

Tutorial: Transfer of Training or Generalization

(See Tutorials on [Social Perception](#); [Social Competence](#); [Friendship and Peer Acceptance](#))

WHAT IS TRANSFER OF TRAINING (GENERALIZATION)?

Transfer of training, or generalization, refers to the degree to which a learned behavior will be repeated correctly in a new situation, or a learned skill or principle will be applied in a new situation. Transfer is sometimes referred to as *generalization* or *carry-over*. In many respects, transfer is the most critical concept in teaching. However effective instruction might otherwise be if a learned behavior or skill does not transfer to relevant functional application contexts and/or is not maintained over time, then the instruction has failed.

Types of Transfer

Transfer can be understood as falling somewhere on four continuous dimensions:

- Near versus far transfer: *Near transfer* occurs when the training context and trained behavior are almost identical to the application context and application behavior. For example a student learns an arithmetic rule with problems on a worksheet and then applies the same rule in the same way on the same day to similar problems in a math workbook. However, he becomes confused when expected to use the rule in a word problem. With *far transfer*, the two situations are interestingly different. For example, the student who has learned a basic arithmetic rule proceeds to apply it later in a variety of word problems with no cues. Or knowledge of Spanish facilitates the learning of French. Far transfer (sometimes referred to as “high-road” transfer) often requires insight or judgment not required by near transfer.
- Specific versus general transfer: *Specific transfer* occurs when the contents of learning are transferred. For example, a student who is taught the basic organizational components of a narrative uses exactly those components later in writing an organized and elaborated story. In the case of *general transfer*, general skills or underlying principles are transferred. For example, the same student may recognize that there is an organized structure that needs to be imposed on other types of writing as well, not just stories.
- Surface versus deep transfer: In *surface transfer*, the student transfers learning to a similar set of circumstances. For example, having learned about the items present on a car dashboard, the student driver applies that learning to a different-looking dashboard. In *deep transfer*, the student might transfer that learning to an airplane dashboard that looks very different.
- Maintenance over time: *Maintenance* of a behavior or skill is a type of transfer. In this case, the learned skill or behavior is maintained from one time to another. In transfer experiments, maintenance is often tested one or more months after the original learning.

Transfer can also be positive or negative. In *positive transfer*, previous learning facilitates performance in the transfer task. In *negative transfer*, the opposite is the case: previous learning interferes with the transfer task. For example, students who have significant cognitive limitations and are concrete thinkers may be taught safe street crossing in their school gymnasium using masking tape on the floor to represent streets and pushed chairs to represent vehicles on the streets. Mastering the safe crossing tasks under those unreal stimulus conditions may actually interfere with learning safe street crossing on real streets with real vehicles. The stimulus-response associations learned in the gym may have to be “unlearned” before safe street crossing can be learned in the real world. For example, “Stop, look both ways” needs to be a learned response to real streets, not to masking tape on the gym floor.

The Importance of Transfer

In certain cases, transfer that is near, specific, surface, and maintained over time is adequate. This might be true of automatic motor acts like tying shoes, or basic academic skills like reading decoding and basic math facts. In other cases, transfer is most meaningful to the extent that it is far, general, deep, and

positive, and the learning is maintained over extended periods of time. For example, in a vocational training context, transfer is typically tested by determining if the trainee applies the learned skill in a variety of on-the-job tasks and if the skill is maintained several months later. Because hundreds of billions of dollars are spent annually on worker training and past studies have shown that failure of transfer from the training setting to the real job is common, employers are increasingly demanding that training yield measurable and meaningful transfer and maintenance (i.e., an adequate return on their investment). Furthermore, on-the-job training has grown in popularity because of the frequency with which out-of-context training fails to transfer to on-the-job performance.

Similarly, educational and clinical interventions are meaningful only to the extent that they yield reasonable transfer and maintenance. There was a time when special education consultants and related services providers in schools (i.e., occupational therapists, speech-language therapists, and the like) could justify their interventions by showing that the student improved on the therapists' specialized measures in their instructional settings. Fortunately, those days have passed in most schools. Increasingly the demand is for measures of improvement that show positive change on core academic tasks or everyday functional tasks in everyday settings. This demand is based on the frequency with which specific interventions have produced changes in behavior in the training settings, but then did not transfer to natural contexts and /or were not maintained over time. For example, a student may learn to produce grammatical sentences given the cues present in the speech-language therapy room, but return to agrammatical habits when back in the classroom, on the playground, or around peers. This observation is one of the reasons for special services being increasingly integrated with general education services in the schools.

Transfer of learning is difficult and therefore should not be assumed, even in the case of intelligent adults. For this reason, most training programs in applied fields (like teacher and therapist training programs) move systematically from classroom instruction to closely supervised application in student teaching or clinical practicum assignments, and then to increasingly independent application in real work settings, but with some degree of ongoing support. That is, transfer of learning is facilitated by this process of systematically decreasing supports and increasing the real-world nature of the application contexts. Thus, transfer of training is important for all students who must learn new information. Transfer should never be assumed, but rather systematically planned for in the design of teaching and training of new information, skills, and behaviors.

In addition, transfer is facilitated by teaching future practitioners using realistic case matter from the earliest stages of the training program. Increasingly, transfer is a focus of training programs from the beginning of training. Even experienced teachers and clinicians who have attended advanced training sessions often complain that they have difficulty transferring what they have learned back to their work situations despite a possible desire to do so.

WHY IS TRANSFER OF TRAINING IMPORTANT FOR MANY STUDENTS AFTER TBI?

Students who have experienced brain injury, especially damage to the vulnerable frontal lobes, are often more “stimulus bound” than other students. That is, their behavior tends to be controlled by the stimuli around them – the events and conditions under which they are currently operating. The terms “concrete thinker” and “concrete learner” are often applied to these students. Students who are stimulus bound or concrete thinkers in this sense may create concrete associations between what they are learning and the conditions under which they are learning it, which then interfere with transfer. As a result, these students need a special focus on transfer of training. **(See Tutorials on Learning Trials; Instructional Routines.)**

For example, if a middle or high school student with organizational impairment is taught to use advance organizers for reading and writing in a special education resource room using special education materials, it is unlikely that she will transfer these use those organizational supports to her in English or Social Studies classes where the same advance organizers need to be used. However, if the student is taught to use the advanced organizer supports in the context of her general education curricular materials and assignments, with possible cuing from all of her general education teachers, transfer is much more likely to occur.

Transfer is additionally important for students with TBI because they often receive their early rehabilitation in hospitals or clinics where the conditions and materials for training may bear little resemblance to the conditions and materials present in school or on the playground where the skills are required. Therefore, there exists a strong argument for making the environment of pediatric rehabilitation as natural (e.g., school-like) as possible and for using the student's educational tasks and materials in their rehabilitation activities. Using school materials in rehabilitation has the added effect of orienting the rehabilitation staff to the tasks and demands that the student will face when returning to school.

WHAT ARE THE MAIN FEATURES OF TEACHING OR TRAINING THAT ARE IMPORTANT FOR STUDENTS WHO HAVE DIFFICULTY TRANSFERRING?

Understanding the Problem

As always, the first task for teachers and parents is to correctly understand the problem. Difficulty transferring what has been learned can easily be misidentified as a behavioral problem. For example, a student who has learned a strategy in therapy but does not use it in class might be thought to lack motivation or to be manipulative. Alternatively, the student might be thought incorrectly to have a general intellectual problem that makes learning and transfer impossible. In most cases, difficulty transferring interacts with these other areas of functioning in complex ways. But it is important to recognize the role played by transfer problems and to implement training and instructional strategies specifically designed to address the transfer problem

Training and Instructional Strategies for Transfer of Training

Traditional theories of instruction have often presented a hierarchical or stage-wise approach to teaching or training: First, help the student to acquire the behavior or strategy in a controlled training context using specific training materials. Next, ensure that the student practices the behavior or strategy in the training context until it is produced fluently. Finally, implement transfer procedures so that the behavior or strategy is used in functional application contexts.

Assuming adequate emphasis on procedures used during the transfer stage, this approach to teaching is useful for many teaching targets, especially motor acts, like swinging a golf club or tennis racket. Unfortunately, the transfer stage has often been neglected in this hierarchical approach. Furthermore, investigators have shown that most behaviors and skills are best taught with a focus on transfer from the earliest stages of teaching.

Because of the theoretical challenges to the traditional model of transfer and the many studies that show that knowledge or skills taught out of context frequently fail to transfer to functional application contexts, an alternative model to enhance transfer of new skills has gained popularity in recent years. Within this alternative framework, teaching begins in meaningful contexts with functional application activities. Adequate supports are available to ensure that the student can be successful. Supports are gradually withdrawn as the student gains competence. From a behavioral perspective, the stimulus conditions that support the learning during acquisition of the behavior or skill are the same as application conditions; thus transfer is guaranteed. **(See Tutorials on Traditional Training versus Apprenticeship; Instructional Routines.)**

The following instructional strategies have been found to facilitate transfer:

1. Similarity of training and transfer/application tasks and contexts: Transfer is facilitated to the extent that there is similarity between the tasks and contexts that are part of the instruction, on the one hand, and the transfer or application tasks and contexts on the other. Thus it is valuable to use a variety of tasks and conditions during the instructional phase, with some of the tasks and conditions resembling application tasks and conditions as much as possible – or actually being application tasks in application settings.

Ideally transfer is facilitated from the beginning of training, rather than waiting for Phase 3 in the traditional three-phase hierarchy: acquire the skill - gain fluency in the skill - transfer the skill.

On the job training and context-sensitive coaching are examples of instruction that is sensitive to this condition of transfer. A respected rule in developmental disabilities instruction is that new behaviors or skills must be taught in at least three different settings, with at least three different people, and in the context of at least three different activities. **(See Tutorial on Traditional Training versus Apprenticeship)**

2. Ability to discriminate application opportunities: Transfer is facilitated to the extent that the learner knows when to use the behavior or when to apply the procedure or rule that has been learned. Thus parents and teachers should use many examples or illustrations of the behavior or rule in the teaching process and highlight what about that situation requires the behavior or procedure that is being learned. To facilitate discrimination, the training should include situations in which the new behavior or skill should not be used as well as situations in which it should be used.

For example, social skills instruction might include practice in telling jokes or teasing, but also practice in discriminating when not to tell jokes or tease. In addition, teaching might include discussion of when to apply the behavior or procedure in various application contexts, when not to apply it, and why there is a difference.

3. Organization of the instructional tasks: Transfer is facilitated to the extent that the instructional tasks are organized as much as possible like the application tasks. For example, this might mean learning the organization of narratives while reading and writing stories using the organizational supports. For teachers in training, this principle recommends acquiring teaching strategies in the context of case application, not strict pedagogy. **(See Tutorial on Errorless Learning)**

4. Practice to fluency or automaticity: Transfer is facilitated to the extent that the behavior or skill is practiced enough that it becomes automatic. For example, in the case of a student learning a basic skills like reading/decoding and arithmetic operations, the student will require a great deal of practice to make basic decoding skills and math operations automatic. Higher levels of reading comprehension will not be achieved without basic fluency in decoding. Similarly, higher levels of mathematical ability will not be achieved without making the basic facts and arithmetic operations (e.g., adding, subtracting, and the like) automatic.

5. Motivation to transfer: Transfer is facilitated to the extent that students know that it is important to transfer what they have learned to application contexts and they want to do so. For example, students should know that the knowledge or skill being taught will be required to learn a more advanced skill or on a future exam, and that the tasks might look somewhat different from what they have practiced. In addition, students should know that the knowledge or skill relates in some meaningful way to issues or activities that they consider important now or in the future.

6. Practice teaching others: Teachers often observe that they did not come to understand their subject matter fully until they were required to teach it. Similarly, students gain understanding of material they are learning when asked to explain or teach the material to other students or family members.

7. Goal setting and self-management strategies: With adult learners, transfer has been shown to be facilitated by engaging the learners in setting goals for themselves (including transfer goals) and participating in managing their learning. This participation can include identifying the difficulty level of tasks, creating plans or strategies to overcome the difficulties, setting goals, monitoring progress, self-reinforcing and the like. **(See Tutorial on Self-Regulation/Executive Functions)** These strategies have been shown to be useful for adolescent as well as adult learners.

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