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Demonstration-Based Training: A Review of Instructional Features

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Objective: This article reviews instructional features used in demonstration-based training (DBT).

Background: The need for fast and effective training and performance support that can be accessed from anywhere is a growing need for organizations. DBT programs are one method to address these needs, but a better understanding of how to maximize the effectiveness of DBT activities is needed. Specifically, beyond the content of the demonstration (i.e., the dynamic example of task performance), what instructional features (i.e., information and activities in addition to the demonstration) can be used to improve the effectiveness of DBT interventions?

Method: The authors conducted a systematic review of the applied and basic science literatures relevant to DBT.

Results: Instructional features in DBT can be categorized according to the degree to which they encourage active learner involvement (i.e., active vs. passive), when they occur relative to viewing the demonstration (i.e., pre-, during-, and postdemonstration conditions), and the observational learning process they are intended to augment. Five categories of instructional features are described: passive guidance or support, preparatory activities, concurrent activities, retrospective activities, and prospective activities.

Conclusion: There is a wide variety of instructional features used in DBT, but more systematic research is needed to understand the conditions under which each is most effective as well as to outline a method for sequencing of demonstration with other delivery methods, such as practice opportunities.

Application: The framework presented in this article can help guide the systematic development of training systems incorporating DBT as well as provide a direction for future research.

Keywords: training, observational learning, instructional design, demonstration-based training, demonstration, instructional systems

INTRODUCTION

To meet the demands of rapidly changing work environments and a fluid or mobile workforce, organizations have turned toward the use of flexible methods of training and performance support (e.g., Mosher & Nguyen, 2008). This trend has increased the need for a scientifically rooted understanding of how to maximize the effectiveness of methods such as demonstration-based training (DBT), a relatively adaptable method of providing training as well as performance-improving guidance on the job. However, just as practice alone does not make perfect (i.e., performing a task does not necessarily ensure learning takes place; Ehrenstein, Walker, Czerwinski, & Feldman, 1997; Kirschner, Sweller, & Clark, 2006), observation alone does not guarantee learning or transfer. Much is known about how the characteristics of the content and representational forms of demonstrations are linked to learning outcomes (e.g., Mayer, 2005); however, there is significantly less guidance available on the use of instructional features in the design and delivery of DBT. Instructional features in DBT consist of information or activities provided in addition to the demonstration itself (i.e., the dynamic example of task performance). These potentially represent inexpensive ways to increase the value of DBT opportunities. Although efforts have been made to address this lack of guidance for practice-based learning (e.g., Cannon-Bowers, Rhodenizer, Salas, & Bowers, 1998), instructional features in DBT have been relatively neglected by the science of training (Salas & Cannon-Bowers, 2001; Tannenbaum & Yukl, 1992).

To begin to address this gap, this article provides a review and synthesis of the literature pertaining to DBT with the ultimate purpose of facilitating the development of a coherent and theoretically based approach to the design of

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DBT systems. To that end, this article addresses four main goals. First, we provide a set of conceptual definitions of the core features of DBT. Second, we outline the theoretical foundations of DBT. Third, we present a categorization scheme for instructional features used DBT. Fourth, we review the research literature on instructional features in DBT. Additionally, we provide a discussion of future research needs for maximizing the design of training systems incorporating demonstrations.

KEY DEFINITIONS IN DEMONSTRATION-BASED TRAINING

In contrast to other areas of learning research and training design, little consensus in terminology exists regarding the components of DBT. This issue manifests itself in the broad range of terms frequently used interchangeably—or with different explicit or implicit meanings—across the scientific and training literatures (e.g., *observational learning*, *observational modeling*, *vicarious learning*, *social facilitation*, *social learning*, *behavior modeling*, *mimicry*, *matched-dependent behavior*; Shlechter & Anthony, 1996; Williams, Davids, & Williams, 1999). This variety of terms poses obvious and significant challenges for the accumulation of knowledge and guidance of practice.

In the practice-based learning and simulation-based training literatures, there are relatively clear definitions of and differentiations between (a) the overall approach, strategy, or method of training delivery (e.g., simulation-based training or event-based approach to training; Fowlkes, Dwyer, Oser, & Salas, 1998); (b) the specific training activities (i.e., a scenario or simulation; Salas, Priest, Wilson, & Burke, 2006); and (c) the additional instructional features that can be included in a training activity (i.e., prepractice conditions; Cannon-Bowers et al., 1998). These distinctions have helped bring clarity to the process of designing training programs as well as organizing and guiding research. Consequently, this section provides a parallel set of definitions based on these distinctions for DBT to frame the typology and review to follow.

Observational (or demonstration-based) learning is the process of acquiring knowledge, skills,

and attitudes (KSAs) through viewing examples of performance. Consequently, *demonstration-based training* is a strategy of training development and delivery involving the systematic design and use of observational stimuli intended to develop specific KSAs in the learner. During this process, the trainee observes another person or team performing the tasks, components of tasks (either in real time or through some form of recorded or computer-generated medium), or characteristics of the task environment related to the competencies targeted for training. The effectiveness of DBT as a strategy depends heavily on the characteristics of the observational stimuli (i.e., the demonstration itself) as well as on the instructional features included in the DBT activity. Thus, the discussion of DBT cannot move forward without an examination of these aspects of the strategy.

In DBT, learning opportunities consist of (a) a demonstration or demonstrations as well as (b) instructional features. A *demonstration* is a dynamic example of partial- or whole-task performance or of the characteristics of a task environment that illustrates (with video recording, modeling, or any visualization approach) the enactment of targeted KSAs. In efforts to improve the effectiveness of demonstrations as learning opportunities, instructional features can be added to the learning opportunity. In DBT, *instructional features* consist of *information* provided to learners or *activities* learners are presented with in addition to viewing the example of task performance.

This is analogous to prepractice conditions provided in simulation-based training programs (e.g., attentional advice, prepractice briefs, and advance organizers; Cannon-Bowers et al., 1998). For example, a learning activity for training skills in a mechanical repair task could consist of a video recording of the task being performed (i.e., the demonstration, a visualization of the targeted skills being enacted) accompanied by an instructional narrative or a handout detailing the procedure of the repair (i.e., instructional features; two examples of information provided to learners in addition to the demonstration). Additionally, learners can be required to engage in activities, such as note-taking exercises while watching the demonstration or setting goals for

their learning. These too are instructional features because they are demands placed on the learner in addition to watching the demonstration. Given the emphasis on active learning in adult training and education, the distinction between information provision (which can be a passive experience on the part of the learner) and activities (which require more active engagement from the learner) is an important one that will be expanded on more in following sections.

These instructional features are the focus of the review and categories presented in this article. First, a review of the theoretical basis of learning through the observation of demonstrations is provided.

THEORETICAL BASIS FOR DEMONSTRATION-BASED TRAINING

Observation has long been noted as a critical means of human learning, especially in social contexts (Heyes, 2001). Emerging work in the area of the mirror-neuron system suggests a strong link between physically passive observation and learning attributable to similarities in neural activation during observation and production of certain activities (e.g., Petrosini et al., 2003; Rizzolatti & Craighero, 2004). To design training systems that maximize learning outcomes through observational processes, DBT must be based on a scientific understanding of how people learn from observing. Instructional features will be effective only to the degree that they support these underlying learning processes. Therefore, this section reviews several topics related to human learning and observation that provide significant contributions to the understanding of demonstrations for the purposes of training.

Observational Learning

The theoretical rationale for behavior modeling (and the use of demonstration for the purposes of training) is born from Bandura's (1986) social cognitive theory. Social cognitive theory describes four observational learning processes: (a) attention (whereby learners must actively process what they are observing to learn), (b) retention (wherein what is observed must be stored symbolically to affect future behavior), (c) production

(whereby the stored symbolic knowledge must be reconverted into overt actions), and (d) motivation (whereby the perceived consequences of performing the observed behavior must be favorable enough to strengthen the likelihood of future performance). This theory has received much empirical attention, with the majority of research conducted under the general observational learning heading tending to involve lower-level motor tasks. Next, we briefly discuss each of the components of Bandura's theory.

Attention. Attention is the means by which an observer is able to extract information from the examples of performance regardless of the sensory mode of presentation. Attention is classically defined as picking one or more stimuli from a larger set of possible stimuli available for consideration. Essentially, attention represents a mechanism (or likely a set of mechanisms; Pashler, Johnston, & Ruthruff, 2001) that determines what information passes through the low-capacity cognitive processing stage (i.e., the bottleneck). Therefore, attention can be seen in terms of a selection mechanism that picks out "important" information in the sensory registers for further processing.

This process highlights the importance of cue or information salience within demonstrations; that is, observers must be able to focus attention on the intended content (the targeted KSAs) in the demonstration. Within motor learning research, it has been found that the most salient aspects of demonstrations are the relative spatial and temporal patterns of movement (Ashford, Davids, & Bennett, 2006). Observation aids the early stages of motor skill learning by providing this "relative motion" information that constrains the learner's attempts at reproducing the unfamiliar movement patterns. Because of inherent limitations in human attentional capacity, observers benefit from slower-than-real-time and repeated presentation of complex examples as well as from presentation of complex tasks in subdivided part-task sequences (Petrosini et al., 2003).

Retention. Bandura's theory posits that observations are transformed into symbolic codes stored in memory. The strength of this memory trace is increased through processes of

cognitive rehearsal (also called mental practice, symbolic rehearsal, and introspective or covert rehearsal). Cognitive rehearsal refers to the activation of the stored symbolic information in the absence of overt task performance. Baddeley's (1997) model of working memory (WM) describes how objects of attention can transition from short-term to long-term memory (LTM) and therefore provides insight into the observational learning process. WM consists of multiple stores where information can be held for processing (e.g., decision making, action selection, problem solving). This is not a long-term storage mechanism but serves to keep the information relevant to the task at hand fresh and readily accessible. The means by which information that is attended to while viewing a demonstration becomes stored in LTM is central to designing effective demonstrations. Therefore, the major features of WM are discussed next.

There are four major components to the most widely accepted model of WM: the central executive, the phonological loop, the visuospatial sketchpad, and the episodic buffer (Baddeley, 1997). The central executive determines what information goes to which store. The phonological loop retains phonologically coded information (e.g., words) and consists of a phonological store and a rehearsal mechanism. The store can accommodate only a limited number of items (Oberauer, 2006). Information in the phonological store decays at a constant rate but can be held in the store longer by being reactivated through the process of rehearsal. The visuospatial sketchpad serves a similar function with visual and spatial information, which are thought to be treated separately. Here too, information is held in a store with a constant decay rate, and rehearsal is used to reactivate the contents of this store. The episodic buffer serves as an interface between the contents of WM (i.e., what is in the phonological loop and the visuospatial sketchpad) both between the stores (cross-coding) and between the contents of WM and the contents of LTM. With increased rehearsal in WM, information is more likely to be stored permanently in LTM. The contents of the WM stores can also be compared or used as retrieval cues to the contents of LTM through the episodic buffer. So, the episodic buffer serves to integrate the contents of

the different stores from different streams of separately coded information (i.e., either phonetically or visuospatially) to united "episodes" as well as to retrieve related information from LTM.

The symbolic mental representations are accessed at a later time and are used to guide future performance. In motor learning research, the degree to which information extracted through observation is stored as symbolic structures or as simple motor patterns is an issue of intense debate (e.g., Ferrari, 1996; Scully & Carnegie, 1998). However, for the acquisition of more cognitive KSAs, the idea of symbolic storage of memories is the most useful explanatory mechanism. Just as mental practice has been shown to increase performance (Driskell, Copper, & Moran, 1994), mental practice is a key method for increasing the retention of mental representations acquired during DBT.

Production. Production involves performance of the observed behavior. An individual recalls the symbolically stored information extracted by means of attentional processes from the time spent observing performance. This recalled information serves as a guide to producing behavior as well as a means to self-evaluate performance (Ferrari, 1996). Therefore, skill acquisition and production are intertwined as the model of performance acquired during observation is reconverted into behavior, which is evaluated in reference to the model of performance acquired during observation (Gray, Neisser, Shapiro, & Kouns, 1991).

In the present context of training design, production is relevant in two capacities: as practice activities and as transfer to the job. Transfer will be discussed in later sections of this article where propositions relating demonstration features to learning outcomes are presented. The literature dealing with simulation-based training and on-the-job training thoroughly address issues of production and practice, which will therefore not be a primary consideration in this article. However, the effectiveness of an overall training system is a function of not merely how well each component is individually maximized but how they are combined. For example, demonstrations can be interlaced with practice episodes for increased effectiveness. Shebilske, Gildea, Freeman, and Levchuk (2006) found

that demonstrations can be used effectively in iterative cycles of practice and demonstrations in which examples of “near-optimal” performance are used as feedback. Additionally, Baggett (1987) found that longer-term retention was better for individuals who performed practice episodes first and subsequently were shown a demonstration of how to perform the task. There is a need to further explore how to best include demonstrations and practice episodes in the larger training system.

Motivation. Motivation in the context of training has been defined as the intensity, valence, and persistence of learning-directed behaviors (Colquitt, LePine, & Noe, 2000; Kanfer, 1991). Motivational processes are a critical aspect for learning in general (Colquitt et al., 2000), and learning through observation is no exception. Most fundamentally, a learner must be motivated to reproduce the KSAs of the example, or learning will not occur. The observer’s attention, retention, and production processes are driven by his or her level of motivation. For example, it has also been shown that the social status of the model (i.e., the person exhibiting performance in the demonstration) is an important determinant of learning outcomes. McCullagh (1986) found that individuals viewing demonstrations performed by high-status individuals had higher levels of performance (but not of knowledge retained) than did individuals viewing demonstrations performed by lower-status individuals and concluded that learners’ production processes were influenced by higher levels of motivation associated with viewing high-status individuals.

Bandura’s (1986) social learning theory provides a strong theoretical basis for understanding the process of learning from demonstrations. In the following section, an overview of applications of social learning theory to training is provided.

Applications of Social Learning Theory

Social learning theory has explicitly or implicitly informed the development of many training interventions, including extensive and systematic research in multimedia learning (e.g., Cox, McKendree, Tobin, Lee, & Mayes, 1999; Mayer, 2005; Moreno, 2006) as well as in behavior

modeling training (BMT). This section discusses some of the major findings related to the demonstration itself (i.e., the example of task performance). The following section will detail instructional features in DBT.

One of the most fundamental findings in DBT research involves the saliency of behaviors targeted for acquisition. KSAs must be perceivable by the learner; the enactment of the KSAs must be visible (or audible) in the example of performance provided. Jentsch, Bowers, and Salas (2001) have shown that the level of expertise of the learner is critical to his or her ability to identify critical behaviors in modeling displays. Additionally, it has been found that when observers lack the physical skills to imitate a model’s performance strategies in motor learning tasks, they perform worse than learners in control groups who simply practice the task (Kohl & Shea, 1992; Martens, Burwitz, & Zuckerman, 1976). If the demonstration content exceeds the observer’s capacity to perform, it provides an ineffective model of task performance and self-evaluation.

As in the use of guided error training with other methods of training delivery (Heimbeck, Freese, Sonnentag, & Keith, 2003), the use of errors (i.e., a mix of positive and negative examples of performance) in the content of DBT has been shown to positively affect learning (Taylor, Russ-Eft, & Chan, 2005). For example, mixed models have shown to be effective in interpersonal skills training when the goal is not for trainees to precisely reproduce the behaviors taught to them but to instill “generalizable rules or concepts, specifying a class of behaviors to be used when certain stimuli are present” (Baldwin, 1992, p. 147). Additionally, observers are better able to recognize key behaviors in incorrect versus correct examples of performance when both positive and negative behaviors are provided (Jentsch et al., 2001).

BMT is one of the most extensively used and well-respected training methods available to modern organizations (Taylor et al., 2005). BMT is based on Bandura’s (1986) social learning theory described earlier (Hogan, Hakel, & Decker, 1986). Built on the model provided by social learning theory, BMT includes processes such as modeling, a retention process, behavioral

rehearsal, feedback, and methods of training transfer to encourage the greatest transfer of training possible (Doo, 2005; Kraut, 1976). However, an important distinction between BMT and DBT is that BMT involves multiple methods of training delivery beyond just demonstrations, including practice-based activities. Although this is likely one of the characteristics of BMT that has made it so successful, it also limits the direct translation of the BMT literature to the design of demonstrations for situations or purposes in which practice-based activities are not feasible or desired (e.g., on-the-job performance support).

With this integrative approach, BMT has proven to be an effective training tool in developing trainee skills and resulting in high transfer of training (Taylor et al., 2005) for diverse purposes, such as technical skills (Chou, 2001; Davis & Yi, 2004; Simon & Werner, 1996; Yi & Davis, 2003), interpersonal skills (Burnaska, 1976), group orientation (Harrison, 1992), and supervisory skills, such as employee coaching (Decker, 1982), handling employee complaints and conflict management (Decker, 1982; Harrison, 1992), and communicating effectively with subordinates (Moses & Ritchie, 1976). Issues involving the combinations of training strategies are discussed in more detail in the future directions section of this article.

Although the results of the application of social learning theory to training is impressive, the results can often be highly varied (e.g., Austin & Laurence, 1992; Berry, 1991; Blandin, Lhuiset, & Proteau, 1999; Blandin & Proteau, 2000). For example, in comparison to text-only instructions, demonstrations usually are more effective for immediate performance, but skills acquired degrade much more quickly (e.g., Palmiter & Elkerton, 1993). Understanding how to systematically develop and integrate instructional features may provide a means for increasing the effectiveness of DBT. The literature related to instructional features in DBT is reviewed in the following section.

A REVIEW OF INSTRUCTIONAL FEATURES IN DBT

This section provides a review of instructional features in DBT organized in five categories of

features. A broad literature search was performed for the many terms used to describe the field (e.g., *behavioral modeling*, *vicarious learning*). The empirical and theoretical articles uncovered were examined for references to specific instructional features, which were coded into the categories described in this section. This section presents and explains these features while organizing them into the DBT classification scheme. This framework is intended to serve as a classification scheme not for any one DBT learning opportunity but for the instructional features that can be embedded within a DBT learning opportunity. That is, the categories presented represent classes of instructional features that can be used to augment learning experiences in a DBT program of instruction.

Any one demonstration may (and likely will) have features from more than one category. This framework is intended to organize the world of possibilities, provide a common language for discussing demonstrations, organize the literature for practical aims, and provide guidance for future research (e.g., by identifying which possibilities have and have not been subjected to systematic research).

Overview of Categories

Figure 1 provides an overview of the classification scheme for instructional features applied to the literature review, and Table 1 provides a more detailed description of each category. There are three main decision points in classifying any one instructional feature. First, instructional features can provide information or activities or tasks for the learner to complete. A common perspective to training design and research in the past century involved a conceptualization of learners as passive recipients of information. This perspective is commonly referred to as passive learning or a conduit or transmission model of learning (Ford & Kraiger, 1995; Schwartz & Bransford, 1998).

In contrast to this approach, active learning perspectives (e.g., experiential learning, action learning) emphasize internal regulation of learning by the trainee versus an external regulation in passive learning as well as a focus on promoting active knowledge construction versus

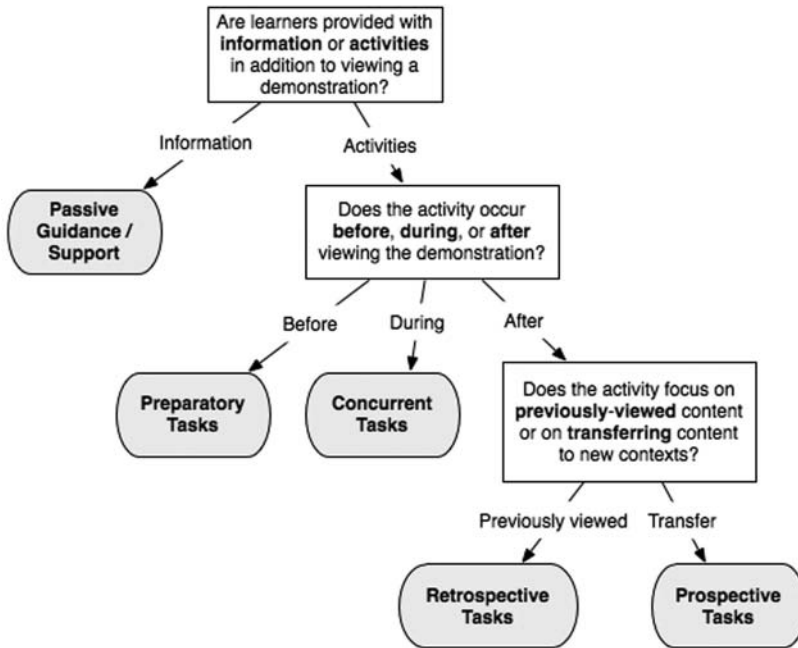


Figure 1. Classification scheme for instructional features in DBT.

internalization of external knowledge in passive learning (Bell & Kozlowski, 2008). Second, instructional features can be described in terms of when they occur relative to viewing the demonstration—either before, during, or after the observation of task performance examples. The timing of the intervention has direct implications for its function, that is, how it influences learning processes (Cannon-Bowers et al., 1998). Third, the literature review suggested a third useful distinction for instructional features occurring after viewing task performance: either a retrospective focus on the content previously viewed or a prospective focus on applying the demonstration content to new situations. Each of the five resulting categories are described as follows. To further illustrate these categories, specific examples from each category of instructional features will be discussed in the context of one core demonstration, training computer skills.

Passive Guidance or Support

Information provided before, during, or after viewing a demonstration can be considered a DBT instructional feature that provides *passive guidance or support* in addition to the content

of the demonstration. This category primarily includes features such as attentional advice, rule codes, instructional narratives, and behavioral summaries. These features are all passive in the sense that the learner is still a recipient of information, but they provide guidance in the sense that they structure the process of learning by observation (e.g., focus attention on critical aspects of performance). In the context of the computer skills training demonstration, providing learners with a behavioral summary of the steps involved in completing the task before viewing the demonstration would constitute passive guidance or support. This added information can help focus the attention of the learner, but it does not require the learner to perform any additional tasks aside from receiving information or viewing the demonstration.

This passive guidance or support involves giving learners information intended to increase learning outcomes by either focusing the learner's attention during the demonstration (e.g., giving advice on what to attend to) or increasing the learner's level of motivation (e.g., through explanations of why learning the demonstrated skill is useful or necessary). A common means

TABLE 1: Overview of Categories of Instructional Features in Demonstration-Based Training

Category of Instructional Features	Description	Example Instructional Features	Representative Citations
Passive guidance or support	Information provided to learners in addition to viewing the actual demonstration	Instructional narratives Rule codes Behavior summaries	Decker & Nathan, 1985; Jentsch, Bowers, & Salas, 2001; Lumsdaine, 1961; Stoffey & Reilly, 1997
Preparatory activities	Tasks performed before viewing a demonstration	Use of imagery to improve motivation Instruction on hierarchical encoding Instruction on self-regulatory skills Goal-setting activities Self-efficacy activities	Cumming, Clark, Ste-Marie, McCullagh, & Hall, 2005; Ferrari, 1996; Hard, Lozano, & Tversky, 2006;
Concurrent activities	Tasks performed while viewing a demonstration	Note-taking exercises Perspective-taking exercises	Hard et al., 2006
Retrospective activities	Tasks performed after a demonstration and focusing on the content just previously viewed	Mental rehearsal activities Learner-generated learning points Guided discussion	Davis & Yi, 2004; Decker, 1984; Hogan, Hakel, & Decker, 1986
Prospective activities	Tasks performed after viewing a demonstration and focusing on transferring previously viewed content to a different context	Goal setting for use of demonstration content on the job Generation of rule codes and learning points for different task contexts Learner-generated practice activities	Robinson, 1982; Russell, Wexley, & Hunter, 1984; Wexley & Latham, 2002

for achieving passive guidance or support involves providing advice on what is most important to attend to in the demonstration. This goal is often achieved by providing learning points and behavior summaries presented prior to observing a demonstration to prime trainees on the behaviors they will be learning (Decker & Nathan, 1985; Jentsch et al., 2001; Mann & Decker, 1984; Stoffey & Reilly, 1997; Taylor et al., 2005). This predemonstration priming helps observers to identify and attend to the targeted KSAs.

Another common example of passive guidance or support is the instructional narrative.

The use of instructional narratives both during and prior to observation of an example have been shown to increase learning (Lumsdaine, 1961). Instructional narratives are a means of focusing the learner’s attention on salient aspects of the example of performance and guiding attention during the demonstration. Additionally, narratives can be used to model covert cognitive aspects of performance (Bandura, 1986). That is, in complex task environments, the physically observable behavior is often less important than the reasons that person is performing the specific behaviors. However, a demonstration without accompaniment makes only the surface-level

physical actions apparent. Instructional narratives can be used to make these covert reasoning processes readily accessible to the observer and thus provide insight into the cognition and motivation involved in the behaviors.

Preparatory Activities or Tasks

Preparatory activities require the learner to complete some type of task before viewing the demonstration. These activities are designed to orient and focus the learner for the observation experience to come. These instructional features move beyond mere provision of information and require engagement of the learner in some type of task performance. These activities require that learners go beyond the content of the demonstration provided to them by either directly focusing on the learning process itself or requiring learners to complete predemonstration activities that prime them for the acquisition of the targeted KSAs.

Several types of preparatory tasks have been developed and evaluated in the literature. First, imagery exercises have been used to increase the motivation of the learner before viewing examples. Cumming, Clark, Ste-Marie, McCullagh, and Hall (2005) showed that relatively simple prompts asking the learners to mentally envision correct task performance, success, or other similar motivating items before viewing a demonstration increased learning. Second, training in various types of self-regulatory and learning strategies have been included before viewing demonstrations. Hard, Lozano, and Tversky (2006) achieved improved learning outcomes by training learners on hierarchal encoding—a process for deconstructing the demonstration they were to view into its component parts to facilitate acquisition. Additionally, instruction on self-regulatory skills for observation, goal setting, and perceived self-efficacy have been linked to improved learning outcomes in observational learning tasks (Ferrari, 1996). In the computer skills example, a possible preparatory activity could involve goal-setting activities wherein learners set performance objectives for themselves.

Concurrent Activities

Concurrent activities occur while the learner is viewing the demonstration and include activities such as perspective-taking exercises and

note taking. Examples of concurrent activities include note taking and perspective-taking exercises, in which learners decompose an example into action units and describe them from multiple perspectives. An example active-concurrent instructional feature for the computer skills demonstration could involve a note-taking exercise wherein learners cluster together steps in the process in ways that make most sense to them. This is an active learning activity in that it requires learners to go beyond the information presented and actively generate a representation of the task instead of using one provided to them. Unfortunately, there is little extant research that focuses on active-concurrent demonstrations. Thus, although it is possible to discuss concurrent activities from a conceptual standpoint, more research must be conducted to assess their efficacy.

Retrospective Activities

Retrospective activities occur after the learner has viewed the demonstration and focus on the content of the demonstration just viewed. These activities are designed to increase retention of the demonstration content. To continue with the computer skills demonstration example, adding an active-retrospective instructional feature could involve a learner-generated rule code exercise wherein learners develop their own propositional statements for when the different observed procedures are appropriate (e.g., when a learner uses one procedure versus another). This would be an active learning activity in that it requires the learner to generate knowledge instead of passively receive an externally structured set of rule codes.

Retrospective activities are included after viewing a demonstration and focus the learner on the aspects of the example of task performance previously viewed. Examples of this category include the use of symbolic mental rehearsal to create links between visual images and symbolic memory codes (Davis & Yi, 2004), learner-generated learning points (Decker, 1984), and rule codes (Hogan et al., 1986). Symbolic mental rehearsal is the process by which trainees organize learned information into verbal symbols that are easily stored and retrieved and then imagine themselves performing demonstrated behaviors, thus linking the two together (Davis

& Yi, 2004). Learner-generated rule codes have been shown to be an effective retrospective activity in DBT. Rule codes are propositional statements describing when a certain behavior should be used. Learners show improved performance and transfer across situations when they are involved in the development of rule codes after viewing a demonstration (Decker, 1980, 1982; Hogan et al., 1986). In an experiment that trained supervisors on conflict management skills, Decker (1982) presented learners with a list of rule codes. Subsequently, the participants identified rule codes as they viewed the demonstration, and afterward, they were told to rewrite or add to the codes if they felt doing so would be useful. Learners who reworded the existing rule codes and developed new rule codes had higher transfer scores.

Additionally, group discussion of the example has been shown to relate to the acquisition of complex skills (Johnson, Johnston, & Stanne, 1985). Research on open-ended group discussion during skill acquisition has shown an increase in learning and revealed that group discussions of this type have three main orientations: giving advice, making social comparisons, and increasing and directing motivation (Prislin, Jordan, Worchel, Tschan Semmer, & Shebilske, 1996). This finding suggests that providing a trainer-guided discussion of the example can increase learning by focusing the attention of the learners on the targeted KSAs, prompting mental rehearsal, and increasing motivation levels in the learner. Such activities would be classified as retrospective because they focus the learner on the content of the example just previously viewed. This guided discussion is similar in concept to an after-action review (AAR), though an AAR is generally conducted after trainee action rather than after viewing demonstrations (Barlow, 2006; Ellis & Davidi, 2005).

Prospective Activities

Prospective activities occur after the learner has viewed the demonstration and includes activities designed to encourage transfer of the learned skills to new situations. Examples include learner-designed practice activities, the generation of rule codes for contexts not included in

the demonstration content, and setting goals for transfer to the job. These activities are differentiated from retrospective activities in that they focus not directly on the content of the demonstration but on the application of that content to transfer situations. These too are active in that they required internally generated knowledge and structure in lieu of prestructured information. A prospective activity in the computer skills example could involve requiring learners to design activities for themselves in which they can practice the skills they viewed in the demonstration.

Prospective activities take place after the demonstration has been viewed to focus the learner on how the example of performance can be applied to other contexts. Examples of prospective activities include goal-setting exercises wherein the learner formally describes how what he or she has learned will be applied to new contexts (Latham & Saari, 1979; Russell, Wexley & Hunter, 1984), the generation of rule codes and learning points targeted at application to other domains or task contexts (Taylor et al., 2005), and activities in which the learner generates his or her own practice scenarios (Robinson, 1982; Wexley & Latham, 2002). Prospective activities focus on transferring the skills learned in training to the work context by having the learner consider how, why, and when the KSAs targeted for training should be used in the workplace or how they can be further developed. In other words, prospective activities increase the application of acquired KSAs (Gagné, 1984).

Prompting learners to create their own scenarios in which to rehearse behaviors has been shown to be an effective prospective activity in DBT. This can occur when observational and practice-based methods are combined into a larger training system, such as in BMT. By developing their own practice scenarios, trainees take examples from their actual work experiences. This method has been shown to provide more authentic practice activities and create greater training transfer to their specific job or role as well as increased self-efficacy (Taylor et al., 2005; Tulving & Thompson, 1973). Additionally, mental rehearsal has been shown to improve learning outcomes (Taylor et al., 2005), such as increased declarative

knowledge, increased task performance, and better generalization to novel situations (Davis & Yi, 2004; Decker, 1980). Similarly, encouraging learners to set personal goals for using the new skills on the job increases the likelihood that what is learned during training will be applied on the job (Russell et al., 1984). After viewing a demonstration, trainees can be guided to engage such goal-setting techniques to improve application.

DISCUSSION AND FUTURE DIRECTIONS

From this review, it is evident that more is known about designing the content of a demonstration than about designing accompanying instructional features. This article highlights a need for more systematic research and development of methods for maximizing the effectiveness of demonstrations by including additional guiding information and activities. The five categories of instructional features proposed here provide an initial effort at meeting this gap. This review provides a common language for the consideration of design options in the development of demonstrations for training and performance support as well as a means by which to organize the existing research literature. From this exercise, it seems as if there is a strong foundation in place to guide researchers and practitioners, but there is much work to do in terms of generating empirical support for the utility of different categories of instructional features. To assist in guiding this work, we address three critical areas for research next.

Predicting the Effectiveness of Instructional Features

The typology presented here is purely descriptive. It is useful for organizing the literature, but more is needed to guide practice in a systematic manner. To accomplish this goal, further theoretical work and systematic experimentation must be conducted. Ideally, a training designer would be able to choose sets of instructional features based on a training needs analysis, that is, to match the training system development to characteristics of the learner (e.g., level of expertise) and content (e.g., task types, complexity). Thus, the instructional features and taxonomy described thus far must be examined in relationship to the wider

range of variables that affect and comprise training efforts.

Combining and Sequencing Methods

This article has focused exclusively on DBT in isolation from other training delivery strategies. There is good reason to do so, as understanding how to design a maximally effective demonstration has value in its own right (e.g., for building stand-alone performance support systems). However, in many applications, demonstrations will be used in conjunction with information provision methods and practice-based learning. For example, the BMT approach discussed earlier focuses heavily on demonstrations (usually in the form of role-modeling activities) but includes a mixture of information and practice activities as well. Although there is extensive support for the idea that the sequencing of content influences learning outcomes (Ritter, Nerb, Lehtinen, & O'Shea, 2007), there is scarcely any theoretically grounded guidance for sequencing delivery methods and few empirical articles examining sequence effects of method (cf. Baggett, 1987; Shebilske et al., 2006). Remediating this gap will allow for practitioners to design DBT programs of instruction using theoretically and empirically based guidelines.

Measurement of Engagement and Attention

One of the major distinctions in the typology proposed here involves active versus passive learning. As simple observation is a physically passive activity, neurophysiological research methods can be a valuable tool for investigating the characteristics of demonstrations and instructional features associated with a more engaging learning experience. Additionally, neurophysiological approaches to adaptive training may be a method to improve the efficiency of DBT training delivery, as measures of workload, arousal, and interest can be used to make real-time decisions about what content and method of delivery will be most effective for a given learner (e.g., Vogel-Walcutt, Nicholson, & Bowers, 2009).

CONCLUDING REMARKS

DBT may represent the next frontier in instructional strategy development. It is well

sued to the distributed learning paradigm many organizations are moving toward (Fiore & Salas, 2007). The instructional features reviewed in this article provide a relatively inexpensive way of improving the effectiveness of demonstrations as a learning activity by embedding active learning principles into what is a generally passive method of learning. It may be possible that by just watching effective performance, trainees could acquire the needed knowledge and skill to perform. The potential for effective, inexpensive DBT techniques is particularly appealing to a training community seeking to improve organizational return on investment. Much work has been done in the area of DBT, but there is much left to accomplish to mature the science underlying these concepts. By working to fill the research gaps that have been delineated in this article, the field will be able to move toward a more effective theoretical and practical model of DBT. Given the relative ease of implementation and high return on investment of DBT, this prospect is especially meaningful to researchers and practitioners alike. Although much is known about creating effective demonstrations, the science of DBT is still in its youth. Much remains to be done, but the potential benefits to the field are promising and within reach.

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KEY POINTS

- Demonstration-based training (DBT) is a highly adaptable method of developing and supporting performance capacities in the workplace.
- DBT has received comparatively less attention from researchers than other methods, such as simulation, and consequently, there is less formalized guidance on the design of effective DBT.
- This article reviews the existing literature on instructional features in DBT and presents a framework for describing them according to when they occur relative to viewing an example of task performance as well as the nature of the

requirements placed on learners: passive guidance or support, preparatory activities, concurrent activities, retrospective activities, and prospective activities.

- Although substantial literature exists, present research is not sufficient to provide concrete guidance to practitioners on the relative value of including different instructional features or for matching specific instructional features to learner or content characteristics.

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