8

Fundamentals of Knowledge Transfer and Extension

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8.1. INTRODUCTION

Increasingly, forestry researchers must do more than solve abstract problems; they must also make those solutions available to those who can use them. Research results and other sources of innovation fall far short of their potential to change management practice when these resources do not become part of the working knowledge of those

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who will make the changes. And, once these resources are applied, the resulting adaptive management raises new questions that drive further research and knowledge development. To ensure that this iterative process occurs effectively, a process for accomplishing as many as possible of the following goals is necessary:

- Application of research results: Through effective transfer of new knowledge and methodologies, research results become part of operational practice.
- Validation of new knowledge: Practitioners ensure that research results are realistic based on their years of experience.
- Operational testing: Practitioners test new practices and new information at an operational level to confirm whether the results are operationally significant.
- Feedback that can help prioritize additional research: After applying new knowledge and practices, practitioners provide feedback to researchers to guide their future research and help them refine new research hypotheses.
- Ongoing dialogue: Knowledge generators, knowledge transfer professionals, and those who apply the knowledge interact through systematic, designed or informal interactions, thereby generating new innovations that would not otherwise have occurred.

The continuum from the development to the application of knowledge involves three major players (DeYoe and Hollstedt 2003): researchers, knowledge transfer (or "extension") professionals, and practitioners. A fourth major category of player, the citizens and communities in which forestry activities occur, cannot be neglected. As such, we mention the role of the public periodically throughout this chapter.

Researchers generate and develop knowledge. They define problems, identify desired outcomes, plan their approach, conduct basic and applied research, and explore the development possibilities. Their work can thus be described as thinking, seeking answers, questioning and formulating hypotheses, testing hypotheses, assessing and interpreting the results of their studies, and publishing the results. They may or may not develop the technology permitted by these results or carry out pilot testing and ground-truthing. They generally communicate mostly within the scientific community.

On the other end of the continuum, practitioners operationalize the researcher's work. They are actively engaged in communication within their organization and with key stakeholders, in operational testing and implementation of new approaches, and in conducting trials of adaptive management. Based on the results of this work, they may evaluate efficacy, supply innovations that modify an original concept, and provide feedback to those who proposed that concept. Finally, they adopt new knowledge and technologies, and either develop new policies and practices or revise old ones. In short, they act and implement while responding to the issues and deadlines that govern their work, and weigh contingencies and risks in so doing.

Knowledge transfer professionals complete the continuum by bridging the gap between those who generate the knowledge and those who apply it. To do so, they engage in audience education and training by linking traditional scientific and

operational knowledge with new discoveries, by collecting and synthesizing information, and by demonstrating techniques or conducting operational testing in close cooperation with practitioners. These professionals employ a variety of strategies and technologies to accomplish these goals, and help the audience to identify their needs and any new research and development capable of meeting those needs. And they communicate, facilitate, mediate, synthesize, simplify, and act as liaisons between researchers and practitioners. In addition, they provide outreach and troubleshooting services once the researchers and practitioners have begun to interact.

Institutions that engage in the transfer of knowledge to the forestry community have highly variable organizational structures, but share the common goals of helping both researchers and practitioners to solve problems, manage their resources, and better engage—all of which contribute to the long-term sustainability of forests and provision of their many benefits.

Peter Bloome, professor emeritus at Oregon State University, has proposed that successful knowledge transfer depends on three principles:

- responsiveness to locally identified issues, which helps to ensure an audience's receptivity toward educational activities that address their expressed needs;
- well-informed citizens capable of contributing to sound community decisions; and
- the achievement of broad social goals through the development of relationships and encouragement of communication among those who share a common vision.

Although these principles are directed at a citizen audience, they can be generalized for other audiences. Based on our own experience, three general categories of key factors are required for successful transfer: a common philosophical foundation, an empowering institutional environment, and effective design principles. Although each category is critically important, we have paid special attention in this chapter to the third category, for which those engaging in knowledge transfer individually have the most direct influence. As transfer professionals, we are familiar with a formalized transfer program so that is our focus here. However, we also summarize the associated principles to help landscape ecologists recognize and apply the principles and approaches outside a formal program.

The broad goal of this chapter is to systematically describe the elements of effective knowledge transfer that match important information with receptive learners who can use that information. Effective knowledge transfer is predicated on (1) engaging these learners in ways that make the educational content clearly relevant to their circumstances, (2) building alliances among individuals and organizations with shared goals, and (3) working to adapt both past experience and new knowledge to improve operational practice. The specific goals of this chapter are thus to suggest a common set of terms and definitions that describe the key elements of knowledge transfer; describe the key elements of successful knowledge transfer activities; illustrate the essential skills for developing, implementing, and evaluating

transfer activities; and describe some challenges of adapting knowledge transfer to changing circumstances.

8.2. DEFINITIONS OF KEY TERMS

Definitions of many of the key terms in the knowledge transfer process vary. To ensure consistency, we have chosen to define the terms that we will be using in this chapter as follows: *Knowledge transfer* includes any effort to deliver knowledge to someone who wishes to or needs to receive it, including the publication of research for use by the scientific and practitioner communities. Knowledge transfer is a precursor to *technology transfer*, which involves the transfer of the results of basic and applied research to the design, development, and commercialization of new or improved products, tools, services, or processes. In both cases, the recipients of this transfer are called the *audience*; other names include *clients*, *students*, or *customers*, but in this chapter, we will use only the more inclusive term. Others with an interest in the outcomes of the knowledge transfer, whether or not they are themselves part of the audience, are called *stakeholders*.

The overall knowledge transfer process is sometimes referred to as *extension*, particularly when the organization responsible for this task is based at an American Land Grant University, whose mission goes beyond educating the university's students. When the knowledge or technology transfer is part of an organized approach, we have used the term *program*. A program is more than a specific activity; rather, it includes an assortment of activities, associated materials, and learning activities related to a specific topic or educational goal.

8.3. A COMMON PHILOSOPHICAL FOUNDATION

The philosophy of knowledge transfer rests on a common foundation, with three main dimensions, defined here and expanded below:

- Engagement: Audiences must be engaged in (involved in) customizing their learning experience.
- Relationships: Transfer occurs via human interactions among individuals, their communities, and their respective organizations.
- Scholarship: High-quality knowledge transfer activities must meet a high standard of excellence, and thus must incorporate some measure of peer review and validation and the possibility of replication by others.

8.3.1. Engagement

As defined by the Kellogg Commission (1998), *engagement* involves the audience as an active participant in the learning experience. This involvement takes several forms, including actively defining the issues and problems and interacting with the

educators (transfer specialists) to enhance knowledge transfer and establish a co-learning environment in which both the educator and the audience benefit. Engagement enriches the learning experience by enhancing opportunities for researchers to develop active relationships with their audience.

Several factors can enhance the level of engagement in support of successful transfer: responsiveness, respect for audience, neutrality, accessibility, integration, coordination, and resource partnerships. These are described in more detail below, and those that may be more relevant to programs are identified.

8.3.1.1. Responsiveness

Those conducting transfer, be they researchers or transfer specialists, can promote engagement by being responsive to their audience and thereby ensuring that transfer activities are relevant. A responsive transfer program or activity asks the right questions, offers effective and timely services, and engages with the audience in the following ways:

- It asks questions that help define the real problems and the real constraints on solving those problems.
- It offers services in a useful format and at the appropriate time.
- It ensures that communications are clear.
- It requests input from stakeholders.
- It invests in open discussions to best understand the dimensions of the problem or issue.
- It understands that by reaching out, valuable information for program development will be obtained.

8.3.1.2. Respect for Audience

The fundamental purpose of engagement is not to provide the researcher's or transfer specialist's superior expertise to a less-competent audience, but rather to encourage joint definition of problems, solutions, and criteria for success. In essence, this means respecting the audience. Respect for an audience is shown by:

- Genuinely expressing appreciation and respect for the skills and capacities of partners in collaborative projects.
- Involving those people who will be affected by our decisions and any program that results from these decisions.
- Showing that we have as much to learn as we have to offer.

8.3.1.3. Neutrality

Of necessity, some of our transfer activities will involve contentious issues, for which multiple "right" answers exist. Remaining objective and offering alternative

solutions often best meets audience needs because it allows the transfer specialist to act as a neutral arbitrator between the various stakeholders. Neutrality includes:

- Maintaining our role as an unbiased facilitator of learning and consideration of alternatives.
- Managing an environment in which participants feel comfortable exchanging ideas.

Although the principles outlined below refer primarily to more formal transfer programs, the underlying principles also are relevant to those contemplating less formal transfer activities.

8.3.1.4. Accessibility

The institutions created by transfer specialists are often confusing to outsiders. To resolve this confusion, we need to find ways to help inexperienced audiences understand and negotiate complex structures so that what we have to offer is readily available. To gauge accessibility, we should consider:

- Wide and appropriate publicity of activities and resources.
- Accommodation of those with special access needs.
- Offering a variety of formats to ensure participation.

8.3.1.5. Integration

We must find a way to integrate our service with our audience (and the public, if they are not formally part of that audience), as our responsibility is to develop and share our intellectual capital. This is best accomplished by fitting transfer efforts into existing systems through integration. To succeed, the institutional climate should foster outreach, service, and engagement. A commitment to interdisciplinary and interorganizational work is indispensable within an integrated approach. Integration considers:

- Incentives that are useful in encouraging researchers, transfer specialists and audiences to effectively engage.
- Respected and senior staff leaders not only participate but serve as advocates for knowledge transfer.
- Enlistment of other organizations or individuals who can contribute to the process.

8.3.1.6. Coordination

When integration is achieved, coordination becomes an issue: someone must take responsibility for ensuring that all parties are involved, cooperative, and aware of the

efforts of the other parties. The task of coordinating activities—whether through serving a management role, creating advisory councils, or providing thematic structures such as multidisciplinary institutes or centers—clearly requires considerable attention. Appropriate coordination means:

- Parties are dealing with each other productively.
- The goal of engagement is understood.
- The need for any party to develop knowledge transfer skills is recognized and addressed.

8.3.1.7. Resource Partnerships

The final test asks whether the resources committed to the task are sufficient. Engagement is not free; the time and effort of participants and the development and implementation of activities all have costs. The most successful engagement efforts are associated with strong and healthy partnerships that ensure the availability of appropriate resources. This adequacy of resources is evaluated by:

- Availability of funding.
- Potential for corporate sponsorship and investment.
- Potential for alliances and strategic partnerships to be formed between government and industry.
- Determining whether new fee structures can be developed for delivery of services.

8.3.2. Relationships

Building relationships is an inevitable outgrowth of engagement. There are several reasons why recognizing and consciously promoting relationships makes sense. First, the involvement of multiple individuals and organizations increases visibility of the issue. This may help to draw additional stakeholders into the learning environment. Second, partnerships, by their nature, lead to commitments that can promote organizational action that, in their absence, might only become rhetoric. Third, the base of skills and resources available to address a problem often increases due to the skills and energy of the additional members.

These relationships are a key factor in expanding a sense of ownership and commitment to working together on common issues. The nature of the relationships may be characterized in several ways:

- Communities: Increased interest in a challenge such as ecosystem management emphasizes the need to engage multiple stakeholders and include the communities within various geographic regions (such as watersheds) in the development and implementation of sustainable management practices for the benefit of the ecosystem and the stakeholders.

- Other institutions: The effectiveness of problem-solving is enhanced by establishing partnerships with other organizations that can provide the benefits of increased scope and scale. The private sector is particularly able to adapt and expand technology transfer to produce marketable products with economic benefits.
- Teams: Few contemporary problems are simple enough to be addressed by a single specialist. Therefore, knowledge transfer activities are enhanced by encouraging the formation of teams that combine the strengths of several disciplines to bolster the content, design, and delivery of one or more activities.
- Stakeholders: Many organizations and individuals share an interest in the success of transfer activities. Involvement of these stakeholders reinforces their mutual concern and their investment of energy, time, and resources.

Distinguishing different types of linkages contributes to understanding the nature of various relationships and the expectations of each participant. These linkages can be defined in terms of three levels of increasing complexity and engagement: cooperation, collaboration, and partnership (Table 8.1), ranging from low-risk or no-risk relationships to fully interdependent linkages (Hogue and Miller 2000). Each has a different purpose, structure, and process for accomplishing its goals (Bergstrom et al. 1996).

8.3.2.1. Cooperation

Cooperation is the least-demanding form of linkage; in its simplest form, it may involve nothing more complex than an informal agreement to avoid interference with each cooperator's goals and activities. However, a true cooperative relationship typically involves sharing of an activity, campaign, or event between organizations as a result of an invitation from one organization to another. The request is seen as consistent with that organization's mission, values, and goals.

Management of the cooperative structure is centralized by means of an informal or semiformal coordinating body. Communication is somewhat centralized and

Table 8.1. Summary of the three main levels of linkage among knowledge transfer participants showing increasing complexity, from cooperation to partnership

Main levels of linkage		
Cooperation	Collaboration	Partnership
• Shared activity at the request of one organization	• Overlapping missions	• A new entity in which former organizational identities are deemphasized
• Relatively short-term; informally defined roles	• Shared resources; active teamwork	• High levels of trust and integration of activities
• Defined, short-term, informal or semiformal organizational arrangement	• Formal relationship defined at high levels	• Decisions by consensus

formal, as group members generally have little or no history of working together. To accomplish the cooperative's intended goals, group members either provide money from their own organizations, or undertake a communitywide fundraising effort.

The process used in this type of linkage is relatively simple. At the beginning of the activity planning, group members select one or two leaders. These leaders allow group members to make numerous interconnected decisions for a range of tasks. The leaders also strive to reduce interpersonal conflicts within the group. Once an activity or program has been completed, the cooperative disbands.

8.3.2.2. Collaboration

In a collaborative relationship, the participating organizations share resources rather than just an activity, use the existing resource base to create new resources, and develop new bases of support that benefit the participating organizations as well as the collaboration itself (Bergstrom et al. 1996). The missions of the organizations generally overlap to some extent, and the partners accomplish the mutual portion of their missions through joint planning. Ownership and credit for the activities is shared equally. This type of linkage is less common than simple cooperation because of the perceived or real relinquishment of each organization's unique identity.

A collaboration is best made operational through prenegotiation and written understandings, and is thus more formal than a cooperative. The structure, including roles, responsibilities, and decisionmaking criteria, is formally defined. Because the collaboration uses significant resources from the parent organizations, the people at the hub of the collaboration are generally higher-level decisionmakers. Most collaborations create a joint budget from newly developed and existing resources. Members communicate frequently and clearly through formal hierarchical channels. Decisionmaking can take place at multiple, previously agreed-upon levels. The collaboration leaders often act independently of their primary organization.

8.3.2.3. Partnership

True partnerships are relatively rare. In this relationship, the participating groups create a new system, with the identities of the individual organizations being subsumed into a new entity. True partnerships are trust-based; partners do not disadvantage each other. Even though a new organization is formed, the history and culture of the parent organizations is still valued and their strengths are encouraged to flourish. The purpose of a true partnership is to work toward a shared vision and mission with tangible results and identifiable impacts. The participating groups develop sophisticated and interdependent systems of ongoing support, including funding, staffing, and operations. Consensus is the preferred decisionmaking method. The relationship is formalized by means of memoranda of understanding and often by statutes that ensure a nonprofit operating structure. The newly formed organization defines work plans and assignments, prescribes roles and responsibilities, and specifies reporting and evaluation criteria.

The nature of a true partnership ensures high levels of trust and productivity. Innovative leadership is the norm. The internal processes of this type of linkage are highly developed and productive, with ideas and decisions being shared equally.

The challenge for those undertaking transfer activities is to consciously choose the level of engagement (cooperation, collaboration, partnership) that best suits a given situation and set of transfer objectives.

8.3.3. Scholarship

Effective knowledge transfer is best done by skilled professionals who have specialized credentials and experience in the design, delivery, and evaluation of knowledge transfer activities. Few academic institutions provide students with coursework designed to produce transfer professionals. Many of our colleagues working in this field have developed their abilities through active involvement in knowledge transfer activities and by developing working relationships with more experienced mentors. Regardless of how their skills are obtained, knowledge transfer professionals learn to plan for desired outcomes, accommodate the attributes of the audience, and implement known instructional design principles. Others contemplating transfer activities can learn from their experiences.

The simplest goal of scholarship is to produce activities and products of high "quality," but quality must be defined. The traditional culture of the research community is that results are exposed to the scrutiny of peers. The resulting peer-reviewed information is generally regarded as having met a higher standard than would be the case if the individual researcher simply provided their own interpretations and conclusions. An even higher standard involves peer-refereeing, in which the referees have the option of declaring certain results unpublishable or certain conclusions indefensible because of deficiencies in the methodology or rigor of the study.

Most current thinking about scholarly work related to knowledge transfer activities springs from the work of Boyer (1990), who argued for a significant expansion of simple research (the "scholarship of discovery"). At Oregon State University, for example, scholarship is required from faculty members who wish to establish tenure and be promoted to higher faculty ranks (OSU 2002). The same expectation applies to teachers, transfer professionals, and researchers who are asked to (1) create something that is new or innovative, (2) accomplish validation of its quality through peers, and (3) appropriately share and archive the contribution to ensure access to it by other scholars.

Among the attributes of university-based knowledge transfer personnel is the expectation that a scholarly approach will strengthen the design, delivery, and evaluation of educational activities. To support these goals, Oregon State University has developed a simple, three-part definition of scholarship that includes the creation of something new or innovative, validation of the results by peers, and appropriate documentation and archiving of the results. Opportunities exist to better define scholarly activities that would advance the concept of engagement and for others contemplating knowledge transfer to learn from these.

8.4. AN EMPOWERING ENVIRONMENT

Whether the organization involved in knowledge transfer is public or private, certain features help to support a durable commitment to the knowledge transfer function: making it a policy choice for organizations and a conscious choice for individuals, ensuring dedicated funding, allowing organizational flexibility, being accountable for and evaluating outcomes, and hiring skilled professionals or acquiring relevant skills. Although the discussion in the remainder of this section refers mainly to formal programs, once again the principles apply to those engaging in knowledge transfer activities outside a formal program.

8.4.1. Knowledge Transfer Is a Choice

Knowledge transfer is one approach to stimulating the behavioral changes required to achieve some goal, such as applying research knowledge or improving the public welfare. Figure 8.1 illustrates how social goals combine with audience characteristics to inform a policy or activity such as education, technical assistance, or regulation. Programs undertake knowledge transfer to achieve desired results. Evaluation of the returns on such investments may be considered in classical terms of efficiency (i.e., return on investment) and equity (i.e., the extent to which benefits are shared among stakeholders).

8.4.2. It Requires Both Stability of Funds and Nimbleness

A durable institutional commitment provides stability of funding over a relatively long period of time, allowing participants to maintain ongoing relationships with their audience. Such a commitment allows for ongoing professional development and the refinement of a knowledge base through the associated development of

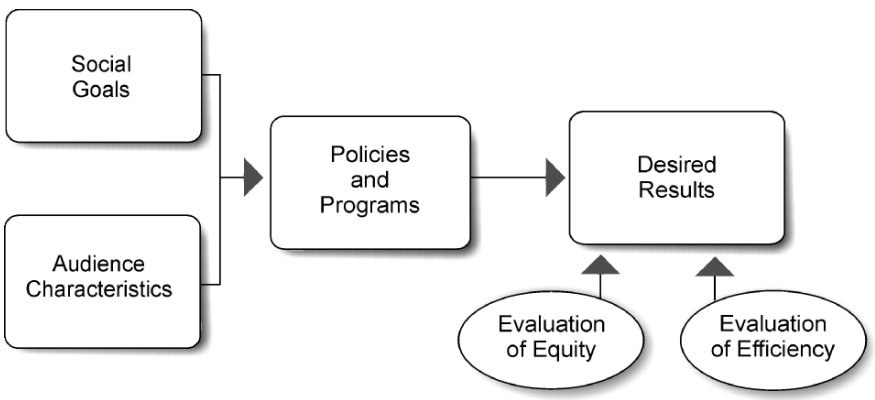

Figure 8.1. The interaction of social goals and audience characteristics to shape policy and produce the desired results. Transfer occurs between the boxes.

knowledge. However, many educational issues that require additional knowledge are more critical and shorter-term in nature, and these can often be difficult to fund from the more durable, long-term kind of funding. Thus, the organization must be able to attract new fixed-term resources that permit immediate attention to the problem, or must be sufficiently nimble to reallocate funds as well as effort to deal with these problems. Leveraging long-term resources allows a more nimble response to short-term, high priority needs. This combination of a commitment to sustained provision of resources for fundamental activities while permitting nimbleness in response to emerging issues ensures both support for long-term transfer projects and responsiveness to unforeseen transfer needs.

8.4.3. There Are Structural Implications

Knowledge transfer organizations must learn to apply the benefits of long-term resources and short-term flexibility to create an organizational structure capable of making progress on critical long-term problems that face their audiences, yet without preventing responses to unexpected problems. The ease of organizational change is influenced by the rigidity of the organization itself. Characteristics that support a more adaptable organization include active use of strategic planning to implement new initiatives, routine deployment of special project teams when necessary, and allowing for creative adaptation and flexibility in setting work priorities.

8.4.4. Accountability and Evaluation Are Included

Organizations and individuals are increasingly asked to account for their use of the resources and support provided by various stakeholders. Ongoing use of performance-based metrics helps to build confidence in and support for the knowledge transfer organization. Measures of accomplishment can be characterized as inputs, outputs, and outcomes. *Inputs* are measures of the amount of resources, including worker time and funds, that have been invested. *Outputs* describe the knowledge transfer activities, the people reached, and their initial reactions to the activities. *Outcomes* describe the social, environmental, or economic impacts of these outputs, and are regarded as the most powerful evidence of success. However, they also are usually the most difficult metric to produce. Evaluation is necessary both for accountability purposes and for continuous improvement of the effectiveness of transfer efforts.

8.4.5. Skilled Professionals Are Hired and Supported

Research and knowledge transfer require different skills. Individual researchers are expected to be expert in their area of research, but are not expected to have advanced knowledge transfer skills in addition to the required research competencies. These skills *can* be learned, and many gifted knowledge transfer professionals develop expertise in research, knowledge transfer, and application of the knowledge.

However the necessary skills are obtained, successful and effective knowledge transfer requires the organization to hire (or train) skilled professionals, and to provide them with the support they require to apply their skills. Suitable individuals possess the following characteristics, summarized here and outlined in more detail below:

- awareness of the roles within the knowledge transfer system
- appropriate knowledge of discipline
- knowledge of instructional-design tools
- exceptional interpersonal communication skills, and
- personal character traits that enhance knowledge transfer

8.4.5.1. Awareness of the Roles within the Knowledge Transfer System

Researchers generate knowledge that practitioners will want to use. They may transfer their own knowledge or work with knowledge transfer professionals whose role is to facilitate the exchange of knowledge between those who create it and those who will use it.

An example illustrates the interactions among these various roles: A group of researchers studied the effects of six alternative management scenarios on forest succession. They developed the study methods, created the simulation approach, obtained the necessary input data, analyzed the model outputs, and discussed the results—all classic researcher roles. When they published the results in the research journal *Landscape Ecology* (Gustafson et al. 2004), they began the transfer of knowledge to the scientific community, and ultimately to the people in the field who could benefit from their work. The researchers can choose to continue the knowledge transfer process themselves, can seek assistance from skilled professionals who will share the responsibility, or can return to the research arena and hope that the published information will eventually be picked up and used by practitioners. The knowledge transfer specialist can take on the role of facilitating the first option, of performing the second option, or of persuading the researchers that the third option is not the most effective approach.

8.4.5.2. Appropriate Knowledge of a Discipline

Knowledge transfer requires an understanding of the discipline underlying what is being transferred. However, the ability to integrate and synthesize information from multiple sources and disciplines may be more important than deep expertise in a single subject. Subject-matter expertise must also be combined with expertise in the delivery of transfer activities.

Knowledge transfer professionals benefit from grounding in several fields and from understanding the concepts and methodologies of systems-based thinking to address complex situations. Rather than reducing a complex situation into its simplest parts, a systems approach to thinking about problems recognizes and attempts to deal with the complexity of the whole. This ability to conceptualize the big

picture helps audience members to develop new ways of thinking about problems (Patterson 1991). It also presents opportunities for spontaneous innovations that can advance the field. These breakthroughs can occur when audience members from different disciplines engage in collaborative thinking and conversation about the desired outcomes, or when the systems thinking triggers a "eureka" moment in a participant (DeYoe and Hollstedt 2003).

8.4.5.3. Knowledge of Instructional-Design Tools

In the context of most forestry problems, knowledge transfer involves adult education. To succeed in this type of education, transfer specialists must understand who the learners are, what they need to learn, and how they learn (Norland 2003). Understanding current theories of adult learning helps in planning, implementing, and evaluating activities. Knowledge transfer thus depends on delivering high-quality, timely educational experiences tailored to the needs and abilities of adult learners (Reed 1999). Patterson (1991) argues that professionals should have thorough understanding of their own learning processes so they can best facilitate the learning of others. The term "autonomous learner" encompasses this concept by defining a professional who possesses both subject-matter expertise and the ability to manage information and new experiences so as to solve problems and make decisions. The transfer specialist requires keen diagnostic skills to ascertain the audience's learning needs, an ability to respond quickly to changing situations, and a predisposition toward encouraging knowledge "exchange."

8.4.5.4. Exceptional Interpersonal Communications Skills

Effective communication is the core characteristic of a knowledge transfer professional. Talented communicators understand people and have learned to get the message across in ways that enable their audience to learn. Transfer specialists have knowledge of a variety of interpersonal and public communication techniques, and can adapt them to suit each learner's needs. They are attuned to people and their environment, and can communicate effectively both orally and in writing with individuals, small groups, and large groups. Active listening is one of the most useful communication tools in their repertoire, as this approach acknowledges the dual roles of learner and teacher (CRC 1998).

8.4.5.5. Personal Character Traits that Enhance Knowledge Transfer

Certain character traits distinguish the most effective knowledge transfer professionals. As experts, they are dependable, fair, honest, and trustworthy, and demonstrate strong teamwork and people skills. They respond promptly to audience needs. As a result, they are highly credible and are respected for their knowledge. They also appreciate the difference between knowledge and wisdom: knowledge is something learned, but wisdom is knowledge that has been tempered by the test of time and

real-world application (Fletcher 1999). They stay current in their fields, and ensure that their activities evolve to meet changing audience needs. They are enthusiastically committed to their subject and to the knowledge transfer process, maintain positive attitudes, and are accepted by their audience as trusted partners, and perhaps even friends (Cooper and Graham 2001). They exhibit genuine customer-service ethics, and deeply wish to improve the public good.

Skilled knowledge transfer professionals engender trust, both through communication skills and through commitment to developing and maintaining ongoing working relationships with an audience. They respect an audience's skills, experiences, and knowledge. The long-term allegiances that result are one of the distinguishing characteristics of successful knowledge transfer.

Such knowledge transfer professionals can make an incredible contribution to science, target audiences, and the public good. The following example illustrates the breadth, depth, diversity, and range of one university-based knowledge transfer specialist who has worked as an extension forester for 19 years. In terms of knowledge transfer, this person has organized 375 events that attracted more than 20 000 participants, and has provided informal, one-on-one assistance to more than 12 000 individuals. In terms of research and scholarship, he initiated three research studies, and authored or coauthored 33 extension publications plus 13 scientific papers. In terms of grants and contracts, the person was the principal investigator or coinvestigator in 17 competitive grants, and enabled the donation of a 120-acre forest property for a total of USD$340 500. Additional tangible impacts of this activity include the fact that two decades ago, most landowners viewed red alder trees (*Alnus rubra*) as unmarketable. As a result of this extension forester's red alder research, this tree is now managed as a commercially valuable species. This knowledge transfer specialist organized a Christmas tree marketing association; more than 40 growers pooled their resources, resulting in $600 000 in farm gate sales. He played a key role in the development and delivery of the original Master Woodland Manager program, which has expanded to 20 states and 10 countries, underscoring the importance of persistence and long-term commitment for successful transfer.

8.5. EFFECTIVE PROGRAM- OR ACTIVITY-DESIGN PRINCIPLES

What constitutes "best practices" in knowledge transfer? The three fundamental attributes are that the program or activity is learner-centric, relies on credible research-based information, and is followed by a rigorous evaluation to ensure continuous improvement.

8.5.1. Learner-Centric Education

Effective knowledge transfer does not focus on what the educator wants to teach; it focuses on what the learner needs in order to develop appropriate knowledge, skills, attitudes, and behaviors. The best activities or programs happen when the audience

and the knowledge transfer professional freely exchange information, experiences, and problem-solving insights. As illustrated in Figure 8.2 and expanded below, the essential steps in developing learner-centric education are to identify audience needs, create a positive learning environment, incorporate a range of teaching modalities to accommodate different learning styles, adapt to the independent, self-directed nature of adult learners, adopt a minimalist philosophy, and document personal and group achievements.

8.5.1.1. Identify Audience Needs

Excellent knowledge transfer begins with identifying the issues (DeYoe and Hollstedt 2003). The philosophical foundations of engagement and relationships consistently present opportunities for input from audiences. Knowledge transfer specialists are committed to learning about the audience's perceptions of issues and trends, their current needs for educational activities, and what they might wish to see offered in the near future (Reichenbach and Simon-Brown 2002).

Approaches for identifying audience needs can be proposed by stakeholders, policymakers, researchers, and knowledge transfer professionals. Informal ways of garnering information include individual telephone calls, taking advantage of unplanned encounters, or responding to unsolicited e-mails from an audience member. Focus groups, interviews, and surveys comprise more formal inquiry methods.

Stakeholders may be engaged on a one-time basis, or may be part of established, semipermanent advisory or working committees (Johnson 2003). Addressing

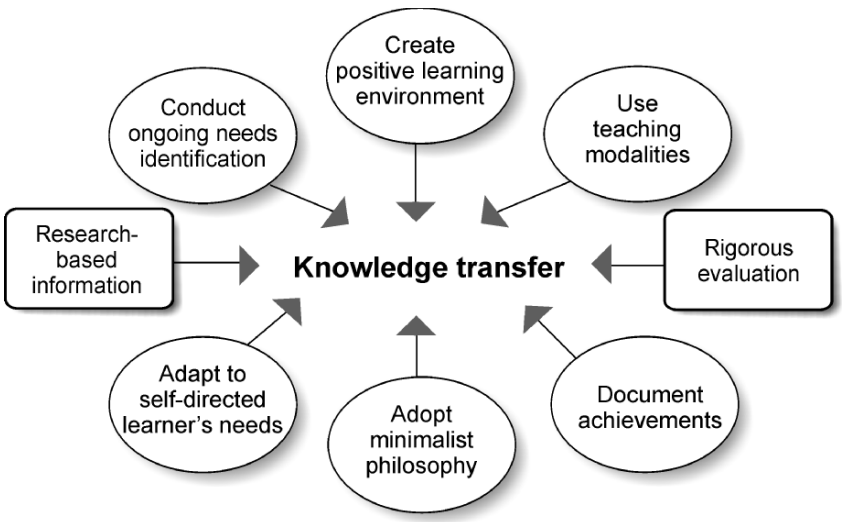

Figure 8.2. The essential components of knowledge transfer process.

the needs of both categories of stakeholder increases the likelihood of the activity meeting the audience's needs. With existing audiences, stakeholders should be involved in the entire design process from needs assessment through implementation and evaluation (Johnson 2003).

This approach works well with known audiences, but it is far more difficult to connect with new audiences to address their emerging issues. Identifying and contacting interest groups, corporations, professional and nonprofit organizations, resource users, community and political leaders, and other education professionals are effective means of expanding beyond the traditional audience base.

This ongoing effort to identify the needs of the audience can reveal additional issues requiring transfer. In that situation, prioritizing new requests for activities becomes necessary, since human and financial resources are limited. This step involves careful scrutiny—analyzing strengths, weaknesses, opportunities, and threats (SWOT)—and an internal assessment that revisits the organization's philosophical foundations and ensures that its strategic goals and activities are consistent; this scrutiny can help direct the group's energies (Simon-Brown 1999). As well, distinguishing between what audiences say they want and what they actually need is an important skill, and this scrutiny can help to set transfer priorities.

8.5.1.2. Create a Positive Learning Environment

Creating a safe and motivating intellectual environment for a thoughtful exploration of knowledge is the key to personalizing learning. To do so, we must consciously think about the needs of the learners. Physical well-being is similarly important. For example, if the audience is attending after-work classes, then comfortable seating, access to refreshments, and appropriate class durations (neither too long nor too short) all become important components of the knowledge transfer. For American contexts, meeting the spirit as well as the letter of the law of the Americans with Disabilities Act (ADA) is also crucial (Simon-Brown 1999); even where no such legislation exists, we should honor the spirit of accommodating the range of needs of all audience members.

Adult learners arrive with broad and diverse sets of prior knowledge, values, beliefs, and life experiences—both positive and negative—that influence their ability to learn (Norland 2003). For many adults, a teacher lecturing in front of a classroom is intimidating or patronizing. The positioning implies that the knowledge is being transferred in only one way—from teacher to student. Successful adult education attempts to minimize this perception by making the interaction more equal. This can be done by accounting for the participants' practical knowledge and by discussing what the participants know about the topic at the beginning of an activity. Doing so creates an exchange of knowledge and recognizes the contributions of each participant to the process, thereby facilitating the process of engagement, and enables the knowledge transfer professional to adapt the activities to the learners based on what was said. This enriches the learning experience for all.

"Train-the-trainer" or "near peer" education is another way to transfer knowledge in an environment acceptable to adult learners. The Oregon State University Cooperative Extension Service's Master Gardener and Master Woodland Manager programs are examples of this practice. Participants are taught in-depth, comprehensive information with the expectation that they will subsequently share their new knowledge with their peers. Currently, no such formalized programs appear to exist in landscape ecology.

8.5.1.3. Incorporate a Range of Teaching Modalities to Accommodate Different Learning Styles

People perceive and process information in different ways. Understanding these differences and incorporating methodologies that account for these different learning styles enhances knowledge transfer. In North America, lectures remain the dominant teaching method, even though it is believed that approximately half of the population has difficulty processing oral information (Simon-Brown 1999). Learning styles are defined as a biologically and developmentally imposed set of personal characteristics that make a given teaching method more effective for some than for others (Dunn et al. 1989; Dunn and Griggs 1988, cited in Reeb 2003). Learning *style* influences how a person learns best and should not be confused with the *ability* to learn. Various social scientists have developed models that propose auditory, visual, kinesthetic, and tactile learning modalities (Simon-Brown 1999).

To overcome the problem of different preferred styles and to stimulate retention, knowledge transfer professionals typically incorporate a variety of techniques in each session. These include hands-on activities; varying amounts of individual, small-group, and full-group work; practicing active listening; offering both practical and conceptual information; conducting field trips; encouraging journal-keeping and role-playing; and creating problem-solving teams. Most students take advantage of most or all learning modalities during learning, but to a different extent for each student and each modality (Reiff 1992, cited in Reeb 2003). An individual's dominant modality offers them the most efficient processing of new information, especially when the person is fatigued or under stress. However, taking advantage of a person's secondary modality enhances, clarifies, or supplements the dominant one, without interfering with it (Wislock 1993, cited in Reeb 2003).

8.5.1.4. Adapt to the Independent, Self-Directed Nature of Adult Learners

Most adult learners are self-directed problem-solvers. Such individuals may only be willing to learn concepts if it is clear to them that the concepts are a necessary step toward solving a problem that is important to them. Learning information for its own sake is not the norm; the information must be meaningful to them in their present situation. Adult learners will typically seek information when they need it, and should be encouraged to take charge of their own learning (Wise and Ezell 2003). Motivated

adult learners incorporate new information into what they already know to develop action-oriented solutions.

Electronic technologies can enhance the knowledge transfer professional's ability to accommodate the needs of these "just in time" learners. The tools of the trade can be synchronous or asynchronous. *Synchronous* (simultaneous) tools include teleconferencing, instant messaging, real-time Web work, and satellite linkages. These approaches offer the advantage of interactions between student and teacher and among the students, but may force students to participate at inconvenient times. *Asynchronous* (not simultaneous) approaches include non-real-time Web work, streaming video, e-mail discussion groups, virtual field trips, videoconferencing, cable TV, CDs, and DVDs, and can also be effective if they are designed according to the best practices for successful instructional design. These approaches offer the advantage of flexible training that can be delivered at the time most suitable for the student, but may reduce the ability for participants to interact.

8.5.1.5. Adopt a Minimalist Philosophy

One of the most difficult techniques for knowledge transfer professionals to master is referred to as minimalism (Carroll 1998), also called the "less is more" philosophy. It is more useful for learners to cover less information and to explore the meaning of that information than it is to rush them through a large amount of material (Norland 2003). Teaching the major concepts and then providing students with the "how to" tools that allow them to locate the specific information they need is one way to overcome the need to "tell all." Providing a myriad of optional in-depth background materials to support the primary knowledge transfer is another way to minimize nonessential instruction. Modeling is a third way in which knowledge transfer professionals can demonstrate the planning, organizational, and decisionmaking strategies that are being taught.

8.5.1.6. Document Personal and Group Achievements

Effective knowledge transfer acknowledges, formally and informally, the achievement of certain learning milestones. Documenting that learning has occurred by awarding certificates or credentials works well because these proofs of accomplishment are valued both within the educational setting and by the larger external community. Participants acquire a sense of accomplishment, but credentials also reinforce the value of and legitimize the knowledge transfer experience.

8.5.2. Credible Research-Based Information

Accurately communicating research information in ways that meet audience needs, without changing the fundamental nature of the information, is the crux of successful knowledge transfer. To maintain our legitimacy and the trust of our audience, knowledge transfer professionals must scrutinize the materials we produce to ensure

their credibility. Materials that have been formally and rigorously reviewed by peers, referees, and panels of scientists can generally be recommended. Scanning the research literature is a good way to subject research to a reality check: it provides a better grasp of the contextual framework for the issue (Adams and Hairston 1994) and insights into how well proven or accepted a conclusion may be. Moreover, maintaining a broad familiarity with research in a variety of fields allows the knowledge transfer specialist to integrate a wider spectrum of research results and provide a more holistic understanding of the subject matter (Krueger and Kelley 2000).

Credible research-based knowledge transfer activities are not prescriptive. Rather than telling the audience what to do, they offer a continuum of alternatives and a discussion of the consequences of each alternative; in addition, they provide diagnostic or decision-support tools that let the audience identify the advantages and drawbacks of each alternative, and make wiser decisions on this basis. The activities do not endorse one practice over another, but rather leave this decision to the audience. This key characteristic distinguishes education from advocacy.

Garland (1997) states that participants should be able to trust the information they receive and act on it to:

- learn about the available options and their consequences
- identify the relevant facts for each option
- distinguish among values, myths, opinions, and facts
- identify any personal values that are involved
- identify unknowns and variables
- use data to analyze individual situations
- define what success would look like for them

All of these principles should be incorporated into planned transfer activities.

8.5.3. Evaluation

Evaluation has various definitions. In this chapter, we use the term to describe the systematic collection, analysis, and reporting of information that can be used to improve programs or activities. Evaluation is also a continuous process of inquiry—a process of asking questions about the social, economic, and environmental conditions and circumstances within which knowledge transfer occurs. Evaluation helps to answer the following questions:

- Are my knowledge transfer efforts making a difference?
- What changes would make my efforts more effective?
- How can I refine future activities to achieve better results?
- To what extent is my audience using the information?

Knowledge transfer specialists can clearly benefit from a rigorous evaluation that answers these questions. In addition to improving future activities, the evaluation

data can raise more questions, which in turn lead to more research. The evaluation can also provide justification for additional research funding. From a management viewpoint, the results of the evaluation can be the basis for performance appraisals and for garnering support from stakeholders, including legislators and granting agencies.

A quick Web search will reveal dozens of methods for evaluating the effectiveness of knowledge transfer. Two standard tools for planning and assessing impacts are "logic models" and various versions of Bennett's hierarchy. A logic model visually displays the sequence of actions that describe what the activity is and what it will accomplish (Kellogg Foundation 2000). It is particularly effective in the natural resources arena since it directly links the problems (situations) to the interventions (inputs and outputs) and to the impacts (outcomes) (McCawley 2001). It illustrates the connections between available resources, activities carried out with audiences, the services delivered, and the intended results, as well as the long-term goal to which the activity contributes. As an evaluation tool, it helps to identify process and outcome indicators, highlight elements that will yield useful evaluation data, and select an appropriate sequence for collecting data and measuring progress (McCawley 2001).

Bennett's Hierarchy of Evidence (Bennett 1975) describes a series of staircase levels of evidence of program impacts (Figure 8.3). Beginning at the bottom step with inputs and progressing upwards to the end result, evidence of program impact

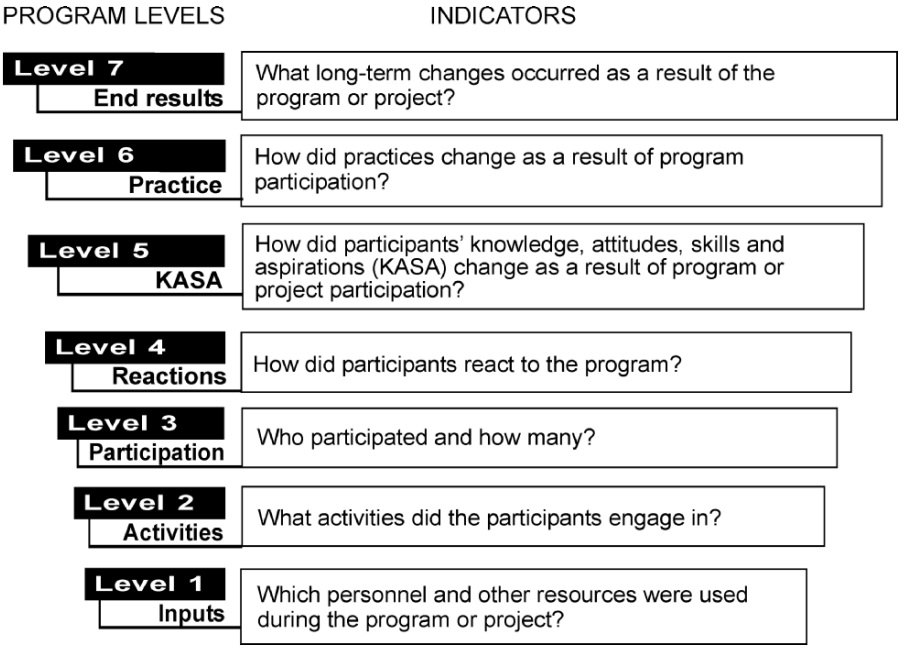

Figure 8.3. Bennett's hierarchy of evidence (Bennett 1975) provides a system for evaluating the impacts of transfer programs. Evaluation becomes progressively more reliable but also more costly (from levels 1 to 7).

at each ascending step is progressively more substantial and more reliable for decisionmaking, albeit more difficult, costly, and time-consuming to measure (Suvedi and Morford 2003).

A newer version of Bennett's Hierarchy, called Targeting Outcomes of Programs (TOP), includes a downward staircase that targets outcomes, tracks progress toward achieving these outcomes, and helps managers evaluate the degree to which activities affect the targeted social, economic, and environmental conditions (Bennett and Rockwell 1995).

Applying any of these methods following transfer activities helps to evaluate and to improve future knowledge transfer efforts.

8.6. SUMMARY AND ONGOING CHALLENGES

The various processes and approaches to knowledge transfer that have been described in this chapter are proven methods to successfully transfer knowledge to an audience. Additional considerations and ongoing challenges for transfer professionals and forest landscape ecologists seeking knowledge transfer success include the following:

- Strive to identify and engage new audiences, while building increasingly strong relationships with existing audiences.
- Seek new and emerging communication technologies that will let us match our approaches to each audience member's needs and abilities. Monitor these options, and strive to provide a diverse mix of approaches to reach more people, more effectively.
- Recognize that communication within and between organizations remains a challenge. Successful knowledge transfer organizations as well as individuals continue to build an increasing sense of community and teamwork.
- Recognize that learning is an ongoing activity throughout a professional's career, and that knowledge transfer activities are not complete just because a program is complete. Knowledge transfer will continue as new information and research results become available, and as feedback from audiences identifies problems with existing knowledge and new needs. Successful learning requires continuous engagement of the learner, and a two-way exchange of knowledge between the transfer specialist and the learner.
- Seek innovative sources of funding to ensure that important long-term programs can continue, while still providing the flexibility to fund short-term programs or activities that respond to sudden changes in conditions. In some cases, a user-pay model may be appropriate, particularly where this approach pays for the cost of an activity that might otherwise go unfunded.
- Evaluate transfer efforts, perhaps by investigating more rigorous ways to document the return on investment from an activity or program. Evaluations should focus on outcomes, and outcomes should be considered in three areas

(OSU 2004): progress toward achieving a program's goals, the benefits for the public good, and the benefits for the audience that has received the transferred knowledge.

- Since circumstances change, plan to periodically assess the situation and, if necessary, redirect efforts and resources. Planning should be both strategic, to cope with long-term situations, and tactical, to cope with short-term or sudden crises.
- Move beyond simple cooperation by striving for collaboration and, eventually, for full partnership.

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