Toward a Meta-Theory of Learning and Performance

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This purpose of this paper is to identify implications of various learning theories for workplace learning and performance and HRD. It begins with a review of various theoretical positions on learning including behaviorism, Gestalt theory, cognitive theory, schema theory, connectionist theory, social learning or behavior modeling, social perspective theory, and situated cognition theory. Implications are drawn from these various theories. A theoretical framework is then constructed incorporating these implications, along with suggestions for needed research.

Keywords: Learning Theory, Training and Development, Workplace Learning and Performance

No single theory of learning currently exists. Rather, a multitude of different theoretical positions emphasize different aspects of the individual or situation context. Furthermore, this situation has characterized the literature on learning and performance for a number of years. As Underwood (1964) wrote

> There are many approaches which might be used to express the relationships among research findings for all forms of human learning. Undoubtedly, the most elegant way would be in terms of theory. A general theory of human learning … is clearly an ideal solution. No such system is available. (p. 48)

More recently, Merriam (2001), acknowledging that no single theory exists, stated "What we do have is a mosaic of theories, models, sets of principles, and explanations that, combined, compose the knowledge base of adult learning" (p. 3).

Although no such comprehensive system or theory currently exists, there are many connections among the different learning theories. The present paper provides a meta-theory of learning and performance with an attempt to include many of the major theories. It begins with an overview of the major learning theories and their implications. It then presents a systems model of learning and performance in the workplace, along with implications for research and practice. As Senge (1990) stated, a systems model is "a framework for seeing interrelationships …" (p. 68-69). One aspect of this interrelationship is the lack of distinction between learning and performance.

Philosophical, Historical, and Theoretical Background

Discussions concerning human learning began with the early Greek philosophers. Indeed, Reynolds, Sinatra, and Jetton (1996) provide an overview of the theories of the Greek philosophers, as well as current-day learning theories. They suggest that these approaches be positioned along a continuum from environment-centered (where all learning comes from stimulation outside the organism) to mind-centered (where all learning comes from manipulations within the mind of the organism). Such a classification helps to identify similarities and differences among the theories.

If we begin with the Greek philosophers, we see that Alcmaeon, Democritus, and Protagorus held a view that can be labeled the "environment-centered." They suggested knowledge or learning comes only from the senses and what is observed. In contrast, Socrates rejected the notion that knowledge comes only from perception. He argued that knowledge comes from ideas, concepts, and reasoning. This can be labeled "mind-centered." Aristotle presented a compromise view in which sensations and perceptions combined with the organization of the mind to create higher-order concepts and processes. Thus, Aristotle provided what might be called an "integrationist" view. Similar distinctions can be made of more current theories of learning.

Behaviorism

The behaviorist approach, derived from the British Empiricists (Locke, 1690, 1995; Mill, 1929) and popular from about 1910 until about 1960, held that all learning comes from behavioral responses to external stimuli. Thus, it provides an example of an environment-centered approach. Watson's seminal article (1913) stated, "Psychology as the behaviorist views it is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior."

Both Pavlov (1927, 1941) and Watson (1913) focused on classical or respondent conditioning. Pavlov introduced the principle of "frequency" according to which the more frequently an unconditioned stimulus (e.g.,

meat powder) is paired with a conditioned stimulus (e.g., salivation) the greater is the likelihood that the conditioned stimulus (e.g., bell) will elicit a conditioned response (e.g., salivation). Watson added the principle of "recency" indicating that the more recently a response has been made to a particular stimulus the more likely it is to be made again. The idea of reinforcement was added by Thorndike (1932). Specifically, the law of effect states that a connection becomes stronger or weaker depending on its consequences. Furthermore, the law of exercises states that, with practice, a connection will be strengthened, and, with no practice, the connection will be weakened. In addition, the concept of identical elements introduced the notion that transfer of training could be enhanced with greater similarity between the learning situation and the environment in which transfer of that learning is to take place. These ideas were further elaborated and codified through various mathematical equations by Hull (1929, 1943, 1951) and Spence (1956, 1960). Skinner (1938, 1953, 1968) refined these ideas to include various stimulus-response-reinforcement paradigms. According to this view, the learner is the passive recipient of knowledge. Information must be broken down into small units in order to maximize success (and provide reinforcement).

Gestalt / Cognitive Theory

Gestalt theory, with a focus on organization provided by the mind, posed certain dilemmas to the strict behaviorists. (See Koffka, 1935; Kohler, 1929; Wertheimer, 1912.) These dilemmas, such as response sets (Lashley, 1929), were easily solved by the behaviorists. However, Chomsky's work (Chomsky & Miller, 1958; Chomsky, 1959) represented a severe threat to the behaviorist approach – more specifically, his critique of Skinner's book (1957) on verbal learning. According to Chomsky, higher-order functioning, such as language acquisition and problem solving, could not be accounted for by stimulus-response-reinforcement. (For example, people would have to learn sentences at a rate faster than one per second for even small vocabularies.) The cognitive revolution led to the notion that humans are active processors of information. Furthermore, cognitive psychologists introduced the concept of mental representations and suggested a computational metaphor (with the computer). In this case, encoding specificity was introduced as the means by which transfer of learning took place (Thompson & Tulving, 1970; Baddeley, 1998). But, it should be noted that the metaphor of the computer still implied an external focus, given that data and instructions must be provided from outside the organism.

Schema Theory

Schema theory emerged in reaction to the machine metaphor of early cognitive theorists. It falls close to the interactionist view but leaning toward mind-centeredness. Following the philosophical notions of Kant (1781/1900) and Wittgenstein (1958), the mind frames perceptions and experiences, actively interacting with sensory information from the environment. Rumelhart and Ortony (1977) and Rumelhart (1980) suggested certain characteristics of schemas: (1) They have variables; (2) They can be embedded in each other; (3) They represent knowledge at various levels of abstraction; (4) They represent knowledge rather than definition; (5) They are active processors; and (6)They are recognition devices, determining the goodness of fit of the incoming information. Such schemas help to organize disparate bits of information into a meaningful system or network (Anderson, 1990). According to schema theory, the individual's background knowledge influences the processing of incoming information. Thus, trainee-centered approaches, such as strategy instruction, metacognition, and selective attention, are recommended.

Connectionist Theory

Connectionism, unlike traditional cognitive models, focuses on nodes and networks. (See Bechtel & Abramson, 1991; McClelland & Rumelhart, 1988; Quinlan, 1991; Rumelhart & McClelland, 1986.) In this case, cognition is the process of changing activation levels of interconnected nodes or neurons within the network. Knowledge is distributed among the nodes and connections. As with behaviorist notions, knowledge is acquired through contiguity and frequency. Back propagation allows for errors to be fed back through the system. Thus, this approach appears at the environment-centered end of the continuum. It emphasizes the importance of proceduralized knowledge, the automaticity of lower level skills, and parallel distributed processing. Rather than teaching isolated facts, network models suggest the importance of chunking information and proceduralizing and automating processes. Such proceduralization and automaticity reduce the cognitive demands or the cognitive load (Paas, Renkl, & Sweller, 2003). Recently, however, Kalyuga, Ayres, Chandler, and Sweller (2003) found an "expertise reversal," such that techniques that reduce the cognitive load for novices may increase the cognitive load for experts.

Social Learning or Behavior Modeling

Initial work on behavior modeling (also called social learning) began when behaviorism was pre-eminent. Bandura (1965a, 1965b) proposed, in contrast to the importance placed on frequency, that most human learning involves no-trial learning. New responses are simply acquired by observing the behavior of other people (i.e., models). The person can, thus, learn new responses without ever having performed the task and without having

received any reinforcement. Nevertheless, since observation of a model is critical to learning, this approach can be considered environment-centered. Sorcher and Goldstein (1972) reported on the first research on behavior modeling undertaken in an industrial setting. Goldstein and Sorcher (1973, 1974) reported on the use of such programs to reduce the turnover among "hard-core unemployed" employees. Since then, over 50 published studies have examined various aspects of behavior modeling. (See Russ-Eft [1997] for a review of this research.) Elaboration of Bandura's original notions of "no trial learning" tend to include the following steps as part of the learning or training process: (1) a description of the behaviors to be learned, (2) a model or models displaying those behaviors, (3) opportunities for learners or trainees to practice the behaviors, (4) feedback and social reinforcement following practice (Decker & Nathan, 1985; Robinson, 1982; Taylor, Russ-Eft, & Chen, 2003).

Andragogy and Self-Directed Learning

Merriam (2001) claimed that these two theoretical approaches formed the pillars of adult learning theory. Andragogay, introduced by Knowles (1968), characterized the adult learner as directing his/her own learning, using life experiences in learning, seeing changing roles as learning opportunities, focusing on the practical and immediate application of knowledge, and being internally motivated to learn. Houle (1961), Tough (1967, 1971), and Knowles (1975) explored self-directed learning. Such learning can lead to an increased capacity for self-directed learning, critical reflection and transformational learning (Brookfield, 1986; Mezirow, 1985), and social action (Brookfield, 1993). These theories seem aligned with mind-centered approaches, while recognizing the influence of the context.

Social Perspective Theory

In reaction to the cognitive approaches, a variety of theorists have begun to emphasize the importance of the social and cultural contexts. Given this emphasis on the social, cultural, and historical contexts, such theories fall near the environment-centered end of the continuum. These approaches have been labeled sociocultural perspective (Wertsch, 1991), social constructivism (Palinscar, 1998; Turner, 1995; Turner & Meyer, 2000), sociohistorical theory (Wertsch, del Rio, & Alvarez, 1995), and socio-cultural-historical psychology (Cole, 1995). The development of cognition comes from an internalization of social interactions, and knowledge is constructed by and distributed among individuals and groups as they interact with one another. Thus, experiences are shared, and learning and knowledge emerges from participation in social interaction. Vygotsky (1979) suggested that learning occurs when a person internalizes the social experiences of interacting with another person; such internalization results in inner speech and thought processes. These theories point toward the importance of considering the training environment, the organizational context, and the broader social and cultural context. At the very least, such theories contribute to the notions of cooperative learning environments and contextualized activities.

Situated Cognitive Theory

Situated cognition arose from artificial intelligence and cognitive psychology (Brown, Collins, & Duguid, 1989; Clancey, 1993; Greeno, 1991, 1998; Winograd & Flores, 1986). Similar to Vygotsky, situated cognition results from reasoning that occurs when the individual interacts with the social and physical situation. In contrast to Vygotsky, this approach places greater emphasis on internal processes. Thus, knowledge is acquired through the internal processing of the individual as that person interacts with the situation. This theory seems close to an interactionist approach in that emphasis is placed on the mind, in the form of mental models, and on the affordances of the environment. This theory suggests that training should facilitate the development of trainee's mental models through problem-solving activities, particularly by using ill-defined problems. Anchored instruction means that the instructors or the medium must anchor or situate trainees in simulated contexts, situations representing life experiences, or apprenticeships in real life situations. Thus, not all learning involves the retrieval of stored propositions; rather the emphasis is upon providing rich contexts or situations in which learning can occur.

Summary of Theoretical Suggestions for HRD and Training Practices

Table 1 provides some training implications for each of the previously described theories.

Table 1. *Summary of Training Implications*

Learning Theory	**Training Implications**
Behaviorism	• Learners are passive recipients. • Information must be organized and broken down into small, simple steps for maximum success. • Learners should be encouraged to make observable responses. • Trainees should be encouraged to make these responses multiple times (frequency), and these

	responses should be rewarded (reinforcement). • Transfer of training can be facilitated through the use of identical elements (Thorndike & Woodworth, 1901).
Cognitive Theory	• Learners are active processors of information. • Learners manipulate symbolic information. • Transfer can be enhanced through encoding specificity, meaning that the stimulus cues in the transfer environment must be encoded with the information being trained (Cormier, 1987). Perceived similarity, not actual similarity, appears to be most critical (Gick & Holyoak, 1980, 1983, 1987). • Providing a variety of examples can enhance transfer, leading to general rules.
Schema Theory	• Trainees' background knowledge influences the interpretation of incoming information. • Active, involved trainees are critical to success in training. • Since schemata are procedures, strategy instruction, instruction in metacognition, and the use of selective attention are critical.
Social Learning / Behavior Modeling	• New behaviors can be acquired by observing the behavior of models and without actually performing the task and without receiving reinforcement. • New behaviors may, however, not be exhibited until and unless some reinforcement is provided. • Behaviors can be changed directly and do not require changes in knowledge or attitudes.
Androgogy / Self-Directed Learning	• Individualized instruction is needed to match learners' needs and increase relevance. • Training should include individual tasks, group processes, and critical reflection to promote discovery, self-knowledge and self-direction.
Social Perspective Theories	• The training environment and social and organizational context shape individual learning, knowledge, and thought. • Trainees should have more opportunities to interact with peers and with those having more experience or more skill.
Connection Theories	• Training should encourage the development of proceduralized knowledge rather than limit development to declarative knowledge. • Training should help to develop automaticity of lower-level skills. (Trainees who have developed such automaticity have more mental capacity available for other tasks.) • Training or trainers should support the development of trainee ability to check, proceduralize, or automate skills or processes.
Situated Cognition	• Training should facilitate trainees' construction of mental models through problem-solving activities, particularly ill-defined problems (Brown, Collins, & Duguid, 1989). • Training should be "authentic," using realistic situations, leading to trainee's acquisition of the requisite knowledge and the condition for applying that knowledge (Sonntag, 1997) • Creating such mental models involves both individual and group construction. • Training should provide settings for group problem solving so that trainees can express their mental models to each other, improve their mental model, and use alternative mental models. (This can provide the "Learning circle" or "Lernstatt." [Sonntag, 1996, 1997].) • The trainer or the instruction materials should provide aid by identifying "affordances," such as easy routes, resources, or strategies. • Training needs to take place within rich contexts or situations (involving real life tasks or using media to simulate such situations). • Trainees should be supported by "coaching" or "scaffolding" and should "fade" over time.

Table 1 continued

An Inclusive Meta-Theoretical Framework

This review of various learning theories helps to identify similarities and differences. Figure 1 depicts a theoretical framework that combines the elements from the various learning theories. By connecting these theories, we can identify further practice and research implications.

Almost all of the learning theories, except perhaps for the behaviorist theory, recognize that learning and performance takes place within a social and organizational context which, in turn, affects the training environment. Furthermore, this training environment leads to the use or non-use of such methods as coaching and fading. The effects of background and context are primarily emphasized in schema theories and social perspective theories.

Critical differences among the theories seem to emerge in what might be labeled as the input phase of the learning process. Various theories possess different conceptions of the trainee and suggest different ways in which information should be presented. Thus, behaviorism posits that the trainee is a passive recipient of information, and therefore the information must be broken into small steps or small bits of information. In a similar way, connectionist theories emphasize the importance of automaticity of lower-level skills, presumably through repetition of procedures. With such automaticity, the learner can engage in higher-level learning, thinking, and problem solving. In contrast, social learning or behavior modeling suggests that the trainee is an observer and can learn simply by observing someone else. It may, nevertheless, require some form of reinforcement and feedback for the learner to display or perform the learned skill or task. Schema, cognitive, self-directed, and situated cognitive theories emphasize the importance of active, involved trainees. The theoretical framework presented in this paper, however, recognizes that new knowledge can be developed and created through all of these different approaches.

Similarities also appear in some but not all of the methods suggested for the transfer phase. Common elements for the transfer phase include frequency, reinforcement or reward, identical elements (according to the behaviorists) or encoding specificity (according to cognitive theorists). Elements such as multiple examples, strategy instruction, metacognitive instruction, ill-defined problems, realistic situations, and learning circles appear in certain theories, such as the cognitive theories, and are missing in other theories, such as the behaviorist theories. Further discussion and exploration of the various elements critical in the transfer phase can be found in Russ-Eft (2002).

HRD Research Implications

The theoretical framework implies that trainees may need information to be presented in multiple ways. It may be that a specific approach may prove more effective for certain types of learning and performance and certain kinds of situations. For example, it may be that the features and benefits of a new product to be learned by salespeople in one day through an e-learning format is best conveyed in small bits of information. In contrast, using a behavior model may be the best method for instructing organizational consultants on new approaches to executive coaching. Alternatively, providing symbolic information and facilitating problem solving may prove most effective in training problem-solving skills to mechanics and computer programmers. These speculations need testing.

The theoretical framework assumes that alternative methods are equally effective in the input phase. Gagne (1970, 1985) and Medsker and Gagne (1996) argue that certain kinds of training may be more effective using a specific theoretical approach. More research is needed to determine whether alternative methods are indeed equally effective or whether certain approaches prove more effective for specific kinds of trainees, certain types of information, and specific situations. As another example, the framework indicates that social and organizational context affects the training environment and that the training environment affects the extent to which coaching and fading takes place. Some research efforts need to examine these relationships. Similarly, it is assumed that the social and organizational context, the training context, and the level of coaching and fading affect the input phase and the extent to which new knowledge is created during training. Again, these relationships need further examination.

If we remove some elements of the social and organizational context, what are the implications for the type of theoretical approach used for the input phase? For example, when uncertainty exists as to the support provided through the social and organizational context or the training context, do multiple input approaches or one particular input approach function better? Might it be that, using behaviorist or connectionist approaches, repetition and reinforcement would lead to learning and automaticity of the response? Such an implication needs further testing.

Various elements appear to affect the transfer phase (such as frequency, reinforcement, identical elements). It is not at all clear whether each of these yields equivalent results. Russ-Eft (2002) provides a more complete taxonomy of elements affecting transfer. Research is needed to determine issues regarding the timing and use of these elements, particularly in relationship to the different types of input methods. For example, learning and transfer may not take place with the behaviorist approach of small steps and bits of information without using both frequency and reinforcement. In contrast, a social learning or behavior modeling approach, suggesting “no trial learning” (Russ-Eft, 1997), may prove equally effective with or without reinforcement. In this case, the behavior or information may be “learned” but may not be “performed” without some reinforcement.

Figure 1. Theoretical Framework Derived from Various Learning Theories

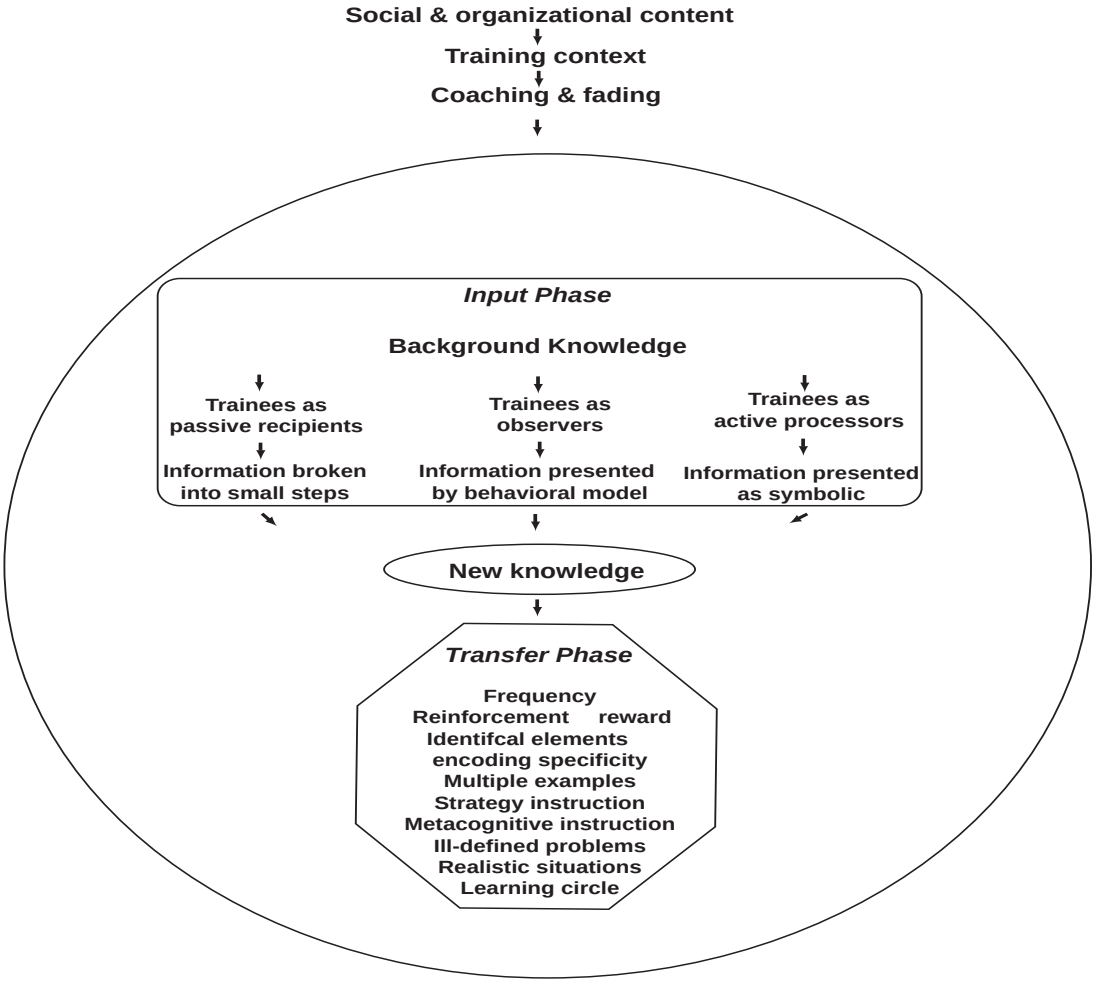

Figure 1. Theoretical framework derived from various learning theories.

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