Constructing a Pragmatic Science of Learning and Instruction with Functional Contextualism

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Constructivism has been embraced by many in the field of instructional design and technology (IDT), but its advocates have struggled to move beyond theory to practice or to empirically demonstrate the effectiveness of their approach. As an alternative to constructivism, a new perspective emerging in psychology, known as functional contextualism, is presented. Like constructivism, functional contextualism also rejects objectivist epistemology, but provides a much more coherent philosophical basis on which to build an empirical science of learning and instruction. The philosophical worldview known as contextualism is reviewed to outline the similarities and differences between constructivism and functional contextualism, and the key characteristics of functional contextualism and the science it supports, behavior analysis, are described. Implications of functional contextualism for research and practice in IDT are then explored.

Keywords: behavior analysis, constructivism, contextualism, functional contextualism, world views

Constructivism has emerged as a powerful—if not the dominant—perspective in American education, and its impact on the field of instructional design and technology (IDT) is evident. Viewing knowledge not as "something we *acquire* but something that we *produce*," (Mautner, 1996, p. 83), constructivists have challenged the field to examine more carefully its philosophical and epistemological assumptions. Some authors propose nothing short of an epistemological revolution in IDT as they boldly claim that "the findings of constructivism replace rather than add to our current understanding of learning" (Bednar, Cunningham, Duffy, & Perry, 1995, p. 110), while others urge

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that we consider a philosophical paradigm shift toward constructivism (Jonassen, 1991).

Constructivists often distinguish their perspective from objectivism or positivism, which they consider to be foundational to the behavioral and cognitive theories on which IDT is largely based (Bednar et al., 1995; Duffy & Jonassen, 1991; Hannafin & Hill, 2002; Jonassen, 1991). Because objectivism is antithetical to their view of knowledge, constructivists have criticized many traditional instructional design practices, such as the emphasis on instructional objectives, the use of task and content analyses, and the reliance on criterion-referenced assessment techniques (Jonassen, 1991). Instead, they recommend a range of different techniques for enhancing instruction, including: situating cognition and providing complex, realistic learning environments; providing for social negotiation; supporting multiple perspectives and using multiple modes of representation; encouraging ownership in learning; and nurturing self-awareness of the knowledge construction process (Driscoll, 2000).

Despite the enthusiasm for constructivism in our field, however, the movement has not been without its problems or critics. Opponents have launched a varied array of attacks against constructivism, and confusion and debate about the topic abound in the educational literature (see Phillips, 2000). Jonassen (1994) wrote that instructional designers and technologists are "grappling with how to design 'constructivist instruction' and trying to determine what guidelines might exist in a 'constructivist design model'" (p. 35). This struggle seems to be raising more questions—both practical and theoretical in nature—than it is answering (e.g., Bednar et al., 1995; Dick, 1996; Hannafin, Hannafin, Land, & Oliver, 1997; Jonassen, 1991, 1994; Rieber, 1993; Winn, 1997). Perhaps the most troubling concern, especially in a field that has a strong tradition of valuing empirical research, is that "at this point, [constructivist] theory and conjecture far outstrip empirical findings" (Driscoll, 2000, p. 395).

One of the main reasons constructivism is proving to be such a perplexing issue for instructional designers and technologists is the lack of theoretical clarity and philosophical cohesion in constructivist writing. McCarty and Schwandt (2000) contended that many in education "call themselves constructivists without much awareness of the fundamental differences among the varieties of constructivism. Nor are they always absolutely clear about the epistemological, ontological, metaphysical, and moral assumptions, concepts, and values that undergird constructivist beliefs" (p. 42). This is certainly evident in IDT, where constructivists typically borrow indiscriminately from the full range of constructivist perspectives, offering only a general constructivist view of learning and instruction (e.g., Bednar et al., 1995; Hannafin & Hill,

2002; Jonassen, 1991, 1994). There are perhaps dozens of different strains of constructivism (Matthews, 2000), and some rely on very different philosophical assumptions than others (see Phillips, 1995; Prawat & Floden, 1994). In fact, constructivism "refers to many ideas, joined by the merest thread of family resemblance and often expressing quite contradictory views" (Burbules, 2000, p. 308). To identify oneself simply as a constructivist, then, really reveals very little about one's specific philosophical and theoretical leanings.

So although the questions and issues raised by constructivists have certainly heightened our awareness to important philosophical concerns, we do not seem to be much closer to having a clear philosophical outlook that works for our field. An appealing solution to this dilemma may be *functional contextualism,* a philosophical perspective emerging in behavioral psychology. Functional contextualism seems to hold great promise for education and IDT because it is based on the same worldview as most constructivist theories, but offers a much more coherent philosophical foundation on which to build an empirical science of learning and instruction. To illuminate the core philosophical assumptions of functional contextualism, and to illustrate its similarities and differences with constructivist perspectives, the philosophical worldview known as contextualism will first be reviewed. Details of functional contextualism and the science it supports will then be provided, and their implications for IDT will be explored.

PHILOSOPHICAL WORLD VIEWS

Understanding the manner in which different communities come to construct truth or knowledge was a primary impetus behind philosopher Steven Pepper's book *World Hypotheses: A Study in Evidence* (1942). In this work, Pepper argued that philosophical systems cluster around a few core world hypotheses, or worldviews. Each worldview is characterized by a distinctive underlying *root metaphor* and *truth criterion.* Root metaphors are based on seemingly well-understood, commonsense, everyday objects or ideas, and serve as the basic analogy by which an analyst attempts to understand the world. Truth criteria are inextricably linked to their root metaphors (Hayes, 1993), and provide the basis for evaluating the validity of analyses. Pepper's framework can prove very useful for revealing the essential components, assumptions, and concerns of different discourse communities, and for this reason his work has recently received renewed attention in many areas (e.g., Berzins, 1979; Bredo, 1994; Lyddon, 1989; Minton, 1992; Morris, 1988; Overton, 1984; Quina, 1982; Reese, 1991; Seifert, 2000).

Pepper identified only four "relatively adequate" world hypotheses, with

adequacy determined by the worldview's degree of precision and scope. *Precision* refers to the number of ways a particular phenomenon can be explained by a worldview's concepts (the fewer, the better), and *scope* refers to the number of phenomena that can be explained using those concepts (the more, the better). All world hypotheses strive to achieve complete scope with absolute precision, but none fully reach this ideal. These four worldviews, however, come the closest: (a) formism, (b) mechanism, (c) contextualism, and (d) organicism. I shall focus my attention on contextualism because it seems most useful for interpreting both constructivist and behavioral approaches to education. Accounts of how the other worldviews relate to theories of learning have been provided elsewhere (e.g., Hayes, Hayes, & Reese, 1988; Morris, 1988; Prawat & Floden, 1994).

CONTEXTUALISM

Contextualism is a worldview in which any event is interpreted as an ongoing act inseparable from its current and historical context and in which a radically functional approach to truth and meaning is adopted. These two aspects represent contextualism's root metaphor and truth criterion, respectively.

Root Metaphor

The root metaphor of contextualism is often called the "act-in-context" or the "historic event" (Pepper, 1942, p. 232), and refers to the commonsense way in which people experience and understand any life event. Consider the simple event of brushing your teeth. What is our commonsense understanding of such an event? First, the event consists of a host of related features that all mutually define the event. Brushing your teeth doesn't involve just a toothbrush, or just a person, or just the toothpaste, or just a room, or just squeezing the toothpaste tube, or just making a circular motion with your hand, or just spitting into the sink. It involves *all* of these things at once, and all of these things (and more) help define and characterize the whole event. Thus, our everyday understanding of an event includes an appreciation of the behavior or action and its *current context* or setting as an *integrated whole* "in which the many features of an action blend, both with themselves and with their context" (Gifford & Hayes, 1999, p. 289). Of course, we could also analyze the act of brushing your teeth as a collection of individual components. But our everyday experience and understanding of that act is one of a complete and whole event, inseparable from its context.

Our commonsense understanding of an event also includes a sense of the purpose, meaning, and function of the event, and all of these depend on *past*

events—or the historical context of the present event. For example, you probably brush your teeth because you have been told that doing so will prevent tooth decay, or because not doing so has resulted in painful visits to the dentist. Likewise, you may brush your teeth in the bathroom because you have found it convenient to do so in the past, and you have probably learned that a toothbrush and toothpaste are good equipment to use for this task, and that a circular motion is effective. All of these past events or life experiences, and more, contribute to an everyday understanding of why and how you brush your teeth. This is why *context* in contextualism refers to both the current *and* historical context of an act. It seems Pepper was basing his use of the term *context* on Dewey's notion of context as "the historical situatedness of the meaning and function of behavior" (Morris, 1997, p. 533).

Contextualists analyze all phenomena as acts-in-context. Events and their contexts are separated into different parts by contextualists only to achieve some practical purpose. Gifford and Hayes (1999) wrote that "in a contextual approach we start with whole, situated actions and break them into pieces purely for pragmatic purposes . . . it is the whole that is primary: useful discriminations and distinctions come second" (p. 294). Thus, when a contextualist constructs theories and analyses that divide the world into parts, it is to aid in the achievement of some goal, *not* to reveal the one "true" organization and structure of the world. In contextualism, such divisions are utilitarian, not foundational. Indeed, there is no single, true unit of analysis in contextualism, and the current and historical context of any event ultimately includes the entire universe and all of time. How, then, does a contextualist know how much and which features of the potentially infinite context must be included in order to adequately characterize an act? In other words, how does a contextualist determine the truth or adequacy of a contextual analysis? The answer to these questions lies in the truth criterion of contextualism.

Truth Criterion

An analysis based on contextualism's root metaphor essentially consists of a description of some event or phenomenon and its current and historical context. Such an analysis is evaluated by examining—not surprisingly—the context in which it was generated. In particular, contextualists determine the validity or truth of an analysis by looking at the purpose or function of the analysis. If the analysis includes enough features of the context to successfully achieve the goal of the analysis, then it is deemed true. In other words, for contextualists, the truth and meaning of an idea lie in its function or utility, not in how well it is said to mirror reality. The truth criterion of contextualism is thus

dubbed *successful working,* whereby an analysis is said to be true or valid insofar as it leads to effective action, or achievement of some goal.

This notion of truth reveals contextualism's roots in philosophical pragmatism, a tradition heavily influenced by the work of figures such as Charles Sanders Pierce, William James, Oliver Wendell Holmes, Jr., George Herbert Mead, and John Dewey. Pragmatists and contextualists are not concerned with the existence of absolute, foundational truths or assumptions about the universe. As James wrote, "the truth of an idea is not a stagnant property inherent in it. Truth *happens* to an idea. It *becomes* true, is *made* true by events" (1907/1948, p. 161).

For the contextualist, ideas are verified by human experiences, with an idea's meaning essentially defined by its practical consequences, and its truth by the degree to which those consequences reflect successful action. Contextualism's extremely functional approach to meaning, with a heavy emphasis placed on the empirical consequences of ideas, reveals the influence of another figure who greatly affected the development of pragmatist thought: Charles Darwin. Pragmatism can be seen as an application of Darwin's selectionism to epistemology: In pragmatism, ideas are "selected" (to be retained as true or valid) if they lead to successful action, just as in natural selection traits are selected (to be retained by the species) if they lead to reproductive success. This influence is not surprising, as Darwinism was just gaining widespread appeal among scholars during the era in which the early pragmatists were cutting their intellectual teeth (Menand, 2001).

Analytic Goals

In contextualism, "serious analysis . . . is always either directly or indirectly practical . . . there is no importance in analysis just for analysis" (Pepper, 1942, pp. 250–251). Not only is analysis just for analysis (i.e., an analysis without some ultimate purpose) not considered very important to the contextualist, but in a sense it is not even possible for the contextualist to do. This is because the analytic tools of contextualism—its root metaphor and truth criterion—both hinge on the purpose of the analysis, and neither can be mounted effectively without a clearly specified analytic goal. The pragmatic truth criterion of successful working is rendered meaningless in an analysis without an explicit goal because success can only be measured in relation to the achievement of some objective (Dewey, 1916/1953). In contextualism, "the relation between truth and practice makes truth contingent on the purpose of the practice" (Reese, 1993, p. 77).

Likewise, the root metaphor of the act-in-context is rendered meaningless in an analysis without an explicit goal because there would be no basis on

which to restrict the analysis to a subset of the infinite expanse of the act's historical and environmental context (Gifford & Hayes, 1999). Without a clear analytic goal, the contextualist could analyze the endless context of an act in perpetuity, without ever knowing when the analysis was complete or good enough to be deemed true or useful. It is very difficult for a contextualist without an explicit goal to construct or share knowledge (Hayes, 1993).

Varieties of Contextualism

Analytic goals are so important to contextualism that the many different varieties of contextualism can be distinguished by them (Hayes, 1993). Contextualists can, and do, adopt different analytic goals, and this dramatically affects the kind of knowledge they value and the types of analyses they conduct. Even when contextualists are analyzing the same subject matter, their goals and approaches can be quite different. Some may be interested in establishing a type of natural science, for example, while others may be interested in establishing a type of natural history (Morris, 1993). Such differences in approach and purpose can result in systems of inquiry that, despite being based on the same worldview, appear quite dissimilar.

Table 1 □ Comparing contextualisms.

	Descriptive Contextualism	*Functional Contextualism*
Example	Social Constructivism	Behavior Analysis
Analytic goal	To understand the complexity and richness of a whole event through an appreciation of its participants and features	To predict and influence events with precision, scope, and depth using empirically based concepts and rules
Knowledge constructed	Personal, ephemeral, specific, local, and spatiotemporally restricted (e.g., a historical narrative)	General, abstract, and spatiotemporally unrestricted (e.g., a scientific principle)
Content and focus	Individual-in-context	Behavior-in-context
Preferred methods	Qualitative and narrative	Quantitative and experimental
Disciplinary type	Natural history	Natural science

Note. Adapted from Biglan & Hayes (1996), Gifford & Hayes (1999), and Morris (1993).

Contextualistic theories can be divided into two general categories, based on their overarching analytic goals: (a) descriptive contextualism and (b) functional contextualism (Hayes, 1993; see Table 1). Descriptive contextualists seek to understand the complexity and richness of a whole event through a personal and aesthetic appreciation of its participants and features (see Rosnow & Georgoudi, 1986). This approach reveals a strong adherence to the root metaphor of contextualism and can be likened to the enterprise of history, in which stories of the past are constructed in an attempt to understand whole events. Knowledge constructed by the descriptive contextualist is personal, ephemeral, specific, and spatiotemporally restricted (Morris, 1993). As with a historical narrative, it is knowledge that reflects an in-depth personal understanding of a particular event at a particular time and place.

Functional contextualists, on the other hand, seek to predict and influence events using empirically based concepts and rules (Biglan & Hayes, 1996; Gifford & Hayes, 1999; Hayes, 1993). This approach reveals a strong adherence to contextualism's extremely practical truth criterion and can be likened to the enterprise of science or engineering, in which general rules and principles are used to predict and influence events. Rules or theories that do not contribute to the achievement of one's practical goals are ignored or rejected. Knowledge constructed by the functional contextualist is general, abstract, and spatiotemporally unrestricted (Morris, 1993). As with a scientific principle, it is knowledge that is likely to be applicable to all (or many) similar such events, regardless of time or place.

DESCRIPTIVE CONTEXTUALISM AND CONSTRUCTIVISM

Contextualism should seem both familiar and appealing to constructivists, as most forms of constructivism are based on that worldview. Virtually all social constructivists are contextualists, for example. And although the radical constructivism of Piaget is probably more representative of organicism than contextualism (Hayes, Hayes, & Reese, 1988; Prawat & Floden, 1994), von Glaserfeld's (1995) take on radical constructivism appears more contextualistic because he interprets Piaget with an "instrumentalist" epistemology.

Although constructivists of any sort in education rarely identify themselves as pragmatists or contextualists, their ties to contextualism are obvious. The core premise of constructivism—that knowledge about the world is constructed rather than discovered—is simply a reformulation of the pragmatic view, first articulated by Peirce and James more than a century ago. When constructivists reject the absolute truths and structuralism of objectivism, they are embracing the antifoundationalism and functional truth criterion of con-

textualism. When they emphasize the cultural and historical context in which education occurs or champion the design of authentic and relevant learning environments, they are embracing the root metaphor of contextualism. And when they adopt the theories of figures such as Dewey, Gergen, Bruner (see Capaldi & Proctor, 1999), Vygotsky (see Reese, 1993), and possibly even von Glasersfeld (1995), they are adopting the theories of contextualists. Indeed, the relation between constructivism and contextualism is so apparent that Mancuso (1993) claimed that "the basic tenets of constructivism as an epistemology demand an acceptance of a contextualist world view" (p. 120).

Understanding the contextualistic core of constructivist theories may help explain some of the confusion surrounding constructivism in education. In taking different approaches to defining *knowledge* and *construction*—the primary dimensions along which variants of constructivism can be differentiated (Phillips, 2000)—constructivists are actually adopting different analytic goals and content areas. Radical constructivists are focused primarily on describing how individuals make sense of the world, for example, wheras social constructivists are more interested in describing how social forces shape our cultural knowledge. Since the purpose of analysis in contextualism guides how the root metaphor is used and how truth is determined, the different constructivist theories are evolving (or have evolved) into contextualistic systems that value and develop different types of knowledge and analyses. This makes it difficult for different types of constructivists to engage in meaningful or useful discourse, and makes it particularly unwise to treat the variety of constructivist perspectives as though they represent a singular theoretical perspective.

Despite their differences, what contextualistic constructivists in IDT do have in common is that they are virtually all descriptive contextualists. This is most evident in their preference for, and heavy reliance on, qualitative research methodologies. Savenye and Robinson (2004) noted that qualitative research is based on the notion that "humans construct their own reality" and typically involves "highly detailed rich descriptions of human behaviors and opinions" (p. 1046). Qualitative research typically includes ethnographies, case studies, surveys, interviews, and historical and document analyses (Denzin & Lincoln, 1998). All of these methods closely resemble historical narrative, which exemplifies the type of knowledge pursued and constructed by descriptive contextualists.

As forms of descriptive contextualism, constructivist theories get their strength from their close adherence to contextualism's root metaphor of the act-in-context, but they also share the inherent weaknesses of descriptive contextualism (Gifford & Hayes, 1999; Hayes, 1993). The analytic goals of descriptive contextualists are somewhat ill defined, and it is difficult to determine when such goals gave been accomplished. This problem is openly acknowl-

edged by many descriptive contextualists (e.g., LeCompte, Millroy, & Preissle, 1992, p. xv). In addition, a personal, holistic appreciation of a specific event and its context may or may not yield any practical knowledge or benefits (Hayes, 1993). This is probably the most vexing problem facing constructivists in education, as they continually struggle to develop empirically verified practical applications of their theory (Cobb, 1999; Driscoll, 2000). By virtue of its own overarching purpose, contextualistic constructivism is a *descriptive* theory of learning or knowledge, not a *prescriptive* theory of instruction. This disconnect between the purpose of constructivism and the practice of instructional design is a problem that has not gone unrecognized by constructivists in IDT (e.g., Jonassen, 1994).

Descriptive contextualism is strong in its adherence to contextualism's root metaphor of the act-in-context, but its analytic goal makes it weak in its ability to construct practical knowledge using contextualism's pragmatic truth criterion. While this perspective clearly has certain advantages, its weaknesses make it a poor philosophy of science and an even poorer basis on which to build an applied academic discipline. Thus, when certain constructivist theories are understood to be variants of descriptive contextualism, the problems associated with attempting to use these theories as the basis for IDT are further illuminated. Functional contextualism, as described in the next section, seems much better suited for such purposes.

FUNCTIONAL CONTEXTUALISM AND BEHAVIOR ANALYSIS

In psychology, functional contextualism has been developed explicitly as a philosophy of science (Biglan, 1995; Gifford & Hayes, 1999; Hayes, 1993). Specifically, it has been offered as the philosophical basis of the field known as behavior analysis. From the perspective of functional contextualism, behavior analysis is a natural science of behavior that seeks "the development of an organized system of empirically based verbal concepts and rules that allow behavioral phenomena to be predicted and influenced with precision, scope, and depth" (Biglan & Hayes, 1996, pp. 50–51). Precision and scope were defined earlier; *depth* means that "analytic concepts about one level of analysis (e.g., the psychological level) cohere with concepts at other levels (e.g., the anthropological level)" (Biglan, p. 29). By studying the current and historical context in which behavior evolves, behavior analysts strive to develop analytic concepts and rules that are useful for predicting and changing psychological events in a variety of settings. These same concepts and rules can also be used to describe and interpret psychological phenomena for which prediction and

influence are presently impractical or impossible (Biglan & Hayes; Skinner, 1974).

Both behavior and context are defined broadly in functional contextualism and behavior analysis. Unlike most psychologists, behavior analysts have always taken the rather unusual approach of including both public or overt events (such as walking and smiling) and private or covert events (such as thinking and feeling) in their definition of behavior. They consider *behavior* to be any psychological event, and this definition "encompasses all things people do, whether or not other people observe them" (Biglan, 1995, p. 46). Therefore, even private events such as thoughts, cognitions, attitudes, and feelings are considered behavior by behavior analysts, and fall within their scope of interest. It may prove less confusing to consider the goal of behavior analysis to be the prediction and influence of psychological events or phenomena. Further, true to the contextualistic root metaphor, functional contextualists recognize that the full context of a psychological event knows no predetermined or absolute boundaries. True to their pragmatic truth criterion, however, they also recognize that only the contextual features of the event of interest that contribute to effective action need be included in an analysis.

The behavior analytic approach to studying psychological events can be described as selectionistic. Essentially, "behavior analysts think of the shaping of behavior as working in just the same way as the evolution of species" (Baum, 1994, p. 64). In biological evolution, contingencies of survival in a given environment select which traits will persist in a species; in behavioral evolution, contingencies of reinforcement in a given context select which class of responses will persist (or be likely to occur) for an individual. Both the evolution of species and the evolution of behavior can be described as selection by consequences (Skinner, 1981), and the same process has also proven useful for interpreting the evolution of cultural practices (Biglan, 1995; Harris, 1979; Skinner, 1981). Indeed, behavior analysts consider human behavior to be "the joint product of (a) the contingencies of survival responsible for the natural selection of the species and (b) the contingencies of reinforcement responsible for the repertoires acquired by its members, including (c) the special contingencies maintained by an evolved social environment [a culture]" (Skinner, 1987, p. 55). Contextualism and selectionism are closely related concepts, with selectionism being the causal mode inherent to contextual philosophy. Selectionism involves an emphasis on the role historical context and consequences play in shaping the form and function of the phenomenon of interest in the current setting—an emphasis that clearly reflects both the root metaphor and truth criterion of contextualism.

Implications of the Analytic Goal

Adopting the analytic goal of the prediction and influence of psychological events leads to several important ramifications for a psychological science. In fact, many of the distinctive characteristics of behavior analysis as a contextualistic science developed directly from this overarching goal. The rejection by behavior analysts of mentalistic and cognitive explanations for behavior, emphasis on functional relations between behavior and environmental events, and preference for experimental research methods can all be linked to the ultimate purpose of the field. It is important to recognize that prediction and influence form a single goal, and functional contextualists thus value analyses that allow both the prediction and the influence of psychological events. They seek to identify variables that "predict the event in question *and* would, if manipulated, affect the probability, incidence, or prevalence of the event" (Biglan, 1995, p. 34). Analyses that only allow the prediction of behavior, or that rely on variables that are not manipulable (at least in principle), are considered inadequate or incomplete.

Much of the research in psychology and education is based on the development of models that describe how hypothetical constructs and mediating cognitive (or neural) mechanisms determine overt behavior (Biglan & Hayes, 1996). These models generally attribute behavioral events to factors such as a person's cognitive schema, information-processing mechanisms, brain activity, learning style, attitudes, expectations, knowledge constructions, emotions, thoughts, or feelings. Although these models can be quite accurate predictors of psychological events, they are not very helpful to those who also wish to know how to influence or change psychological events. When one type of psychological event is said to cause or explain another, with limited reference to the impact of environmental or historical variables, there is little information about how to change or influence either type of psychological event. To change or influence the behavior or psychological events of another person, psychologists and educators must search for manipulable variables in the environment. Why? Because they are part of that other person's environment. Anything a psychologist or educator could possibly do to affect the performance of an individual, such as an deliver an instructional module or implement an electronic performance support system, occurs in the environment of that individual—in the context of his or her behavior (Hayes & Brownstein, 1986).

In addition, the purported causes of behavior in cognitive and mentalistic models are themselves psychological events that require explanation. What caused the attitude, for example, and how can it be changed? Once again, behavior analysts search for the answers to such questions in the environment,

or—more specifically—in an individual's lifelong history of interacting with his or her environment. Cognition and other internal events are interpreted by appealing to a person's learning history, rather than assuming they are underlying processes causing and controlling overt behavior. To put this perspective in terms that may seem less controversial, behavior analysts simply believe that people learn how to think, reason, plan, construct meaning, solve problems, and more through interactions with their natural, social, and cultural environments. Thus, behavior analysts attempt to identify aspects of the manipulable environment that influence the occurrence, incidence, prevalence, or probability of both private and overt psychological events.

The most effective strategy for identifying variables that both predict and influence behavior is controlled experimentation: Events in the context of the behavior are manipulated in a systematic manner, and the resulting effects on the behavior's occurrence are observed (Biglan, 1995; Hayes, 1993). This orientation allows researchers to isolate which features of the context are functionally related to changes in the psychological event; purely descriptive or correlative research generally does not provide such knowledge. In behavior analysis, these procedures have traditionally involved the intensive study of individual organisms with time-series (or repeated measures) methodology (e.g., Barlow & Hersen, 1984; Sidman, 1960). Whereas functional contextualists favor experimental techniques, they encourage the use of a diverse set of methodologies, provided that value is always measured against pragmatic goals (Biglan & Hayes, 1996). Group designs using between-subject comparisons can be employed effectively for the purposes of functional contextualism, for example, and even correlational or predictive research of the sort described above can provide clues about contextual variables that might have an impact on behavior. Qualitative methodologies also have their uses in functional contextualism, but are not as effective as experimental procedures for testing the influence of environmental variables on behavior or for verifying the general utility of principles.

Contextualistic Science

Valuing science. Functional contextualism is a philosophy of science with a decidedly scientific analytic goal, and behavior analysis is a science based on that philosophy. One might wonder why a scientific system is sought at all. In particular, some postmodern scholars participating in the debates known as the "Science Wars" or "Paradigm Wars" seem to consider science to be something of an overrated affair whose participants falsely believe they can achieve complete objectivity in a search for ultimate truths about the universe (see Cromer, 1997; Gage, 1989; Koertge, 2000; Ross, 1996). Even most descriptive con-

textualists believe that a science of behavior is a futile pursuit because the utterly unique nature of every human event prohibits the possibility of generalizable principles of behavior (e.g., Gergen, 1986; Sarbin, 1986).

Functional contextualists seek to construct a science of behavior for a reason that is deceptively simple, and thoroughly pragmatic: Science is useful. Science is not advocated by functional contextualists because it is the only valid form of knowing (it is not), provides complete objectivity in the analysis of events (it cannot), or reveals the true nature of the universe (it does not). Rather, scientific practice—characterized by careful observation, open analysis, experimentation, theorization, and the free exchange of ideas (Hayes, 1998)—has proven remarkably successful in allowing humans to interact with their world effectively. Few features of modern society would be as advanced or as effective as they are without science. Functional contextualists simply assert that the history of human civilization shows that scientific knowing is a valuable form of knowing (Hayes, 1998), and work to develop scientific principles of behavior that might be used to improve the way human beings interact with their world and each other.

Scientific knowledge. The success of scientists is due in large part to their quest to develop rules and principles that apply to events generally, not particularly. As Morris (1993) observed, scientists attempt to construct knowledge that is general, abstract, and spatiotemporally unrestricted: knowledge that is applicable to more than just specific people, places, objects, events, or times. Such knowledge, in the form of general laws or principles or rules, allows a person to interact more effectively with the natural world in a wide variety of contexts (Skinner, 1953). General principles are very useful, and science has evolved into a system based on "direct experience, verbally described experience, and logical coherence" (Hayes, 1998, p. 205) that is intensely focused on the generation of such knowledge.

Some find it difficult to imagine a contextualist philosophy serving as the basis of a science because contextualists do not presume the existence of universal laws or general principles (e.g., Capaldi & Proctor, 1999). Indeed, contextualists view every event, when considered in its context, to be unique and do not assume that there is any sort of inherent order in the universe at all (Pepper, 1942). This might seem to suggest that contextualism is at odds with the scientific endeavor, but this is not the case. Although each act-in-context, individual, and psychological event is considered unique, contextualists accept that a given type of analysis may be successfully applied to more than one case. Different cases may be analyzed using the same terms and verbal descriptions "not because the cases are the same, but because the same analysis works for them" (Biglan & Hayes, 1996, p. 52). Such a perspective is not as unusual as it might sound. In medical science, for example, it is recognized

that each human body is a unique biological entity, shaped by an entirely novel combination of genes and experience. Yet it is understood that there are many principles of medicine, physiology, and pharmacology that can be successfully applied to nearly every human being. Likewise, every event in physics and chemistry is also considered unique, but this has not precluded the construction and use of general principles in these areas (Skinner, 1953).

Others claim that perspectives that consider truth and knowledge to be relative, as contextualism does, cannot sustain a science at all (e.g., Capaldi & Proctor, 1999; Merrill, Drake, Lacy, Pratt, & ID_2 Research Group, 1996). Extreme or skeptical relativism can, in fact, be problematic for a philosophy of science based on contextualism, for it obscures how knowledge claims are evaluated and how the progressivity of science could be achieved (Gifford & Hayes, 1999). If all truth is relative, isn't one analysis just as good as any other analysis? Functional contextualism is largely saved from the bog of relativism for two reasons, however. First, while contextualists do take truth to be conditional, provisional, and never absolute, this does not mean that all analyses or knowledge claims are equally valid or valuable. Claims are evaluated by the degree to which they allow the accomplishment of the analytic goal, and progress can be marked by analyses that permit the scientist to act successfully with an increasing degree of precision, scope, and depth.

Second, science is a deliberately social process, and knowledge claims are therefore evaluated against the shared analytic goals of a specific scientific community, and subjected to empirical verification by members of that community. By using a scholarly community's shared purpose as the metric for analysis, contextualists are able to avoid the risk of "rendering truth relative and making all philosophical convictions simply a matter of individual preference" (Diggins, 1994, p. 189)—a risk clearly inherent in the views of pragmatists such as James and modern descriptive contextualists. In addition, scientific confirmation is a process by which claims are verified using empirical methods. Truth has always been linked to empirical consequences in pragmatism, and scientific methodology seeks to ensure that epistemic claims remain tentative until members of the scientific community can test their empirical implications. Functional contextualists avoid the problems of relativism by recognizing that it is possible to have empirical knowledge without absolute truth (Gifford & Hayes, 1999; Hempel, 1965).

Contextualism or Objectivism?

This contextualistic view of modern behavioral psychology is probably foreign to most constructivists in IDT, who generally consider behavioral theory to be based on objectivism (e.g., Bednar et al., 1995; Duffy & Jonassen, 1991;

Jonassen, 1991)—a perspective derived from mechanism, not contextualism. To understand this discrepancy, it is important to realize that there are more than a dozen varieties of behaviorism (O'Donohue & Kitchener, 1999), some of which are clearly grounded in positivism, objectivism, and mechanism, and some of which are not (see Chiesa, 1994; Smith, 1986). Behavior analysis, which is based largely on the system developed by Skinner, can be particularly troubling in this regard because it has historically contained elements of both contextualism and mechanism (Hayes, et al., 1988). This seems to be primarily because of the gradual evolution of Skinner's ideas and certain philosophical inconsistencies in his writing (Gifford & Hayes, 1999; Hayes et al., 1988; Moxley, 1999, 2001). Nevertheless, a powerful case has been made that the most important and distinctive features of behavior analysis are clearly contextualistic (Gifford & Hayes; Hayes et al., 1988; Morris, 1988), and many behavioral psychologists now explicitly embrace contextualism as the philosophy underlying their work (e.g., Barnes-Holmes, 2000; Biglan, 1995; Gifford & Hayes; Lee, 1988; Morris, 1988; Odom & Haring, 1994; Roche, 1999).

FUNCTIONAL CONTEXTUALISM AS THE BASIS FOR IDT

IDT has been defined as a field that "encompasses the analysis of learning and performance problems, and the design, development, implementation, evaluation, and management of instructional and non-instructional processes and resources intended to improve learning and performance in a variety of settings" (Reiser, 2002, p. 12). In short, instructional designers and technologists seek to predict and influence psychological events in certain contexts using certain methods. Functional contextualists and behavior analysts have been working toward a broader version of the goal of IDT for many years, and have developed a coherent philosophy and science of behavior explicitly focused on its achievement. It is a parsimonious, empirically based approach with remarkable scope and depth. And it is *not* based on mechanism, objectivism, or positivism.

Given the central role behavioral theory has already played in the development of both instructional systems design and human performance technology (Binder, 1995; Burton, Moore, & Magliaro, 2004; Reiser, 2002; Rosenberg, Coscarelli, & Hutchison, 1999), one might wonder what more functional contextualism and behavior analysis could truly offer the field. After all, many of the recommendations behavior analysts have for improving instruction (Burton et al.; Fredrick & Hummel, 2004; West & Hamerlynck, 1992) are already incorporated into numerous instructional design models. The advantages of adopting functional contextualism as a basis for IDT are perhaps best summa-

rized by three concepts discussed earlier: (a) precision, (b) scope, and (c) coherence. Relatively few core principles and concepts are used in functional contextualism and behavior analysis to account for virtually all types of psychological phenomena, and these principles and concepts are united by a strong and coherent philosophical basis.

At the very least, functional contextualism provides field with a clear philosophical grounding that is resistant to the epistemological objections of constructivists who denounce the systems approach. Likewise, functional contextualism exemplifies how a science of learning and instruction can be conducted without an adherence to objectivism or mechanism. At the very most, functional contextualism offers a dynamic new vision for examining learning and performance with increased clarity, precision, and concern for the construction of practical knowledge. Some aspects and implications of this vision are outlined below.

The Nature of Instructional Research

Instructional research conducted from the perspective of functional contextualism would share the characteristics of behavior-analytic research described earlier (and for the same reasons): an emphasis on studying functional relations between performance and environmental events and a preference for experimental methods. This means purely cognitive theorizing and research would be devalued, and the use of qualitative and correlational methods would be more limited. Only analyses that emphasize the current and historical context of performance can directly contribute to educational practices since we, as educators, can do nothing more than modify events in our students' environment. By favoring such analyses, we should be able to more efficiently construct knowledge and principles that have a positive impact on our instruction. Although correlational and qualitative techniques would receive less emphasis, they would still be valued because they can provide clues about which contextual variables could be modified to achieve our practical goals. In all cases, instructional research and practice should be characterized by careful and frequent measurement of target performances and other relevant outcome data (Bushell & Baer, 1994; Greer & Keohane, 2004).

Instructional Objectives

Functional contextualists would also advocate a renewed emphasis on specifying and measuring the performances educators are attempting to enable with the learning environments they create. Some constructivists have confused the use of clear instructional objectives with an attempt to "impose a pre-

scribed reality on learners" (Jonassen, 1991, p. 11). The real reason clearly specified learning objectives are needed is that the very nature of pragmatic truth is tied to the achievement of specified goals. When the purpose of instruction is not stated clearly, or is couched in such vague terms as to be practically meaningless or immeasurable, contextualists of any ilk are unable to evaluate their instructional efforts. Contextualists cannot construct knowledge about instruction if they do not specify in advance the empirical consequences they hope to observe as a result of the instruction. This pragmatic process also requires that the relevant performance of the learner be measured and compared against goals. Functional contextualists embrace Mager's (1997) classic guidelines for developing instructional objectives that specify the performance, the conditions under which the performance should occur, and the criteria for acceptable performance.

Technology with a Purpose

The IDT literature is replete with reports, case studies, analyses, and descriptions of how some form of technology can be or has been incorporated into an instructional setting. Too often, however, it seems that the means (such as the use of a particular technology) are mistaken for the goal (improving human learning and performance). It is becoming increasingly rare to see an empirical demonstration of how the use of technology actually affected learning. This overemphasis on media development threatens to intellectually bankrupt the field, as instructional technologists move further and further away from any kind of grounding in a science of learning. They are in danger of becoming mere technologists without a philosophy or science to guide, evaluate, distinguish, or advance their work. Functional contextualism may offer the strong philosophical foundation and firm commitment to a pragmatic science needed to help them avoid this fate, as well as maintain their focus on developing empirically verified strategies for enhancing the performance of both individuals and organizations.

Exploring Evidence-Based Educational Methods

Pursuing a functional contextualistic approach to education would also expose instructional designers and technologists to a host of new research topics and instructional methods. Behavioral psychologists have developed, and continue to develop, a wide range of instructional strategies and systems for learners of all ages. Most of these have an extensive amount of data supporting their efficacy (see Moran & Malott, 2004), yet are largely ignored by mainstream instructional designers. Many in IDT are aware of the historical and

conceptual contributions of Skinner's programmed instruction movement (1954, 1968) to the field, but are likely less familiar with other behavioral approaches. It seems much progress could be made by focusing more attention on these techniques, capitalizing on their documented successes, learning more about what makes them effective, integrating them into current methods, and exploring how technology could be used to further enhance them.

The Personalized System of Instruction (PSI)

PSI (Keller, 1968) is a student-centered approach to mastery learning that was developed in the 1960s as an alternative to the dominant lecture-based method of teaching. Its key features have recently been described as unit mastery, flexible pacing, on-demand course content, immediate feedback, and peer tutoring (Fox, 2004a). Shortly after its introduction, PSI quickly became the focus of widespread attention and research, and has been implemented in a wide variety of settings to teach a wide variety of subjects (Sherman, Ruskin, & Semb, 1982). Although interest in PSI peaked in the 1970s and has seen a sharp decline in the decades since (Buskist, Cush, DeGrandpre, 1991; Lamal, 1984), the efficacy of the approach is difficult to question. It is estimated that more than 2,000 PSI research studies have been conducted (Sherman, 1992), and reviews and analyses of this literature have shown that PSI is consistently superior to traditional lecture-based instruction for student mastery and retention of course content (Kulik, Kulik, & Bangert-Drowns, 1990; Kulik, Kulik, & Cohen, 1979; Taveggia, 1976).

PSI remains an exemplary model for course development, and should be particularly attractive for developers of distance education courses. Many of the factors that contributed to the decline of PSI—such as the greater amount of development and planning time required, the difficulty adapting a self-paced system to the traditional academic calendar, and the hesitation of instructors to transition from a teacher-centered approach to a learner-centered approach (Buskist et al., 1991; Sherman, 1982, 1992)—are identical to the challenges faced by *any* distance educator (Berge & Muilenburg, 2000; Herring & Smaldino, 1997). Further, there are already a number of examples showing how PSI can be effectively implemented in the context of distance education, and its use in both distance and face-to-face courses can easily be enhanced with the use of modern information technology (Fox, 2004a; Koen, 2002; Pear & Martin, 2004; Price, 1999). In an era when distance education is experiencing explosive growth, PSI offers a flexible model for course development that is supported by a strong empirical research base, has clear guidelines for implementation, and is well-suited for courses delivered at a distance.

Direct Instruction (DI)

DI (Becker & Carnine, 1980; Engelmann & Carnine, 1991; Kinder & Carnine, 1991) involves a teacher-centered classroom characterized by "highly sequenced instruction, clear and concise directions, teacher guidance, active student participation, and assessment probes in order to practice and master new knowledge and skills" (Hummel, Venn, & Gunter, 2004, p. 96). It is an approach with tremendous research support (see Slocum, 2004 for an overview), outperforming numerous other educational models in the extensive Follow Through project (Engelmann, Becker, Carnine, & Gersten, 1988) and producing a very large average effect size of +0.97 in a recent meta-analysis of 37 research studies (Adams & Engelmann, 1996).

Constructivists are likely to object immediately to the highly structured, teacher-centered approach of DI, but if one is truly interested in producing thoughtful, independent learners, it is difficult to criticize an approach that has proven so effective at giving students the core academic skills necessary to attaining higher intellectual goals. Johnson and Street (2004) suggested that "constructivist practices either implicitly or explicitly assume that all learners are equally prepared to benefit from exploration," but that this may be a dangerous assumption that "widens rather than lessens the gap between the powerful and disenfranchised" (p. 25). DI provides a powerful and proven methodology for providing learners with some of the key components of intellectual independence, and deserves greater attention from instructional designers and technologists. Adapting the DI approach to other settings (such as instructional software development), for example, or investigating ways in which classroom technology might be used in the delivery of scripted DI content could prove to be very fruitful research areas.

Precision Teaching (PT) and Behavioral Fluency

Measures of learning typically focus on accuracy of responding, but other measures are possible, and perhaps desirable. The instructional strategy known as *PT* measures learning with response rate (Lindsley, 1996), working to increase both the accuracy and speed of academic skills. Precision teachers argue that an exclusive emphasis on accuracy restricts the assessment of learning, because no additional measurements are possible once response accuracy reaches 100%. In addition, rate of responding is a key characteristic of truly expert or fluent performance: An expert reader, for example, can read more words per minute than a novice reader. *Behavioral fluency* is a term used to describe the combination of accuracy plus speed of responding characteristic of expert or competent performance (Binder, 1988, 1990, 1996).

PT essentially consists of a set of procedures and tools for measuring and

working toward fluency, and is not tied to a specific curriculum, subject matter, type of student, or grade level (Merbitz, Vieitez, Merbitz, & Pennypacker, 2004). It relies on the Standard Celeration Chart, a graph with a logarithmic scale on the ordinate, for recording and displaying student performance in a standardized format. The chart is an innovative method for measuring and displaying changes in learning, and can be an important tool in making data-based instructional decisions (Merbitz et al.). The use of frequency-building techniques, either through PT alone or in combination with other instructional strategies, has produced remarkable educational outcomes with both children and adults (Beck & Clement, 1991; Binder & Bloom, 1989; Binder & Sweeney, 2002; Johnson & Layng, 1992, 1994; McDade & Goggans, 1993).

Behavioral fluency offers instructional designers a broader and perhaps more authentic conception of mastery, as measures of content mastery that do not include speed of responding may be less reliable and valid indicators of expert performance. Some have already begun exploring the ways information technology can be used to support and enable fluency-based instruction. The Center for Individualized Instruction (now called Learning Services) at Jacksonville State University has used fluency-based computerized instruction to successfully provide academic support to college students for more than two decades (McDade & Goggans, 1993), fluency-building flashcard emulation software called ThinkFast (Parsons, 2004) has been developed for use by both students and instructors, and Headsprout Reading Basics™ (Layng, Twyman, & Stikeleather, 2004) is an interactive, Web-based beginning reading program that includes fluency as a critical element.

Comprehensive Application of Behavior Analysis to Schooling (CABAS®)

Those interested in investigating and affecting the larger context in which education occurs would find the CABAS (Greer, 2002) compelling. CABAS is a systems approach to managing the performance of the full range of individuals and factors that influence schooling, including "students, teachers, parents, supervisors or teacher mentors, administrators, the university training program, and the organization as a whole" (Greer & Keohane, 2004, p. 38). It relies on a construct called the learn unit as a standard measure of learning that incorporates measures of both student and teacher behavior. Essentially, learn units represent the interactive, contextually situated nature of effective teaching (Greer, 2002). CABAS incorporates elements of empirically based methods of instruction, and includes a sophisticated and extensive curriculum for training teachers to become "strategic engineers" or "strategic scientists" of instruction (Greer, 2002).

CABAS has been implemented in several schools in the United States, Ire-

land, and England, and an early version of the system was shown to help students learn four to seven times more (as measured by correct responses and instructional objectives) than with traditional teaching techniques (Selinske, Greer, & Lodhi, 1991). Other studies have shown the CABAS can be more cost effective than traditional schooling (Greer, 1994) and in a classroom for students with autism, CABAS produced an average of 11 months of learning in a 4-month time period, compared to less than 2 months of learning for the regular classrooms (Greer, 1997a, b). Additional summative evaluations of this system are warranted, and research exploring how the complex and sophisticated teacher curriculum could be further streamlined and implemented in different settings is needed. The utility of the learn unit as an analytic tool for both instructional research and practice also deserves closer examination, and has the potential to revolutionize the way educators talk about and measure learning.

Morningside Model of Generative Instruction

The Morningside model (Johnson & Layng, 1992, 1994; Johnson & Street, 2004) integrates features from several behavioral methods of instruction (including PSI, DI, and PT) into a system that has been used successfully with 86 schools and agencies throughout the United States and Canada. Evaluations of the Morningside model have produced impressive results. At Morningside Academy in Seattle, where the model was formed and continues to evolve, mean standardized test gains for its elementary and middle school students are remarkable: 2.5 years growth per school year for reading, 4 grade levels per year for language arts, and 3 grade levels per year for mathematics (Johnson & Layng, 1992, 1994). Implementations of the model at other school sites have also produced tremendous learning gains (Johnson & Street, 2004), as have implementations with adult learners in both academic and corporate settings (Johnson & Layng, 1992).

Moreover, both the Morningside model and CABAS exemplify how a functional, scientific approach to learning and instruction can be used to systematically work toward the complex, molar goals of education described by constructivists. Architects of the Morningside model explicitly recognize and value this, noting that the model favors a more systematic, molecular approach to instruction "to build a foundation for thinking and reflection," while favoring "a Deweyian approach to natural reinforcement that makes some use of constructivist practices to build reflective, thoughtful learners who are socially conscious and engaged with the world around them" (Johnson & Street, 2004, p. 25). Thus, the Morningside model and CABAS represent thoroughly contextual approaches to education: They effectively use strategies derived directly from the functional principles of behavior analysis, along

with a sensitivity to the larger social and cultural context in which education occurs, to produce the kind of learning environments described and valued by constructivists. The incredible results produced by these models should make them appealing to any instructional designer or educational researcher, and the potential for using information technology to expand, enhance, or adapt specific components of their programs should make them appealing to any instructional technologist.

A Pragmatic Approach to Language and Cognition

Language and cognition is perhaps the most important topic in both psychology and education (Hayes, Blackledge, & Barnes-Holmes, 2001). Thus, it is not surprising that cognitive theories have had such a significant impact on IDT in recent decades. These theories have clearly resulted in important research and applications, but it is not always easy to derive applied solutions from them because they rely so heavily on hypothetical constructs and mediating cognitive mechanisms that cannot be directly manipulated (Biglan & Hayes, 1996). In recent years, a promising new behavioral approach to studying language and cognition known as relational frame theory (RFT; Hayes, Barnes-Holmes, & Roche, 2001) has been offered, and may prove more useful for our field.

RFT is based explicitly on functional contextualism, the principles of behavior analysis, and several decades of research on derived stimulus relations. A full overview of RFT, its empirical support, and its implications for psychology and education is not possible here, but Hayes, D. Barnes-Holmes, et al. (2001) provided a comprehensive account of the theory, and an introductory tutorial is also available online (Fox, 2004b). RFT is similar to semantic network theories of meaning in some ways, but in RFT semantic or relational networks are not treated as hypothetical mental structures. Instead, such networks are considered learned patterns of relational responding under contextual control. In emphasizing the role of experience and context, relational frame theorists are exploring new avenues for developing practical knowledge about predicting and influencing complex human behavior. Further, the contextual approach of RFT provides a functional account of the structure of verbal knowledge and cognition, creating an important link between the traditionally disparate traditions of cognitive and behavioral psychology.

The potential contributions of RFT to education and instructional design are considerable. Relational frame theorists assume that "skills in relational responding provide the basis for a wide range of cognitive abilities that correlate with educational achievement" (Barnes-Holmes, Barnes-Holmes, & Murphy, 2004, p. 283), and training on these over-arching relational skills may thus result in broad academic and intellectual benefits (Barnes-Holmes, Barnes-

Holmes, & Cullinan, 2001; Hayes, 1994). In addition to outlining procedures that target these general verbal and cognitive processes, researchers have also used RFT to interpret, analyze, and investigate several particular skills that are of interest to educators, including logical reasoning, cognitive perspective taking, concept learning and instruction, and problem solving (Fox, 2003; Hayes, Barnes-Holmes, et al., 2001; Stewart & Barnes-Holmes, 2003). Moreover, the terminology of RFT could be used to provide more precise analyses of the psychological processes involved in ill-defined instructional strategies such as situating cognition, as well as the full range of competencies addressed in Bloom's (1956) *Taxonomy of Educational Objectives.* Essentially, RFT could provide the field with a coherent, parsimonious, useful, and technical way of speaking about complex human performances.

CONCLUSION

Constructivists have contributed significantly to education and IDT by encouraging the instruction of relevant and meaningful skills and knowledge, emphasizing authentic learning environments and assessments, and promoting student self-reflection and independence. They have struggled, however, in empirically demonstrating that their suggestions and techniques actually improve learning or contribute to the achievement of their noble goals. Many of their difficulties are likely related to the inconsistencies inherent in attempting to integrate multiple constructivist theories that have different purposes and rely on different philosophical assumptions.

An understanding of the contextualistic worldview that underlies most constructivist theories sheds further light on constructivist difficulties in our field. By adopting description and understanding as their central purpose, constructivists position themselves as the consummate historians of educational events. Their methods and analyses permit a personal appreciation of the rich complexity of the individual learning experience and the context in which it occurs. This type and level of understanding is, of course, important. It does not lend itself well to empirical evaluation or the construction of general principles of learning, however, and this makes it difficult to use constructivism as the foundation for IDT.

To develop the principles and rules that have the general utility required of an applied discipline such as IDT, more scientific goals must be adopted. Science is expressly focused on creating generally applicable ways of speaking about the world, and has cultivated an effective methodology for achieving this purpose. Fortunately, one must not abandon the contextualistic worldview to be scientific. Functional contextualism exemplifies how the sci-

entific goal of the prediction and influence of events can be adopted without an adherence to mechanism or objectivism.

In the form of behavior analysis, functional contextualism supports a natural science of behavior that has generated an extensive body of practical knowledge about how to predict and change psychological events. The precise language, experimental methods, empirical knowledge base, and measurement techniques of behavior analysis have much to offer those interested in designing effective instruction, improving the performance of individuals and organizations, or simply helping others learn. Furthermore, functional contextualism need not be seen as a replacement for, or competitor to, constructivism in education. The scientific knowing engendered by functional contextualism and the historical knowing engendered by constructivism can both be embraced by educators, with the understanding that the relative value of each will depend on purpose and context (Morris, 1993). For the purpose of constructing effective, efficient, and relevant learning environments, however, functional contextualism clearly shows that—even in these postmodern times—the art of teaching can, indeed, be based on a science of learning. □

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