solutions provide a frame of reference as well as some useful information about the type and placement of a product, the specific needs and desires of individual clients are paramount. So, when choosing products for a home modification project, it is important to keep these fundamental differences in mind.

*Expert Beware.* Common questions that we have heard over the years include: Why can't I just do what I did on my last home modification job? It worked for Mr. Smith. Why can't I just use the ADA accessibility guidelines? What is task analysis and what has it got to do with product selection? Why can't I just stick the grab bar up on the bathroom wall? The label says "handicapped," isn't that good enough?

If you take nothing else away from this introduction, we hope you will remember this crucial piece of information: knowledge about available accessible products is the single least important aspect of a successful home modification project. Instead of considering what products are available or what you used in the last project, think about what features and attributes are needed to help the client meet his or her needs and realize his or her goals. Then you can think about the product or combination of products that may provide those benefits. A product or solution that works for one client may or may not be appropriate for another. In addition, experience in using the ADA Accessibility Guidelines, which are intended to provide a basic level of access for many people in public buildings, is not enough to address specific problems experienced by an individual in his or her home. Similarly, because many of the ADA guidelines were originally developed for young individuals, they often do not meet the age-related needs of older adults.

In the course of my work, I have been out to visit potential clients in their homes. After the exchange of pleasantries, I usually ask, "How can I help you?" The answer is often, "I need a..." (Fill in your choice of products - stairway chairlift, bathtub removal, widening a door, handicap sink, etc.). And guess what? The client is often wrong! While clients definitely know about the problems they experience and the issues they wish to address, they may not know what solutions will work the best. They focus on products that they
have seen before, without giving detailed thought to the needs that must be addressed. Unfortunately, home modification novices often depend too much on the client for the solutions and immediately focus on available products, which can be used, rather than trying to figure out the underlying problem. If time and energy are devoted to a thorough understanding of solving the specific problems, the search for the product will be greatly simplified and the cost of the modification will often be significantly reduced.

Instead of focusing on which product or products to use, it is best to begin by defining the basic problems to be addressed. Then, break that basic problem down into its component parts or tasks. Analyze each of those tasks, and relate them to the client's functional abilities. List all of the areas of need or all of the component tasks for which some special help from the product is required. Make a list of the design characteristics of each potential solution, which will address those tasks and needs. Matching the client's needs to the design characteristics will help identify the best solution.

**From Investigation to Intervention**

*Task Analysis.* Whether you use a formal assessment instrument or you simply use your own expert reasoning to conduct the assessment, performing a task analysis in the investigation stage is the most effective means of understanding where problems occur. This method will lead to a firm understanding of the needs of the individual, which in turn will develop solutions to address those needs. Simply defined, task analysis is the breakdown of a particular activity (or occupation in OT language), such as toileting or bathing, into its component parts or tasks, and the subsequent evaluation of how an individual performs each task. Suppose a wheelchair user states that he or she has a serious problem bathing. Our first inclination might be to recommend a roll-in shower. However, closer examination of the component tasks involved in taking a bath reveals a number of different types of potential functional problems, which impact decisions about product selection. For example, the individual might have difficulty bathing because he or she cannot get close enough to the tub or maneuver the wheelchair into a comfortable transfer position. Alternatively, he or she might not be able to fill the tub with water due to an inability to reach the faucet, grasp the handle, or turn the knob. Finally, getting in and out of the bathtub might be problematic due to an inability to transfer between the wheelchair and the tub, or because difficulty with lowering down and rising up from the bottom of the tub exists.

Although a roll-in shower might ultimately be the best solution for some wheelchair users, it may not be the best for everyone, particularly when a low-cost modification and keeping an existing bathtub are important to the client, which might also include other residents. Without performing a task analysis to identify the key component tasks that are causing a problem, we are likely to implement some modifications that will not address the problem. Even worse, we might miss modifications that do address the problem. For example, if the wheelchair user in the example above could not bathe because he or she had a problem only with grasping and turning the faucet handle, a roll-in shower with the same faucet would be a very expensive solution that did not address the problem. You have completed the third section of this course.
Important Design Characteristics

Identifying Relevant Design Characteristics of Alternative Solutions. Once task analysis has defined a problem, it is possible to identify the key design characteristics of each potential modification, which might be used to solve the problem. Quite often, a mainstream, off-the-shelf household product will fit the bill very nicely, and in other cases, that mainstream product will be perfectly satisfactory if used either in a modified fashion or in a non-standard installation.

For example, suppose a task analysis identifies the problem as the inability of an individual to maneuver his or her wheelchair close enough to the bathroom sink to turn on the water and wash up. Our first thought is to replace the existing sink with the same institutional, it-only-comes-in-white, wall-hung sink with the concave front edge that we have seen in virtually every public washroom in the U.S. While this option may be a good solution, let us think about the "handicapped" sink’s design characteristics, which enable a wheelchair user to reach the faucet and use the sink. First, the sink is open below allowing a person using a wheelchair to pull up underneath the fixture. In addition, it is deeper than a standard residential sink allowing the wheelchair user to pull up all the way to the front edge of the sink. Clearly, there are off-the-shelf, more residential options available, which would provide those essential characteristics. For example, a standard wall-hung or half pedestal sink can be used. They are available in a wide variety of styles, prices, and colors. In fact, the half pedestal has the added advantage of having a false pedestal to cover the pipes. This option not only presents a more pleasing appearance to begin with, it also eliminates the need to cover the pipes with insulation to protect the user’s legs from scalding.

Alternatively, if a full counter is desired to accommodate toothbrushes, hairbrushes, toiletries, and other items likely to be found in a residential (as opposed to public) bathroom, a countertop can be installed either open or without a full base cabinet underneath. Countertops come prefabricated, but can be custom crafted on site from an almost endless variety of materials, such as a cultured marble or solid surface (e.g., corian) with an integrated sink, or a laminate, tile, or stone. As a result, countertops can be made to fit any decor, price range, or need. This type of solution provides the space for a person to sit at the sink, while also providing a great deal more convenience and a much more pleasing residential look. Additionally, this modification might be achieved without the purchase of any new materials by merely removing and/or modifying the existing base cabinet.

Unfortunately, the desirable attributes of products may not always be readily apparent. Consider a hand-held shower. Everyone who has ever taken Accessibility 101 knows that anyone having difficulty using a bathroom gets a hand-held shower. Why is that the case? Would a hand-held shower be such a ubiquitous product if a bathing/showering task analysis were done for all clients? To answer these questions, let us look at how a shower is accomplished by someone without functional limitations. The individual generally stands in front of the water, turning his or her body to enable the water to reach all body parts. The client moves his or her head from side to side to keep out of the water spray when desired. The client also moves his or her body out of the spray by stepping back or...
to the side (depending on the size of the shower) to use soap and shampoo and then back into the spray for rinsing.

While not all individuals have the types of limitations that would prohibit basic showering, an individual with limited mobility is likely to be seated in the shower rather than standing, or at the very least, to be much less mobile and secure in his or her movements (perhaps having to hold onto a grab bar during the entire shower) than an individual without mobility problems. That difference means that the water is directed to hit them in one part of the body all the time and the water hits only one side of their bodies. Wetting and rinsing other parts of the body are extremely difficult, if not impossible. Additionally, if a caregiver is providing assistance, there is tremendous need to reduce the over-spray and to control the water flow better in order to prevent water escaping from the shower area and making a big mess.

Matching Characteristics to Needs. After identifying the important design characteristics of products, it is necessary to match the relevant characteristics to a client's needs to ensure that at least one of the alternative solutions will actually work for the client.

Let us start with an easy example. Go back to our task analysis of boiling an egg. Now, assume that our client, Mary, has impaired ability to grip, reduced upper body strength, poor balance, and is therefore, unable to carry a pot from the sink to the stove. Also assume this client's stove is on the opposite side of the kitchen from the refrigerator and sink (you all remember that infamous kitchen triangle don't you?). Based on our task analysis, the use of a rolling cart is quite likely the best type of solution. But, when we complete an internet search for rolling carts, we find that there are dozens of types and manufacturers. How do we decide which one to use? And does it really matter? To answer these questions, we need to conduct a task analysis: how do we expect the cart to be used by this particular client? Then we need to assess the ability of the design characteristics of each model of cart to match the client's needs and abilities.

Let us start by examining the critical design factors that affect the way we expect the rolling cart will be used. Because Mary has difficulty lifting a pot and carrying it across the kitchen, she will probably slide it from a counter to the cart and from the cart to the stove. Also, to keep from lifting an object that is heavier than it needs to be, Mary will probably add the water and egg after the pot is on the stove. So, she will probably transfer a cup of water on the cart. She also has balance problems, so she probably will not need a cart with a lower shelf. Weighing all of this information, the critical characteristics include:

- Height of the cart - to slide items between the cart and the surfaces of the counter and stove.
- Flat top without a lip - to transfer items.
- Simplicity - as Mary may not be able to bend over to use multiple shelves or drawers.
- Size of the top - to carry all the necessary items.
- Size of the cart - to fit in Mary's kitchen and not be in the way.
- Weight of the cart - so that it is light enough for Mary's limited strength.
- Sturdiness of the cart - to provide support for Mary without spilling the water.

Certainly, the process of selecting the best rolling cart is substantially easier if you had years of experience with carts or, at the very least, if you had the opportunity to go to a major trade show and inspect the different units in order to gather information about each of them. However, even if you do not know the difference between one cart and another, you can determine what design characteristics are critically important to the client and you can arrange to get that information.

**Mediating Factors.** Most of the time there are multiple potential solutions to a problem in the home, probably none of which are an "ideal" fit with all of the client's needs. For example, if the problem is an inability to get into the bathtub, one solution may be to use a tub transfer bench. Another solution might be to remove the bathtub and to install a barrier-free shower or a curbless shower. Yet another solution is a tub with a door. Clearly, different options provide different levels of convenience, usability, safety, independence, and ability to meet a client's individual needs both now and in the future. Moreover, often the most important is the different potential solutions that will almost always have different implications for a variety of mediating factors, which have nothing to do with usability or accessibility, but might influence decisions on which solutions should be implemented. To review from the beginning of this course, these factors include: tastes and preferences that are inherent to the individual, structural limitations of the home, social constraints of the living situation, and external restrictions, such as building codes. Any or all of these factors might play a role in selecting the best situational fit for the individual, which may or may not be the most accessible or usable solution.

While there are a large number of potential mediators, cost is by far the most common and most influential. Although an unlimited budget would surely create the opportunity to enable an ideal solution to be implemented, such situations are rarely the case. Therefore, there is little point in designing a perfect solution unless the financial resources available are consistent with the cost of the ideal plan, and unless the other parameters and constraints of the client's situation are met by the plan as well. In the final analysis, the challenge is not simply to devise the best modification plan; the real challenge is to devise the best modification plan achievable in a given circumstance, while ensuring that the resources of time and money have been well spent and that those expenditures have produced a maximum return of benefit to the client.

**Final Note**
Before you continue on with this and the other courses in this series, it is important to note that people with different types of impairments experience many of the same general problems, such as getting in and out of the home, going up and down stairs, and managing in the bathroom. Despite the similarities, individuals with different types of impairments will have different modification needs. For example, let us examine problems related to getting in out and out the home. People with upper extremity impairment experience problems manipulating interfaces, many of which are used to control the environment. As a result, they might have problems grasping a doorknob or
turning a key in a lock to open an entry door. People with sensory impairments experience problems receiving visual and auditory information from the environment, which might cause difficulty finding the lock and putting in the key. People with lower extremity impairments have problems moving through space and accessing objects, which can result in difficulty maneuvering at an entry door or moving through the doorway. Finally, people at risk of falls might have problems maintaining balance while undertaking any of the tasks of getting in and out of the home. Therefore, although many of the same areas of the home are modified for people with different impairments, specific design goals, objectives, and home modification strategies will differ. In closing, remember that while public building accessibility is a science (well at least cookbook science), home modification is more of an art. The public building codes provide exact information about what must be done to provide accessibility in a public building, at a minimum. In a residence, strict adherence to those guidelines will make virtually every home modification either too expensive to undertake, inadequate for the client's particular needs, or too ugly to behold. Make sure that the needs of the client are addressed by the modifications, that the modifications are sufficient and necessary, and that the plans meet the client's budget and wishes.

**Part II Evaluation and Assessment**
Carrie Bruce, MA,CCC/SLP, ATP

Evaluation is the first and perhaps the most important step in the home modification process. According to AOTA, evaluation is the “process of obtaining and interpreting data necessary for understanding the individual, system, or situation” [AOTA, 1998]. As a process, evaluation is concerned with the use and flow of information. Home evaluation is the process that identifies and characterizes problems, which occur in the conduct of daily activities, and then utilizes this information to make decisions about home modification strategies and solutions, which will improve the fit between person and environment. While assessment is often used interchangeably with evaluation, it can be distinguished as the part of the evaluation process that focuses on the gathering of information. As such, assessment includes the “specific tools, instruments, or interactions” used in the evaluation process [AOTA, 1998] to guide the identification, acquisition, and generation of (presumably) relevant information so that it can be utilized in the evaluation process.

**What is the Purpose of Home Evaluation?**
Evaluations are problem-focused; they are specifically undertaken to characterize, analyze, and/or manage problems related to Person-Environment (P-E) fit, which results in performance dysfunction in daily activities.

While evaluations may ultimately lead to determining the best fit solutions for problem management, finding these solutions may not necessarily be an immediate outcome of all evaluations. Instead, some evaluations may have more short term goals, such as characterizing or analyzing problems. Such goals are typically important for defining future needs, project planning, or qualifying for third party reimbursement. For example,
the purpose of an evaluation might simply be to characterize the problem by identifying the nature of the problem (e.g., getting on the toilet) and describing the characteristics of contributory factors (e.g., there are no grab bars). Alternatively, an evaluation may manage problems by defining usability requirements (e.g., provide support on both sides of the toilet), which can be used to determine specific home modification solutions (e.g., install fold down grab bars). It is important to note that when the immediate purpose of the evaluation is to characterize or understand problems, follow-up evaluations are often needed later when best-fit solutions (e.g., the specific brand and model of the grab bar) need to be determined to manage the problem.

What is the Evaluation Process?
Home evaluation is a 6-step process, which includes:
1) Identification of Problems,
2) Characterization of Usability Factors,
3) Analysis of Usability Factors to Define Needs,
4) Translation of Needs into Usability Requirements,
5) Synthesis of Usability Strategies and Mediating Factors, and
6) Generation of Best Fit Solutions.

However, as we pointed out earlier, not all evaluations follow all six steps through to problem management. As a result, any particular evaluation should only include those steps necessary to meet its purpose. For example, an evaluation intended to characterize problems would only include steps 1 and 2, whereas one analyzing problems would only include up to step 4, as detailed in Table 4, below.

<table>
<thead>
<tr>
<th>Purpose Evaluation Step</th>
<th>Characterization of Problems</th>
<th>Analysis of Problems</th>
<th>Management of Problems</th>
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<tbody>
<tr>
<td>1) Identification of Problem</td>
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<tr>
<td>2) Characterization of Usability Factors</td>
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<tr>
<td>3) Analysis of Usability Factors to Define Intervention Needs</td>
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<td>4) Translation of Needs into Usability Requirements</td>
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<td>5) Synthesis of Usability Requirements and Mediating Factors</td>
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<td>6) Generation of Best Fit Solutions</td>
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Table 4. Evaluation Steps by Purpose

As in any process (see Figure 1 below), there is a flow of information between its various stages from the beginning to the end. As illustrated in Figure 1, the information flow begins with the acquisition of information to (1) identify problems and activity goals for the individual. Then, using a task analysis, goals are broken down into their relevant
person, place and performance related components, which drive the (2) characterization of usability factors, including: a) personal, b) place, and c) performance factors.

**Acquisition of Information for Characterization of Usability Factors**

a) Personal factors are all the aspects of health and function intrinsic to the individual, which impact ability/skill level, including demographics, health status/condition, impairment, and function.

b) Place factors are the physical and social context within the control of the individual (e.g., home environment) and which may pose barriers to task performance.

c) Performance factors are those characteristics of an activity that impose task demands, which result in performance deficits.

The (3) analysis of usability information establishes causal links between problems identified and each factor as well as results in the derivation of intervention needs specific to person (e.g., skill enhancement for functional limitations), place (e.g., home modifications to remove environmental barriers) and performance (e.g., adaptive strategies or behavioral changes to overcome performance dysfunction). Intervention needs are filtered through a clinical reasoning process (e.g., based on the expertise of the individual or inherent in the assessment instrument performing the evaluation) and (4) translated into usability requirements for the best-fit solutions (i.e., how to achieve a good P-E fit). The outputs of usability requirements are intervention strategies and technical requirements. The (5) synthesis of usability strategies and requirements with mediating factors results in the development of contextually-relevant intervention strategies. These strategies are used to (6) generate solutions (i.e., changes to person, place, or performance), which represent the best fit within the overall context (i.e., for a particular individual in a particular home given his or her particular circumstances).

![Figure 1. Evaluation Process Model](Sanford and Bruce, 2005)

**Consumer Role in Evaluation and Assessment**
Clearly, the person who is going to be affected needs to be involved in the decision-making process. It seems simple, but remember that everyone from the funding sources, to the person conducting the evaluation, to the person implementing the modifications, impacts the recommended changes of a home environment. Sometimes the desires of the person at the center of the evaluation are lost in the process.

Some researchers have proposed that older adults are underserved because they dislike the paternalistic nature by which interventions such as home modifications are often delivered (Baker and Pallett-Hehn, 1995). Even if it is an easy fix, they want to be the ones to decide to make it. Unfortunately, older adults are rarely consulted. In addition, despite the many excellent educational programs along with materials developed to educate the consumer, the media used to convey the message as well as the perspective of these materials and the products and changes recommended for people to put in their homes have often targeted the consumer as the problem and have not been consistent with what the consumer wants (Wylde, 1996).

When considering consumer involvement in home evaluation, it is useful to assess the current home modification delivery system by using some of the key principles of an ideal consumer-directed approach (NICDLTS, 1996). Take a look at four of these principles.

1. Consumers are the experts on their needs. While the evaluation is a key element in the home modification process, it can also be a weak link in the delivery of home modification services. More active involvement of the consumer could greatly improve the process. It is critical that consumers are considered the experts because they can identify best how they use the environment and thus, what types of problems may or may not actually exist. For example, a case manager might view a person's living room as overly cluttered and suggest that much of the furniture be moved out to provide a clear path for walking. However, unless the case manager asks the client how he or she gets around in the room or better yet, observes how he or she walks through the room, the case manager might miss that the person holds onto various pieces of the furniture for support. If those pieces are removed, there might be a greater chance for the person to fall.

Home modification affects not only a person's ability to function in the environment, but also the aesthetics and appearance of the home environment. Moreover, the appearance often has special meaning to its resident in terms of aesthetics, memories, and the messages that it conveys to others. The values and the preferences of the clients need to be taken into account when changes are going to be made to their homes. For example, I attended a workshop at a recent conference where the participants (all health professionals and gerontologists) were given a case-study that described the health problems and living conditions of an 83-year-old woman named Mary. A well-meaning, well-educated woman raised her hand and declared: "Of course, I would remove all of her area rugs because we know that she could trip on them and then I would remove all of her favorite desserts from her diet because they are all high in fat..."

How would you feel if someone came into your home and decided to remove your household furnishings because they thought they were a danger to you? What the very well-intended woman did not know is that those area rugs were a wedding present from
Mary's grandmother, who she dearly loved and still remembers when she sits alone in her living room at night looking at them. Mary's grandmother taught her to make her favorite desserts and the recipes had been in her family for generations. She had lived with the rugs and made those desserts for most of her life. Why would she want to give up those few things that give her pleasure? Of course, the well-intentioned woman had no way of knowing this because the case-study didn't provide that information. Perhaps if she did, she might have suggested that we first inform Mary, her family, or caregivers of the danger to her tripping and then ask Mary how she might solve the problem. We could make suggestions to Mary, such as displaying her rugs as wall hangings, but we cannot decide for her.

I think by now we have hammered home the point that the consumer must be involved in the decision making, but here is the caveat. Do not assume that the consumer always knows what problems the environment presents or which solutions will work effectively. For example, there is evidence that consumers under-report environmental problems because of their lack of knowledge or concern (Steinfeld and Shea, 1993).

2. Consumers rely on professional expertise to make informed decisions. Consumers may be experts on their needs, but they are less knowledgeable when it comes to what modifications to make. Service providers can enhance consumer decision making by discussing alternative solutions and tailoring modifications to the specific functional needs of clients (e.g., type and height of grab bars). A thorough service provider will also follow up to monitor the effectiveness of the modification and make any necessary adjustments. It may be unnecessary, however, for consumers to be involved in all the details of the actual installation (e.g., how the plywood is blocked to support the grab bar, how the floor is sloped for a walk-in shower).

Consumer involvement and direction in home modification is often complicated by the reality that decisions are often made in a hurry and under stress. For example, after discharge from the hospital, a person with a hip fracture may require grab bars and a raised toilet seat in the bathroom and may need a ramp at the entry to be able to function in his or her home. These changes may need to precede the return of the resident to their home, making it difficult for them to be involved in the process. It may be possible to devise strategies to involve consumers (for example, show the client a selection of grab bars that are readily available).

3. Choice and control should be introduced into the evaluation process. Evaluations need to have the flexibility to include a variety of options, which cater to a diverse group of consumers. For example, some consumers may want to be able to exert less or more control over the various aspects of the home modification process. The reality is that some programs, because of procedural requirements, may be somewhat locked into formal evaluation methods. Programs that are part of agencies with budgetary authority over both personal care services and home modifications should be in a particularly advantageous position to give clients choices, such as spending more money on adapting the bathroom versus homemaking. Again, reality may intrude on the ideal.

4. Consumer involvement should be maximized regardless of financing mechanism. Depending on who is paying for the home modification (e.g., insurance, public agency), the consumer may not have many choices or much involvement in the decision making process. Individuals with low incomes often seek public funding for home modification through loans, grants, and other government subsidized programs. Unfortunately, these
programs only cover limited and/or specific types of services. As a result, evaluations performed for consumers served by publicly funded programs face special challenges, which are often dictated by program coverage rather than by comprehensive evaluations based on client needs. Meaning, if there is funding for ramp installation, a ramp is likely to be installed, regardless of whether a ramp is the best, or even the cheapest, solution. In addition, case managers within publicly funded programs often find it difficult to coordinate varying funding sources with conflicting eligibility requirements. The caps on client expenditures and services restrain consumer choice and limit the ability to conduct comprehensive and responsive evaluations. "At times the best interests of a client may conflict with agency survival: when reimbursement is scarce, for example, or expenditures are capped, and the client requires a costly care plan" (Wetle, 1995:71). The dilemma is how do you involve consumers and, at the same time negotiate the best outcome for them? I do not have all of the answers but PATIENCE, CREATIVITY, AWARENESS, and PERSISTENCE do go a long way in helping low-income persons live in optimal environments.

Assessment Activities and Information
To select an appropriate assessment tool to meet the specific purpose of an evaluation, it is important to know what to look for, or more specifically, the kinds of activities and information included in an assessment instrument. Specifically, characterization of problems is achieved through investigation activities, analysis of problems is achieved through interpretation activities, and management of problems is achieved through intervention activities.

The conceptual framework illustrated in Figure 3 depicts the possible scope of activities and types of information, which could be of interest in any assessment. Each cell of the matrix represents the interaction between a specific type of information acquired from an assessment activity and one of the key factors contributing to P-E fit. Key factors (i.e., person, place and performance) were included in the framework based on P-E fit theory. Assessment activities, including: 1) Investigation, 2) Interpretation, and 3) Intervention, and their subcategories were derived from the analysis of existing instruments.
Investigation is the primary activity of all assessments. While identification of problems and goals can be dictated by the individual having difficulty, or his or her caregiver or family, investigation is the assessment activity that provides the critical information from which decisions can be made. The failure to acquire adequate, valid, reliable, and relevant information will result in home modifications, which may be ineffective in meeting the activity goals of a particular individual.

Investigation is characterized by the acquisition of three types of information: 1) information about activity goals, 2) information about mediating factors, and 3) information specific to the P-E relationship including a) characteristics of potential existing conditions, b) person-environment transactions, and c) attributions of causality.

Interpretation is the translation of intervention needs into actions. While all assessments engage in investigation activities, only a few assessments include interpretation activities. Interpretation actions can be framed in terms of either prescriptive or performance requirements for the interventions.

Intervention, which includes gathering information about alternative solutions, evaluating alternatives for best fit, and recommending best-fit solutions, has historically been primarily an evaluation activity. Therefore, it is not surprising that few existing home modification assessment instruments include intervention activities. However, as onsite use of computer databases has become more practical, traditional paper and pencil assessments, which focused on investigative, and to a lesser extent, interpretive activities, are being augmented by “smart” expert systems, which enable intervention activities to be included in the assessment protocol. Even some traditional “checklist” assessments...
are including “standard” intervention information based on expert recommendations. In such cases, intervention is both an assessment and an evaluation activity.

**Assessing Assessments**

Unfortunately, there is no “best” assessment, which can be used in every situation for home modifications. Do you see that all of the instruments are assessing home modification needs differently and will get very different results? Assessments vary depending on the purpose of the evaluation and the content of the specific assessment process or instrument, as well as the expertise and disciplinary perspective of the evaluator. It is important to review all of these aspects to determine the best assessment for the particular situation. To determine which assessment is most appropriate, the following questions should be answered:

Does the assessment include measures that address the purpose of the evaluation?
Does the assessment provide information that is applicable to the evaluation?
Does the assessment provide sufficient depth and breadth to recommend best fit solutions?

The answers to these questions will establish the suitability, relevancy, and comprehensiveness of the assessment in question. The best assessment for the situation will gather information that satisfies the purpose of the evaluation (suitability), applies directly to the situation (relevance), and meets quantity and quality needs (comprehensiveness).

Choosing the right instrument is dependent on understanding the key elements that provide a foundation on which the evaluation is built. These include the key P-E factors and the activities designed to discover and generate information about these factors.

No one assessment instrument gathers information using all three of the assessment activities. In fact, few assessment instruments collect and generate information for all of the P-E factors. Even fewer are suitable, relevant, and comprehensive enough to meet the needs of many different situations. At the very least, most assessment instruments provide guidance on investigation, providing minimal support for interpretation and intervention.

So, what does this all mean? It means that few assessment instruments provide sufficient information for someone to install or construct home modification solutions tailored for an individual in his or her own home. To do so, problems must be identified and detailed information must be collected about the whole environment (e.g., measurements), the person (e.g., abilities and preferences), and the interaction between the two. It be nice to have an assessment instrument that takes a team approach so that home modifications can be provided after only one assessment. That is exactly the approach taken at Extended Home Living Services in Wheeling, IL, where Contractors, Designers, and Occupational Therapists have been developing an assessment process, which involves both the paper-
and-pencil information gathering instrument, CASPAR, and eCASPAR (www.eCASPAR.com/ec), an electronic database of home modification solutions.

While CASPAR and eCASPAR enable single-assessment modification plans, other semi-intelligent databases, such as BuildEASE (www.Lifease.com) have been developed to provide investigation and interpretation components for complementary investigative assessments (e.g., EASE). Whereas both eCASPAR and BuildEASE are proprietary and are part of fee-based services, a number of Internet database resources, such as assistivetech.net (www.assistivetech.net) and ABLEDATA (www.Abledata.com) include a broad range of AD and UD solutions for a variety of environmental interventions, including home modifications. However, these resources are not linked to a particular tool that supplements assessment instruments when interpretation and intervention activities or knowledge and experience of the evaluator are limited.

In the end, the most important question really is not which assessment is the best, but instead, what assessment instrument is going to guide the process, given the skill level and expertise of the individual conducting the assessment, to make the decisions that will best enable the client to meet his or her specific needs. The most important thing to keep in mind when approaching a client about home modification is that every person is a unique individual and although it is not always cost efficient to meet every single person's individual needs, using an assessment protocol that will fit the particular situation will enable us to come close.