9

ACTIVITY THEORY AS A LENS FOR CHARACTERIZING THE PARTICIPATORY UNIT

Sasha A. Barab
Indiana University

Michael A. Evans
Indiana University

Eun-Ok Baek
California State University

9.1 INTRODUCTION

Since the cognitive revolution of the sixties, representation has served as the central concept of cognitive theory and representational theories of mind have provided the establishment view in cognitive science (Fodor, 1980; Gardner, 1985; Vera & Simon, 1993). Central to this line of thinking is the belief that knowledge exists solely in the head, and instruction involves finding the most efficient means for facilitating the "acquisition" of this knowledge (Gagne, Briggs, & Wager, 1993). Over the last two decades, however, numerous educational psychologists and instructional designers have begun abandoning cognitive theories that emphasize individual thinkers and their isolated minds. Instead, these researchers have adopted theories that emphasize the social and contextualized nature of cognition and meaning (Brown, Collins, & Duguid, 1989; Greeno, 1989, 1997; Hollan, Hutchins, & Kirsch, 2000; Lave & Wenger, 1991; Resnick, 1987; Salomon, 1993). Central to these reconceptualizations is an emphasis on contextualized activity and ongoing participation as the core units of analysis (Barab & Kirshner, 2001; Barab & Plucker, 2002; Brown & Duguid, 1991; Cook & Yanow, 1993; Gherardi, Nicolini, & Odella, 1998; Henricksson, 2000; Yanow, 2000). Sfard (1998) characterized the current shift in cognitive science and educational theory as a move away from the "acquisition" metaphor towards a "participation" metaphor in which knowledge, reconceived as "knowing about," is considered a fundamentally situated activity.

In spite of the wealth of theoretical contributions in terms of conceptualizing learning as participation, there have been less empirical and methodological contributions to aid researchers attempting to characterize a participatory unit of activity. This reconceptualization of knowledge as a contextualized act, while attractive in theory, becomes problematic when attempting to describe one's functioning in a particular context. Of core consequence is the question: What is the ontological unit of analysis for characterizing activity?[1] Defining the participatory unit is a core challenge facing educators who wish to translate these theoretical conjectures into applied models. In this chapter we describe Activity Theory (Engeström, 1987, 1993, 1999a; Leont'ev, 1974, 1981, 1989) and demonstrate its usefulness as a theoretical and methodological lens for characterizing, analyzing, and designing for the participatory unit. Activity Theory is a psychological and multidisciplinary theory with a naturalistic emphasis

[1] See Barab & Kirshner, 2001, or Barab, Cherkes-Julkowski, Swenson, Garret, Shaw, & Young, 1998, for further discussion on this topic.

that offers a framework for describing activity and provides a set of perspectives on practice that interlink individual and social levels (Engeström, 1987, 1993; Leont'ev, 1974; Nardi, 1996). Although relatively new to Western researchers, Activity Theory has a long tradition as a theoretical perspective in the former Soviet Union (Leont'ev, 1974, 1981, 1989; Vygotsky, 1978, 1987; Wertsch, 1985) and over the last decade has become more accepted in the United States.

When accounting for activity, activity theorists are not simply concerned with "doing" as a disembodied action, but are interested in "doing in order to transform something," with the focus on the contextualized activity of the system as a whole (Engeström, 1987, 1993; Holt, & Morris, 1993; Kuutti, 1996; Rochelle, 1998). From an activity theory perspective, "the 'minimal meaningful context' for understanding human actions is the activity system, which includes the actor (subject) or actors (subgroups) whose agency is chosen as the point of view in the analysis and the acted upon (object) as well as the dynamic relations among both" (Barab, 2002, p. 533). It is this system that becomes the unit of analysis and that serves to bind the participatory unit. As such, Activity Theory has much potential as a theoretical and methodological tool for capturing and informing the design of activity. It is in making clear the theoretical assumptions and the applied value of activity theory for research and design that this chapter is targeted. In terms of instructional design, assumptions underlying activity highlight the need for a more participatory unit of analysis, thereby, complicating design in that the design process is recognized as involving much more than simply producing an artifact.

It is much simpler to conceive the design process as the development of an artifact than as supporting the emergence of a mediated activity system. The latter fundamentally situates and complicates our work as designers. In our own work, we have found that conceiving design work as producing a series of participant structures and supports that will facilitate the emergence of activity to be a productive and useful characterization. Further, as if designing participation structures (opposed to objects) was not complex enough, many of the designs that our work has been focused on are in the service of social interaction (Barab, Kling, & Gray, in press). This is evident in the building of virtual communities in which designers move beyond *usability* strategies to employ what might be referred to as *sociability* strategies—that is, strategies to support people's social interactions, focusing on issues of trust, time, value, collaboration, and gatekeeping (Barab, MaKinster, Moore, Cunningham, & the ILF Design Team, 2001; Preece, 2000; Trentin, 2001). In these cases, it is not that we design artifacts but rather that we design *for* social participation—the latter characterization highlighting that designs are actualized in practice and not in the design laboratory. In these cases, especially when designing for something like community, the focus is not simply to support human–computer interactions but human–human interactions that transact with technology.

A key concept underlying this perspective is the notion of transaction, which has as its base assumption the interdependency and interconnection of components—components that only remain separate in name or in researchers' minds, for in their materiality they change continuously in relation to other components (Dewey & Bentley, 1949/1989). Through transactions the tools we design for, the subjects who use the tools, the objects they transform, and the context in which they function are all changed—we can never treat our designs as a static thing. Instead, our designs must be understood in situ, as part of a larger activity system. It is here, in providing a characterization of the larger activity through which our tools transact, that Activity Theory can serve as a useful tool for designers. Toward that end, we begin with a discussion of activity more generally, overviewing the work of Vygotsky, Leont'ev and others who focused on the mediated nature of activity. This discussion is then followed by Engeström's (1987, 1993) and Cole's (1996) treatment of mediated activity as part of a larger context, extending Leont'ev's (1974, 1981) commitment to situate action as part of larger activity systems. Implications for instructional design are then summarized. Armed with this appreciation of Activity Theory we highlight the application of activity theory to three different contexts. From here, we then offer some cautionary notes for those applying activity theory to their respective designs.

9.2 LITERATURE REVIEW

In the following sections, we sketch the genealogy of a version of Activity Theory that is commonly invoked by researchers and practitioners in instructional and performance technology, along with cognate fields including educational psychology (Bonk & Cunningham, 1998; Koschmann, 1996), human–computer interaction (Kuutti, 1999; Nardi, 1996) and organizational learning (Blackler, 1995; Holt & Morris, 1993). Our intent is not only to provide the reader with a sufficient background of the origins of the theory, but also to gradually make apparent its usefulness for understanding learning and design from a truly systemic perspective that emphasizes the participatory unit.

9.2.1 Conceptualizing Learning as Mediated Activity

Beginning around 1920, Russian revolutionary psychologists Lev Vygotsky (1978, 1987), A. R. Luria (1961, 1966, 1979, 1982) and A. N. Leont'ev (1978, 1981) initiated a movement that is now referred to as Cultural-Historical Activity Theory (Cole & Engeström, 1993; Engeström & Miettinen, 1999). Recognizably the most central character in this movement, Vygotsky laid bare what he argued as the then problem in psychological investigation that limited experimental research to reductionist laboratory studies separated from the contexts of human lives (Luria, 1979; Scribner, 1997; Vygotsky, 1978). From his perspective, this research tradition led to the erroneous principle that to understand human cognition and behavior the individual (or organism) and environment had to be treated as separate entities. Consequently, to transcend this Cartesian dichotomy, Vygotsky formulated on a Marxist basis a new unified perspective concerning humanity and its environment (Cole, 1985).

The central notion of this revolutionary standpoint revolved about the triadic relationship between the object of cognition, the active subject, and the tool or instrument that mediated the interaction. As he notes,

> The use of artificial means [tool and symbolic artifact], the transition to mediated activity, fundamentally changes all psychological operations just as the use of tools limitlessly broadens the range of activities within which the new psychological functions may operate. In this context, we can use the term higher psychological function, or higher [truly human] behavior as referring to the combination of tool and sign in psychological activity. (Vygotsky, 1978, p.55)

Thus, in contrast to his intellectual peers (e.g., Thorndike, Wundt, and Hull) who accepted the behaviorally rooted proposal of a direct link between the object (stimulus) and subject (respondent), Vygotsky maintained that all psychological activity is *mediated* by a third element. This third element he labeled *tool* or *instrument*. Generally speaking, tools fall into two broad categories—*material tools,* such as hammers or pencils, and *psychological tools,* such as signs and symbols. Eventually, to Vygotsky, these *semiotic* tools (i.e., signs and symbols), would take on enormous importance in his work. To some (e.g., Engeström, 1987), this imbalance in the emphasis of the cognitive over the material limited Vygotsky's work, a point we will take up later. Vygotsky's triangular schema of mediated activity, composed of the subject, object, and mediating tool, is represented in Fig. 9.1. In the schematic, the subject refers to the individual or individuals whose agency is selected as the analytical point of view (Hasu & Engeström, 2000). The object refers to the goals to which the activity is directed. Mediating tools include artifacts, signs, language, symbols, and social others. Language, including nonword items like signs, is the most critical psychological tool through which people can communicate, interact, experience, and construct reality.

What Vygotsky contended, and this is an important point regarding the inseparability of the elements of mediated activity, is that individuals engaging in activities with tools and others in the environment have undertaken the development of humanity (Cole, 1996). Throughout history, humans have constructed and transformed tools that influence their transformation and likewise tools embedded in social interactions have triggered human development. In essence, humans and their environment mutually transform each other in a dialectical relationship. Culturally, these tools and the knowledge pertinent to their continued use are passed from generation to generation. As such, learning is not solely an individual activity but a collectively shared process with significant cultural and historical

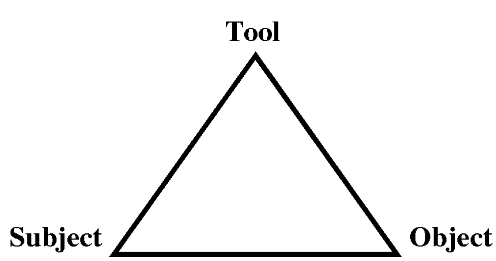

FIGURE 9.1. The basic schematic of mediated activity as developed by Vygotsky (1978, 1987).

dimensions (Stetsenko, 1999). It is important to note that although tools are present whenever we are engaged in a certain activity, they are also constructed through our activity (Bannon & Bødker, 1991). In this way, mediating action involves subject, object, and tools that are constantly transformed through the activity.

To explain this cultural–historical interrelationship between human and environment, Vygotsky (1978, 1987) proposed the concept of a zone of proximal development (ZPD). Put simply, the ZPD is conceptualized as the distance between what an individual can achieve on her own (the actual level of cognitive development) and what she can accomplish when guided by more capable peers or adults (the potential level of development). The primary idea of the ZPD is that humans learn through social interaction, this interaction taking place in a historical context and imbued with cultural artifacts. Thus, social interaction emerges through "the genetic law of cultural development" that incorporates intermental and intramental planes:

> Every function in the child's cultural development appears twice: first, on the social level, and later on the individual level; first, between people (intermental), and then inside the child (intramental). (Vygotsky, 1978, p. 57)

The intermental plane is a place where shared cognition emerges through interaction between and among individuals and the intramental plane is a place where this shared cognition is internalized or appropriated. This is in contrast to the view of learning as a mere response to outside stimuli. Very definitely, it posits that learning is inevitably a collaboration with others in a cultural and social environment. In this sense, learning is a collaborative mediated action between individuals and objects of environment mediated by cultural tools and others (Rogoff, 1990; Vygotsky, 1978; Wertsch, 1985).

The concept of mediated activity within ZPD lead us to a perspective of learning that sees the learner as actively constructing meaning within a cultural–historical context. Although the learner is conceived of as active, it is the responsibility of the culturally more advanced facilitator (e.g., teacher), to provide opportunities for acceptable constructions. As Vygotsky indicates, "instruction is good only *when it proceeds ahead of development,* when it awakens and rouses to life those functions that are in the process of maturing or in the zone of proximal development" (1987, p. 222, emphasis in original). The ultimate burden then, is placed on the facilitator. With increasing breadth of impact, Vygotsky's perspective has influenced both educational psychology and instructional design over the past 20 years.

While Vygotsky made tremendous strides in breaking free of the Cartesian dichotomy, by framing learning as mediated activity within a cultural–historical milieu, he was criticized for two critical shortcomings. First, his articulation of what was meant by activity was never fully developed. It took his colleague, Leont'ev, to formulate more elaborate schemes of activity and the relationship between external and internal activity. Moreover, as was hinted at earlier, Vygotsky overemphasized the cognizing individual or individuals as the unit of analysis. As we will see shortly, Engeström has come a long way to bring back into current formulations of Activity Theory the importance of cultural–historical elements.

9.2.2 Characterizing Activity

In his search for an answer to the riddle of the origin and development of the mind, A. N. Leont'ev formulated the concept of *activity* as the fundamental unit of analysis to understand the objective and subjective worlds of complex organic life (Leont'ev, 1974, 1978, 1981, 1989). Like his mentor and colleague Vygotsky, his driving intention was to break away from the conventional Cartesian-inspired theories and methodologies of psychology to develop a conceptualization that could wed both the objective, material world and subjective, psychic world. While his radical approach had similar beginnings to those of Vygotsky, Leont'ev was able to articulate a conceptualization of activity that more clearly emphasized the inherently collective nature of learning and, the inspiration for the entire lineage of this line of thought, work (or labor). The stride that was made was that instead of focusing on the psychologically developing individual within a cultural–historical milieu, Leont'ev emphasized the *object's* place in the concept of activity. His agenda to locate the focus of the conceptualization and study of activity on the object is unmistakably stated in the following excerpt:

> *Thus, the principal "unit" of a vital process is an organism's activity; the different activities that realise its diverse vital relations with the surrounding reality are essentially determined by their object; we shall therefore differentiate between separate types of activity according to the difference in their objects* [emphasis in original]. (Leont'ev, 1981, p. 37)

A key move in Leont'ev's work was to emphasize the importance of the object (as opposed to the subject) of activity and to distinguish between the immediate action and the larger overall activity system. It was in this way that he began the process of situating activity within a larger system, a point that Engeström (1987) would take up and extend in his subsequent work.

Within Leont'ev's framework, the most fundamental principle of analysis is, therefore, the hierarchical structuring of activity. Thus, to understand the development of the human psyche, Leont'ev (1978, 1981) proposed three hierarchical levels—operation, action, and activity. At the risk of sacrificing the subtleties of the conceptualization, an activity system can be thought of as having three hierarchical levels corresponding roughly to automatic, conscious, and cultural levels of behavior (Kuutti, 1996; Leont'ev, 1978). Starting at the automatic level, he referred to these as *operations*. Operations are habitual routines associated with an action and, moreover, are influenced by current conditions of the overall activity. This construct in many ways parallels the view Simon takes of human behavior as he presents the parable of the ant making his "laborious way across a wind- and wave-molded beach" (1981, p. 63). In Simon's words:

> *A man (sic), viewed as a behaving system, is quite simple. The apparent complexity of his behavior over time is largely a reflection of the complexity of the environment in which he finds himself*" [emphasis in original]. (1981, p. 65)

For Leont'ev, nevertheless, *operations* are the most basic level of activity. *Actions* occur at the next higher level and are often associated with individual knowledge and skills. Thus, within the activity of project management, there are possibly several associated actions, including, for example, consulting, accounting, and writing (Kuutti, 1996). These actions, either separately or in various combinations, are subordinated to individual needs. At the highest, or cultural, level is *activity,* which is essentially defined at the level of motives and goals (Gilbert, 1999). The motivation of an activity is to transform the object into an outcome. It should be noted that within this hierarchy individuals are usually aware only of action at the conscious level, on immediate goals with local resources. This "action" level is conditioned by a larger cultural scope, and supported by automatic behaviors previously learned. Again, the focus here is on attempting to characterize the nature of the activity and not the processes of the individual mind.

In a now famous passage from *Problems of the Development of Mind,* Leont'ev describes the case of hunters on the savannah to illustrate more definitely the relationship of the concepts of activity and action and how they contribute to a unique understanding of human production:

> Let us now examine the fundamental structure of the individual's activity in the conditions of a collective labour process from this standpoint. When a member of a group performs his labour activity he also does it to satisfy one of his needs. A beater, for example, taking part in a primaeval collective hunt, was stimulated by a need for food or, perhaps, a need for clothing, which the skin of the dead animal would meet for him. At what, however, was his activity directly aimed? It may have been directed, for example, at frightening a herd of animals and sending them toward other hunters, hiding in ambush. That, properly speaking, is what should be the result of the activity of this man. And the activity of this individual member of the hunt ends with that. The rest is completed by the other members. This result, i.e., the frightening of the game, etc. understandably does not in itself, and may not, lead to satisfaction of the beater's need for food, or the skin of the animal. What the processes of his activity were directed to did not, consequently, coincide with what stimulated them, i.e., did not coincide with the motive of his activity; the two were divided from one another in this instance. Processes, the object and motive of which do not coincide with one another, we shall call "actions". We can say, for example, that the beater's activity is the hunt, and the frightening of the game his action. (1981, p. 210)

Here then, we have the distinction between activity and action and how collective labor, with its inherent division of labor, necessitates such a conceptualization. That is, in collective work, activity occurs at the group level while action occurs at the individual level. Thus, what may be of particular interest to researchers and practitioners is the concept of the action level of activity. Here the task would be to analytically represent and further understand (Engeström, 2000) the processes involved in using tools (either conceptual or artifactual), the meditative effects (either enabling or constraining) these tools have on object-oriented activity, and the outcomes (e.g., knowledge) that result. Necessarily attractive to instructional and performance technologists, then, is that this hierarchy of activity

TABLE 9.1. The Hierarchical Distribution of Components in an Activity System: Three Examples

Hierarchy of Activity Components	Activity Systems		
	Hunters[a]	Flute Makers[b]	Preservice Teachers[c]
Activity	Hunting	Flute making	Preservice Training
Motive(s)	Survival	Production of world-class quality flutes	Professional qualification
Action(s)	Drum beating; spear throwing	Carving flute body; tuning mechanisms	Participating in lectures, writing field notes
Need(s)	Clothing; sustenance	Professional reputation; flute making skill maintenance; compensation	Professional teaching position; course credit; intellectual development
Operation(s)	Striking drum; gripping spear	Gripping and manipulating instruments; striking or carving materials	Gripping writing and manipulating instruments; expressing preconceived beliefs and attitudes
Conditions	Material of drum skin, drumstick, and spear; savanna landscape and climate	Materials for crafting flutes; working conditions; organizational standards	Classroom and online environment and tools; learning materials and resources; faculties' teaching styles

[a]Adapted from Leont'ev (1981).
[b]Adapted from Crook & Yanow (1996) and Yanow (2000).
[c]Adapted from Blanton et al. (2001).

provides a comprehensive view of mediation. Moreover, development, or learning, might be defined as the process of activity passing from the highest (i.e., social) to the lowest (i.e., automatic) level of activity, or vice versa (Engeström, 1987). More poignantly, an activity theory perspective prompts the designer to look beyond the immediate operation or action level and to understand the use of the designed tool in terms of the more comprehensive, distributed, and contextualized activity. This shift places emphasis on understanding not simply the subject but the entire context. The implications of this radical idea should be obvious to instructional and performance technologists, particularly those occupied with the assessment of needs and the analysis of tasks. An illustration of this hierarchy using both the hunting example and one from the organizational learning literature is provided in Table 9.1.

9.2.3 Contextualizing Mediated Activity

Whereas Vygotsky began the process of moving the locus of cognition and knowing more generally outside of the individual mind, and Leont'ev refined the emphasis of the role of contexts and actions as part of larger activities, Engeström further contextualized the unit of activity. More specifically, Engeström (1987) provided a triangular schematic (see Fig. 9.2) for the structure of activity that can be described as follows. Similar to Vygotsky (1978), the most basic relations entail a *subject* (individual or group) oriented to transform some *object* (outward goal, concrete purpose, or objectified motive) using a cultural–historically constructed *tool* (material or psychological). For example, an employee (the subject) in an organization may use an electronic library and reference (the tool) to compose new accounting procedures (the concrete purpose) for her colleagues in an effort to improve customer satisfaction. What this example has introduced, which emphasizes Engeström's contribution and thus completes the schematic, are the components of *community* (the organization) and *outcome* (the intended or not implications of activity). Moreover, the subject relates to the community via *rules* (norms and conventions of behavior) while the community relates to the object via *division of labor* (organization of processes related to the goal) and to the subject via rules (Rochelle, 1998). It is the bottom part of the triangle (rule, community, division of labor) that acknowledges the contextualized nature of activity.

One dimension of this reconceptualized activity system that is potentially critical for design is the concept of *contradiction*. According to Engeström (1987), any activity system has four levels of contradictions that must be attended to in analysis of a learning and work situation. These contradictions are as follows:

- Level 1: Primary contradiction arise *within* each node of the central activity under investigation; this contradiction emerges from the tension between use value and exchange value

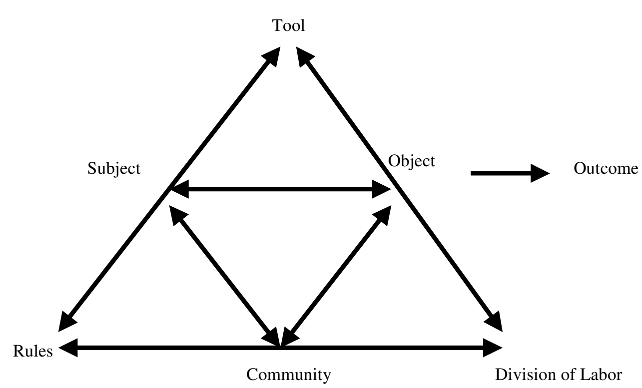

FIGURE 9.2. The basic schematic of an activity system as developed by Engeström (1987).

- Level 2: Secondary contradiction arises *between* the constituent nodes (e.g., between the Subject and the Tool) of the central activity system
- Level 3: Tertiary contradiction arises *between* the object/motive of the central activity and the object/motive of a culturally more advanced form of the central activity
- Level 4: Quaternary contradictions arise *between* the central activity and adjacent activities, for example, instrument-producing, subject-producing, and rule-producing activities.

As an empirical example of this notion, Barab, Barnett, Yamagata-Lynch, Squire, and Keating (2002) used Activity Theory as an analytical lens for understanding the transactions and pervasive tensions that characterized course activities. Reflecting on their analyses, they interpreted course tensions and contradictions in the framework of the overall course activity system, modeled in general form using Engeström's (1987) triangular inscription for modeling the basic structure of human activity (see Fig. 9.3). Each of the components Engeström hypothesized as constituting *activity* is depicted in bold at the corners of the triangle.

The figure illuminates the multiple and interacting components that from an activity theory perspective constitute activity. In this figure, Barab et al. (2002) illustrate the pervasive tensions of the course, characterizing them in the form of dilemmas within each component of the triangle (e.g., subject: passive recipient vs. engaged learner). Contradictions within a component are listed under each component, and dotted arrows (see a, b, c in Fig. 9.3) illustrate cross-component tensions. Viewing the class as an activity system allowed for an appreciation of pervasive tensions and how these fueled changes in the course. Below, we further discuss this case example and further illustrate the use of contradictions for understanding medical surgical teams.

In summary, Activity Theory (Cole & Engeström, 1993; Engeström, 1987, 1999a) can be conceptualized as an organizing structure for analyzing the mediational roles of tools and artifacts within a cultural–historical context. According to the principles of activity theory, an *activity* is a coherent, stable, relatively long-term endeavor directed to an articulated or identifiable goal or *object* (Rochelle, 1998). Moreover, activity can only be adequately understood within its culturally and historically situated context. Examples of activity might include the collaborative authoring of a book, the management of investments in mutual funds, the raising of a child or even the hunting of game on the savannah. Importantly, the unit of analysis is an activity directed at an object that motivates activity, giving it a specific direction. Activities are composed of goal-directed actions that must be undertaken to fulfill the object. Actions

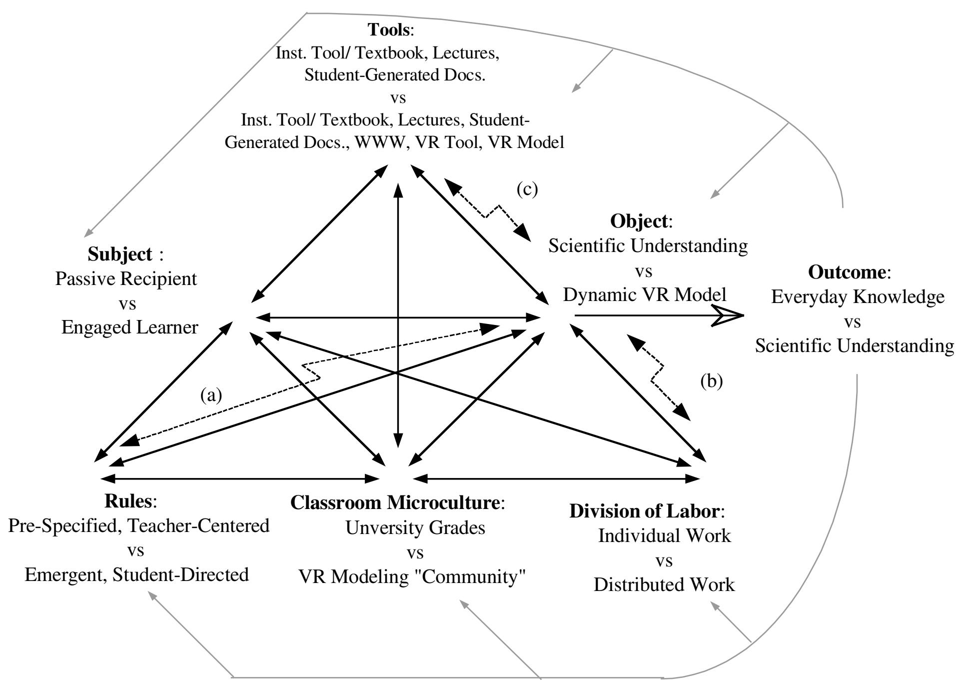

FIGURE 9.3. The mediated relationship between subject and object, and the interrelations among the various components of the system in the VSS course. The figure illustrates the mediated relationship between subject and object, and the interrelations among the various components of the system. Specifically, it illuminates the systemic dynamics and pervasive tensions of the course activity of students participating in the VSS course (see Barab, Barnett et al., 2002).

are conscious, and different actions may be undertaken to meet the same goal. Actions are implemented through automatic operations. Operations do not have their own goals; rather they provide an adjustment of actions to current situations. Activity Theory holds that the constituents of activity are not fixed, but can dynamically change as conditions change.

9.3 DESIGN IMPLICATIONS

In the design of instructional materials or constructivist learning environments, the following design guidelines have been drawn from Vygotsky's (1978) notions more generally:

(1) instructor's role as a facilitator to support students in becoming active participants in the learning process;
(2) instructional materials structured to promote student collaboration;
(3) instruction designed to reach a developmental level that is just above the students' current developmental level;
(4) use of a wide variety of tools, such as raw materials and interactive technology (e.g., computers) in order to provide a meaningful learning context; and
(5) student evaluations focusing on the students' understanding, based upon application and performance (Brooks & Brooks, 1993; Brown, et al., 1989; Hausfather,1996; Jonassen, 1991).

Examples of these learning environments include (1) anchored instruction (Cognition and Technology Group at Vanderbilt, 1991, 1992, 1993); (2) apprenticeship modeling (Collins, Brown, & Newman, 1989); (3) problem-based learning (Barrows, 1985, 1992; Savery & Duffy, 1995; Dabbagh, Jonassen, Yueh, & Samouilova, 2000); and (4) case-based learning (Jarz, Kainz, & Walpoth, 1997; Jonassen & Hernandez-Serrano, 2002).

From our perspective, taking into account the hierarchical layers of activity described by Leont'ev (1974, 1981) may provide instructional designers or performance technologists with a broad picture of the entire collective activity systems, not just isolated actions or automated operations. We believe that understanding participation at these broader levels is necessary to truly facilitate development/changes in activity systems. For instance, Hyppönen (1998) used the hierarchy to link user activity with product functions and features, by associating the process of the activity with results of usability evaluations of the technology, in the entire stages of a product's development. Furthermore, Activity Theory might provide an ideal position—one with sufficient scope and depth—for observing individuals at work, alone or in collaboration with others, using electronic tools. As an example, the designers of an electronic performance support system (EPSS) might be able to use Activity Theory to determine the effectiveness of the specific functions of the tool, depending on where the behavior is located in the hierarchy and whether and how the tool is enabling or constraining a particular goal-oriented behavior.

The schematic advanced by Engeström (1987) provides a framework for viewing and designing tool-mediated activity as it occurs in a naturally organized setting. As Jonassen (2000) has pointed out, "Activity theory provides an alternative lens for analyzing learning [and work] processes and outcomes that capture more of the complexity and integratedness with the context and community that surround and support it" (p. 11). Given our goal in instructional and performance technology to understand collective practice, Activity Theory provides a potentially rich and useful description of how practice is culturally and historically situated. Acknowledging design work as targeted toward supporting contextualized activity while a useful move also brings with it a host of challenges that designers must engage. This is because when designers shift from focusing on the production of artifacts to the development of tools in the service of larger activity many complications arise.

It is an appreciation for the complexities of supporting activity in situ that we have shifted from our understanding of design as the application of a series of principles to a balancing of tensions (Barab, MaKinster, & Scheckler, in press; Wenger, 1998, 2000). In our work, this has meant identifying relevant tensions in the use of our work and supporting the coemergence of participant structures that best balance the potentially conflicting and frequently complementary struggles. Engeström (1993) has argued that it is in the balancing of these tensions that systems are energized and continue to evolve and grow. It is important to note that these tensions cannot be designed and controlled from the outside or in some design document, but must be managed in situ as part of contextualized activity. It is for this reason that many of the complex design projects in which we are engaged are not simply about designing an artifact, or even designing learning, but are about designing for change. Such a process does not involve the simplistic application of those principles advanced by other researchers. Instead it involves reading other rich descriptions, relating these accounts and local struggles to that confronting one's own work and determining how to best balance local tensions that emerge through design.

For an ingenious interpretation of activity theory in applied settings, the reader is referred to Mwanza's (2001) case study on the requirements for a computer system to facilitate customer support (operated by a firm in the industrial computing sector); Hasan's (1998) longitudinal case study that analyzes the progress of university management support systems and highlights benefits of the use of activity theory in the field of information systems (IS) and HCI; Petersen, Madsen, and Kjær's (2002) usability study—a long-term empirical study conducted in the homes of two families, that illustrates how the development of television use is supported or hampered by users' backgrounds, needs, experiences, and specific contexts; and the collection of studies in Nardi's (1996) book on *Context and Consciousness*. In the next section we briefly illustrate three examples in which activity theory was applied to understand and enrich contexts of participation. However, we encourage the interested reader to also refer to the case examples above.

9.4 APPLICATION OF ACTIVITY THEORY

Below, we briefly highlight three research and design projects that have usefully integrated activity theory to understand and evolve activity. We begin with a technology-rich astronomy course in which Activity Theory was applied to understand particular course actions and resulting in a more general characterization of course activity and systemic tensions that fueled more useful iterations of the course. From here, our unit of analysis expands to focus on applying Activity Theory to make sense and evolve the design and participation of an online community consisting of over 1600 members. Finally, our unit expands even farther as we relate a case in which Activity Theory was useful for exposing and intervening on the practices of the medical profession more generally. While each case is useful in its own right, taken as a collection they highlight the ever expanding unit of analysis and different time and space scales that can be examined from an Activity Theory perspective. In this way, operations, actions, and even activities are always nested in more complex contexts all of which might be considered when designing and researching activity systems.

9.4.1 Case I: Tensions Characterizing a Technology-Rich Introductory Astronomy Course

In the design project discussed above, Barab, Barnett et al. (2002) used Activity Theory to understand the systemic tensions characterizing a technology-rich, introductory astronomy course. More specifically, in this work they designed and examined a computer-based three-dimensional (3–D) modeling course for learning astronomy, using the central tenets of Activity Theory to analyze participation by undergraduate students and instructors, illuminating the instances of activity that characterized course dynamics. They focused on the relations of subject (student) and object (3-D models and astronomy understandings) and how, in their course, object transformations leading to scientific understandings were mediated by tools (both technological and human), the overall classroom microculture (emergent norms), division of labor (group dynamics and student/instructor roles), and rules (informal, formal, and technical). In addition to characterizing course activity in terms of Engeström's (1987) system components, through analysis of the data they interpreted and then focused on two systemic tensions as illuminative of classroom activity (see Fig. 9.3).

With respect to the first systemic tension, they examined the dialectic between learning astronomy and building 3-D models, with findings suggesting that frequently participation in the development of model building (using the 3-D modeling tool) coevolved with the outcome of astronomy learning. This is not to say that there were not times when the using of 3-D modeling tools did not frustrate the students or detract time from actually learning astronomy content. However, there were many times when grappling with the limitations of the tool actually highlighted inconsistencies that were supportive of developing a rich appreciation for astronomy content. With respect to the second tension, an examination of the interplay between prespecified, teacher-directed instruction versus emergent, student-directed learning indicated that it was rarely teacher-imposed or student-initiated constraints that directed learning; rather, rules, norms, and divisions of labor arose from the requirements of building and sharing 3-D models.

The authors found that viewing the class as an activity system allowed them to understand how "dualities, analyzed as systemic tensions, led to outcomes that were inconsistent with students developing astronomical understandings" (p. 25). By understanding the tensions in the context of the larger activity system they made appropriate changes in the course participant structures (see Barab, Hay, Barnett, & Keating, 2001) that leveraged emergent tensions in ways that would best support learning. As part of a larger design experiment work, they found the characterization of course actions and activity in terms of Engeström's (1987) schematic, with its focus on understanding how tools and community mediate object transformation, to be useful for identifying particular tensions and making necessary changes in future iterations of the course.

9.4.2 Case II: Conceptualizing Online Community

In one instructional design project, Barab, Schatz, and Scheckler (in press) applied Activity Theory as an analytical lens for characterizing the process of designing and supporting the implementation of the Inquiry Learning Forum (ILF), an online environment designed to support a web-based community of in-service and preservice mathematics and science teachers sharing, improving, and creating inquiry based pedagogical practices. In this research they found Activity Theory to be a useful analytical tool for characterizing design activity. For example, when they attempted to characterize the design and implementation struggles, they realized that when applying Engeström's (1987) triangle it was necessary to develop two separate triangles—one from the perspective of designers and the other from that of users. As they attempted to determine how to relate these two systems, they realized the schism in their design work. While the team was already becoming uncomfortable with the divide, characterizing activity in terms of two distinct systems made this even more apparent. It is in understanding their lack of a participatory design framework that Activity Theory proved particularly useful. Additionally, it helped them account for the more complex dynamics and influences that come into play when thinking about online community. In their work, they began to develop an appreciation that design activity when targeted towards designing for online community does not simply involve the development of a tool or object but establishing a system of activity.

As one moves toward trying to design community, especially one in which the members are expected to engage in new practices that challenge their current culture, many contradictions emerge. Since Lave and Wenger's (1991) seminal book on communities of practice, it has become generally accepted to look at community in which action is situated as an essential mediating artifact of action. This is particularly true when viewing communities of practice designed to support learning (Barab, Kling, & Gray, in press), where the community itself is a tool that mediates the interaction between the subject and object. In terms of Engeström's triangle, this treatment elevates the notion of community from simply occupying the bottom of the triangle to an entity whose reach is distributed across multiple components as it functions as tool, object, outcome, and, at one unit of analysis, even subject. Barab, Schatz, and Scheckler (in press) show how their online environment for learning functioned in multiple roles and, thereby, occupied multiple components of Engeström's triangle. They stated, "when the community itself is considered a tool as well as an outcome it comes to occupy multiple components with its compartmentalization being an acknowledgment of function—not form."(p. 28). As such, they concluded that while an activity theory framework as advanced by Engeström (1987, 1993) was useful for understanding the design and use process and some of their faulty design decisions, isolating components to particular components of the triangle did not appear to be ontologically consistent with the activities through which the community of practice emerged and functioned.

9.4.3 Case III: Analyzing Discoordinations in Medical Consultations/Care

Engeström (1999b, 2000) presents an elegant example of how the concept of secondary contradictions between the principle nodes of a central activity system can provide powerful insights for analysis and redesign of work environments. In the case of a medical team working in an outpatient clinic at Children's Hospital in Helsinki, primary contradictions were detected that resulted in costly gaps, overlaps and discoordinations of care.

As chronic patients passed through the system of encounters with physicians, specialists, and practitioners, the first contradictions detected were between the object (patients moving smoothly from hospital to primary care) and the instruments, or tools. In the Children's Hospital, so-called critical pathways were the officially accepted instruments for dealing with complex cases. The critical pathways are normative guidelines providing step-by-step procedures for moving a child with a given diagnosis through the health care system. The contradiction arises when a physician must use the critical pathway for a patient with multiple diagnoses. On the contrary, the critical pathways were designed to handle only one diagnosis at a time. When the conventional critical pathways were applied to patients with multiple diagnoses, the inadequacy, and possible contribution to additional disturbances, was revealed in the analysis. Multiproblem patients who move between different care providers and thus require interinstitutional coordination instigated two additional contradictions within the overall system. As for the contradiction between the traditional rules of the hospital (which emphasize solo responsibility on the part of the physician) and the object, multiproblem patients forced physicians to request assistance from other institutions. Likewise, the contradiction between the division of labor (where physicians are socialized and trained to act as solo performers) and the object created a disturbance among physicians, specialists, and practitioners. Against tradition, the needs of multiproblem patients demanded that cooperation and collaboration be enacted to ensure the object was achieved.

Consequently, given the case presented here, the concept of contradictions becomes most useful, for researchers and practitioners in our field because it permits for the formulation of hypotheses about contradictions in the central activity system. Thus, in the case of the medical team study, Engeström (1999b, 2000) constructed hypotheses to be used in the redesign of work practices that could lead to innovations and, ideally, expansive learning opportunities. One of these innovations was a *care agreement* formulated by physicians, nurses, and parents that permitted for continued attention to conventions, but also required the coordination and collaboration among individuals and institutions to meet emerging and unforeseen needs. In a way, contradictions became a source for the design of innovative work practices.

9.5 UTILIZING ACTIVITY THEORY FOR ANALYSIS AND DESIGN

Undoubtedly, Activity Theory can at times be an overwhelmingly complex framework, making it difficult for the novice and expert alike to utilize the concepts and principles efficiently and effectively for analysis and design. Nonetheless, from our own experience and through reviewing the extant literature, we have found that a general heuristic for taking advantage of Activity Theory can be derived to aid both researcher and practitioner. One thing we wish to make certain, though, is that the order of tactics presented here should not be taken as a prescription or as generally accepted practice. Although certain researchers may consistently apply a preferred strategy, there currently is no accepted methodology for using Activity Theory, particularly in the fields of instructional and performance technology.

9.5.1 Characterize Components of Activity

One of the most powerful and frequently invoked uses of Activity Theory is as a *lens, map,* or *orienting device* to structure the analysis of complex sociocultural learning and performance contexts (Barab, Schatz, & Scheckler, in press; Blanton, Simmons, & Warner, 2001; Cole & Engeström, 1993; Engeström, 1999a; Engeström & Miettinen, 1999; Rochelle, 1998). That is, by attending to the primary components of Engeström's (1987) activity system triangle—Subject(s), Tools, Object(s), Outcome(s) Rules, Community, and Division of Labor—an investigator can begin to structure her analysis without the burden of too overt a prescription. However, before activity more generally can be segmented into components the researcher must select a unit of analysis for investigation (micro or macro). In the case descriptions described above, the first case has a more fine-grained unit of analysis, focusing on particular learning episodes in the course, than does Case II, focusing on community participation in the ILF, which is still finer than Case III in which Engeström (1999b) is characterizing medical practice more generally. Once the unit or grain size is selected, the researcher than mines collected data to determine the content that they view as constituting a particular component of the triangle with the goal of developing a triangular characterizing of activity. These components may be used as "buckets" for arranging data collected from needs and task analyses, evaluations, and research.

As an example, Blanton, Simmons, and Warner (2001, p. 443) utilized the components of the activity system triangle to contextualize a computer technology and telecommunications mediated learning system designed to promote conceptual change in prospective teachers' perceptions of teaching, learning, and pupils. As a precursor to analysis, the researchers filled each node with empirical data collected from their site. For example, under Subjects the investigators placed the college faculty developing and implementing the course curriculum; under Tools they placed items such as "discourse," "distance learning," "field notes," and "telecommunications"; under Objects they placed "undergraduates," "meaning-making," and "reflection." In essence, the authors were using the activity system triangle as an aid to account for the meaningful participants, processes, and elements of the learning intervention so as to ensure a more thorough analysis.

9.5.2 Structuring Levels of Activity

A second increasingly used tactic generated from the Activity Theory perspective is the attention to the *hierarchical structure of activity*. Here, the analyst is interested in discovering and constructing the motives of the overall activity system, the needs associated with the actions of individual participants and users, and the conditions that enable or inhibit accompanying operations (Gilbert, 1999; Hyppönen, 1998; Kuutti, 1996; Leont'ev, 1978, 1981). Metaphorically speaking, attention to the hierarchical structure of activity provides "depth" to the initial "breadth" gained from the activity triangle orientation. Whereas we have already offered an abbreviated exercise using this hierarchical notion to analyze the motives, needs, and conditions of three activity systems from the literature (see Table 9.1), a more detailed example may provide further aid and insight. In an elegant attempt to bridge user needs with product specifications (in this case, an alarm system for disabled users incorporated into an existing mobile telephone technology), Hyppönen (1998) drew upon the hierarchical notions of activity (Leont'ev, 1978, 1981) to capture requirements for design and development. At the activity level, the researcher inferred that the principle motive was the gaining of easy access to alarm services. This motive implied cooperation among relevant actors and organizations in regard to, for example, locating reliable network services to carry the technology, distributing and maintaining the technology, and educating users on its use. At the action level, it was revealed that several need-driven tasks had to be addressed, including the making of ordinary calls, recalling previous calls from memory, and using a remote alarm key. Finally, the operational level of analysis oriented the researcher to the conditions under which reliable, easy access could be promoted. These included locating the phone, remembering the sequence of operations, and requirements for layout of keys and functions. As seasoned needs analysts and researchers, we find that the riches gained from this perspective provide insights not possible with more conventional views or practices.

9.5.3 Locating Points of Contradiction

A final, equally insightful, tactic taken from an activity theoretical posture is to identify *contradictions* within and between nodes in the central activity system as well as across entire activity systems (Barab, Barnett et al., 2002; Engeström, 1999b, 2000; Holt & Morris, 1993; Nardi, 1996). If you will recall from an earlier section, Engeström (1987) has indicated four levels of contradiction that need particular attention during analysis: primary contradictions within each node of the central activity system, secondary contradictions between constituent nodes (e.g., Subject(s) and Community), tertiary contradictions between object/motive of central activity and culturally advanced form of central activity, and quaternary contradictions between central activity system and adjacent activities. The importance of contradictions to Activity Theory is that they serve as indications of both discordance and, more positively, potential opportunities for intervention and improvement. Paradoxically, contradictions should not be mistaken as *dysfunctions,* but as *functions* of a growing and expanding activity system. Another way to think of the process of contradiction identification is "gap analysis." To illustrate, whereas in the third case from the previous section (concerning discoordinations of medical consultation and care), we presented an example of how secondary contradictions between nodes disrupted care in a children's hospital, Holt and Morris (1993) provide a concise tutorial in detecting primary contradictions. In their retrospective analysis of the space shuttle Challenger disaster, the authors used the notion of primary contradictions to hypothesize possible causes of failure of NASA's Flight Readiness System (the system installed to ensure unqualified safety for each launch). By indicating contradictions within each node (p.105), for example, in the Rules node ("safety first" vs. timely flight) in the Community node (defense-dependent vs. self-sustaining shuttle program), and in the Division of Labor node (priority given to Flight Readiness Review vs. timely flight by Flight Readiness Team), it was concluded that fundamental differences in priority (i.e., safety vs. timeliness) between contracted engineers and NASA officials may have contributed substantially to the decision to launch, ending in disaster. Thus, a substantial "gap" was detected between the mindsets or cultures of officials and engineers involved in the space shuttle program, a significant discovery that could inform a number of possible performance interventions.

Before ending this section, we want to make certain the reader is clear on three important points. First, as mentioned in the opening paragraph, there currently is no generally accepted methodology for utilizing concepts and principles from Activity Theory. Through a review of the literature and from our own experience applying Activity Theory, we have offered at best a loose heuristic for use. Our recommendation is that the reader access the works cited above (particularly Barab, Barnett et al., 2002; Blanton et al., 2001; Hyppönen, 1998; and Holt & Morris, 1993) to gain a deeper understanding of how Activity Theory is used for analysis. Second, speaking of methodology, it can be confidently stated that researchers and designers adopting an Activity Theory perspective are often committed, although not explicitly obligated, to the use of strategies and tactics from methodologies such as case study (Stake, 1995; Yin, 1994), ethnography (Hollan et al., 2000; Metz, 2000; Spindler & Hammond, 2000), and design experiment (Brown, 1992; Collins, 1990). The commitment is to take an extended, holistic view that allows for the contribution of multiple perspectives. Third, and arguably most importantly, Activity Theory as promoted by Vygotsky, Leont'ev, and Engeström is to be used *descriptively*. That is, the framework in its original intention aids in the *understanding* and *description* of learning and work in socioculturally rich contexts; it does not claim to advocate a prescription for *change*. Nevertheless, in the domains of instructional and performance technology, our efforts are often focused on bringing about positive change. Consequently, although we encourage the exploration of using Activity Theory in more prescriptive endeavors, researchers and designers must take heed of the origins and original intentions of the theory and respect inherent limitations. For ideas on how to adapt Activity Theory to more practical uses, the reader is referred to the work of Kaptelinin, Nardi, and Macaulay (1999), Mwanza (2001), and Turner, Turner, and Horton (1999).

9.6 CAUTIONARY NOTES

Despite the obvious opportunities Activity Theory provides to understand and redesign for learning and work (Engeström, 1987, 1999b, 2000), there are unresolved issues that still must be addressed. Life tends not to compartmentalize itself or act in ways that are always wholly consistent with our theoretical assumptions. As such, just as we identify the strengths of any theory we must also understand its limitations so that we can most usefully apply it to impact practice. Below, we briefly highlight three issues that seem particularly problematic as cautionary notes for those using Activity Theory to make sense and evolve their particular contexts.

9.6.1 Issue 1: Move from Interactive to Transactive Framework

Engeström's (1987) triangle provides an analytical focus and allows researchers to identify components of activity and to gain insight into the interaction among the components of the triangle. However, Garrison (2001) has argued that while activity theory has much usefulness as an analytical lens, it can frequently be used in ways that suggest system dynamics are less transactive those they are trying to represent. Instead of treating each component as independent and simply interactional with other components, transactional thinking "allows us to see things as belonging together functionally . . . [and] allows us to recognize them as subfunctions of a larger function [the ILF]" (Garrison, 2001, p. 23). Transactional thinking assumes that components of the world transact through a dialectic in which both sides continually are transformed. Dewey and Bentley (1949/1989, p. 101–102) distinguished among three forms of action:

> (1) Self-action: where things are treated as functioning independently and viewed as acting under their own powers; (2) Inter-action: where one thing is balanced against another thing in casual interconnection; and (3) Trans-action: where systems of description and naming are used to deal with aspects and phases of action, without attribution to "elements" or other presumptively detachable or independent "entities," "essences," or "realities," and without isolation of presumptively detachable "relations" from such detachable "elements."

Central to the notion of transaction is the interdependency and interconnection of components that only remain separate in name or in researchers' minds, for in their materiality they are transformed continuously in relation to other components.

Garrison (2001) argued that applications of Activity Theory must be careful to ensure that all components, when examined in the context of activity, are treated as subfunctions (not separate entities) of a larger transactive function—the activity. Without such an appreciation, researchers will strip the overall activity and its nested components of their ecological functioning as part of larger system. As long as we treat the components as interacting we run the risk of thinking that tools (or subjects) are somewhat isolated and that they can be understood in isolation from their contextualized transactions. Instead, we argue, that they must be considered fundamentally situated and transactive and reinterpreted as they come to transact as part of new systems. Said succinctly, they are always situated. This does not entail that subjects, tools, and communities have no invariant properties that persist across contexts, but rather that these are re-situated as part of each context through which they function (Barab et al., 1999).

9.6.2 Issue 2: Move from Static to Dynamic Characterization

The temptation is to look at any activity system as a black box, static in both time and structure. This temptation is exacerbated when the researcher characterizes the system using a static representation such as occurs when using Engeström's (1987) triangle on paper. Any generalized and static account of an activity system obfuscates the numerous nested levels of activity that occur throughout the making of the system. As such, while Activity Theory offers an excellent characterization of the dynamics of a system and as such does useful work, the compartmentalization also runs the risk of leading to the ontological compartmentalization and static portrayal of reciprocally defining and transacting components. This is because most segmentation is based on a compartmentalization that frequently treats the components it compartmentalizes as independent ontological entities, essences, or realities. Barab, Schatz, and Scheckler (in press) argued that in their analysis of their online community, they found that components treated as, for example, tools were at other times objects or even the community. As such, they suggested that researchers should view Engeström's (1987) triangle as illuminating a functional and not ontological distinction.

By functionally relating each component (subject, tools, community, and objects) as subfunctions of the larger system, one comes to appreciate how activity systems function as a unit that is transformed over time through transactions inside and outside the system. For example, reflecting on the Inquiry Learning Forum, Barab, MaKinster, and Scheckler (in press) suggest that at times the Inquiry Learning Forum was the tool, at other times the object to be transformed, and still others it is the community. Further, as subjects transact with tools both the subject and the tool are transformed in ways. They stated that:

> . . . while an activity theory framework as conceptualized by Engeström (1987, 1993) was useful for understanding this process and some of our faulty design decisions, isolating components to particular locations along the triangle did not appear to be ontologically consistent with the activities through which this community of practice was made and functioned. (p. 23)

We argue that any description of an activity should be treated as continually in the making with the segmented characterization simply being a static snapshot that informs at the same time it reifies. Every system, however, has a history and nested actions, which when viewed from different vantage points and from different points in time may be construed and represented differently and constitute their own activity systems. It is for this reason that some researchers have used Activity Theory in conjunction with other theoretical perspectives.

9.6.3 Issue 3: Move from Isolated to Complementary Theoretical Perspectives

Several researchers have noted the similarities between Activity Theory and other theories that address collective knowledge and practice (Davydov, 1999; Engeström, 1987; Schwen, 2001; Wenger, 1998). The particular theories that we find to have a great deal of potential include Communities of Practice Theory (Lave & Wenger, 1991; Wenger, 1998, 2000), Actor Network Theory (Latour, 1987), and Institutional Theory (Berger & Luckmann, 1966). Although space does not permit us to go more in-depth into the comparison, a cursory survey should pique the reader's interest enough to explore the issue further.

To begin, Wenger (1998) has noted that Activity Theory and Communities of Practice Theory both are concerned with the tensions and contradictions that exist between the collective (or community) and the individual. For Wenger (1998, pp. 230), the notions of identification (to indicate the individual) and negotiability (to indicate the community) exist in a duality that stimulates both harmony and tension. Interestingly, both Wenger and Engeström see this tension as an opportunity for learning and development for both the individual/subject and community. Researchers in instructional technology are also picking up on this notion of integrating these perspectives when describing collective activity. For example, Hung and Chen (2001) attempted to derive certain heuristics to describe the sufficient conditions for online participation. Using situated cognition, Communities of Practice Theory and Activity Theory, they concluded that community-oriented web-based design should take note of at least four dimensions as follows: situatedness, commonality, interdependency, and infrastructure.

Next, Engeström (1999b) himself admits that Actor Network Theory and Activity Theory are simultaneously attempting to attend to multiple activity systems as the cross-cultural (be it professional, organizational, national, or multinational) dimension of learning and work has come to the forefront of research and practice in the latter part of the last century. Thus, it would be beneficial both conceptually and practically to make an attempt to integrate these overlapping approaches. Ideally, this work would provide us the means to analyze collective practice and (re)design the technology that supports and facilitates the involved actors. In the work of Barab, Schatz, and Scheckler (in press) as one example, they combined activity theory with a network theoretical approach, resulting in a richer characterization in which the network approach was used to illuminate the transactional nature of the system and Activity Theory helped to characterize the various functioning of the system and further illuminated pervasive tensions. In other words, while actor-network theory is particularly useful for characterizing the system and understanding its functioning, network approaches can prove useful for observing the dynamic transactions of a system as a simultaneously functioning unit.

Finally, as for Activity Theory and Institutional Theory, we have not found a piece that explicitly attempts to wed these two perspectives. Nonetheless, there is a remarkable congruence to the way the two positions articulate the construction of objective and subjective reality involving processes of internalization and externalization. Like Berger and Luckmann (1966) emphasize a triadic process of externalization–objectivation–internalization. Critical here is the notion of an "obdurate" reality that shapes and is shaped by human production. Of note is that both draw heavily from dialectical materialism.

9.7 CONCLUSIONS AND IMPLICATIONS

Our intentions have been to provide the reader a brief sketch of a theory that we feel can have tremendous impact upon the fields of instructional and performance technology. First, Activity Theory provides us the means to overcome the limiting heritage of the Cartesian dichotomy that has misled us into believing that individuals and their environments can be separated for analytical and synthetic activities. Next, in its development Activity Theory has given us powerful conceptualizations for thinking about learning and work as an activity. Leont'ev's distinctions between activity and action have clear consequences for needs assessment and task analysis and for conceptualizing the targets of our designs. Finally, Engeström has provided a lens for better coordinating the evidently complex task of taking account of activity at a systemic level. Although other approaches have made claims of accomplishing this feat (e.g., Heinich's instructional systems [see Heinich, 1984; Schwen, 2001]), none have been developed from psychological perspectives that conceptualize *collective* production. Another way to put this is that conventional so-called "systemic" approaches have mistakenly taken individual aggregation as being equal to "collective." Additionally, it is one thing to design to support existing systems and another design with the goal of changing the system.

Designing for change is a complex activity that involves balancing many tensions. It is one thing to design tools that support users in doing what they already do but in a more efficient manner. It is another thing to support tools that focus on bringing about change. Barab, Thomas, Dodge, Carteaux, Tuzun, and Goodrich (in press) stated that:

> The goal of improving the world is a messy business, with numerous struggles, opposing agendas, multiple interpretations, and even

unintended and controversial consequences. Instead of simply building an artifact to help someone accomplish a specific task, the goal is to develop a design that can actually support the user (and the culture) in his or her own transformation. (p. 3)

Design work targeted towards transformation, or what Barab et al. (in press) refer to as empowerment design work, requires establishing buy in and commitment, honoring people wherever they are at the same time supporting them in envisioning and accomplishing what they can be, and balancing multiple agendas and tensions. Understanding the context of the activity through which the design work transacts is a necessary part of any design work (Norman, 1990). We view Activity Theory in general and Engeström's (1987) schematic framework with its acknowledgment of the larger community (including norms and division of labor) of activity as providing useful starting points for understanding the tensions that emerge in this type of work.

Despite its clear advantages in helping instructional and performance technology make strides in accounting and designing for learning and work in the 21st century, there are still many obstacles ahead, a few of which we have mentioned here. As a closing remark, we want to emphasize that a perspective inspired by Activity Theory can be well supplemented with a desire to make meaningful and lasting contributions to society (Coleman, Perry, & Schwen, 1997; Driscoll & Dick, 1999; Reeves, 2000; Reigeluth, 1997). That is, our choice of taking Activity Theory with us on design projects is grounded in a belief that it will permit us to recognize and respect the culture of the collective we are engaged with and support them longitudinally in their aspirations for better lives (Eisenhart, 2001; Metz, 2000; Spindler & Hammond, 2000). It is in this way that we view Activity Theory as a transactional tool that can help us improve local practice and, hopefully, the world through which these practices occur.

References

Bannon, L. J., & Bodker, S. (1991). Beyond the interface: Encountering artifacts in use. In J. Carroll (Ed.), *Designing interaction: Psychology at the human-computer interface* (pp. 227–253). New York: Cambridge University Press.

Barab, S. A. (2002). Commentary: Human-field interaction as mediated by mobile computers. In T. Koschmann, R. Hall, & N. Miyake (Eds.), *Computer supported collaborative learning* (pp. 533–538). Mahwah, NJ: Erlbaum.

Barab, S., A., Barnett, M., Yamagata-Lynch, L., Squire, K., & Keating, T. (2002). Using activity theory to understand the contradictions characterizing a technology-rich introductory astronomy course. *Mind, Culture, and Activity, 9*(2),76–107.

Barab, S. A., Cherkes-Julkowski, M., Swenson, R., Garrett. S., Shaw, R. E., & Young, M. (1999).Principles of self-organization: Ecologizing the learner-facilitator system. *The Journal of The Learning Sciences, 8*(3&4), 349–390.

Barab, S. A., & Duffy, T. (2000). From practice fields to communities of practice. In D. Jonassen & S. M. Land (Eds.), *Theoretical foundations of learning environments* (pp. 26–56). Mahwah, NJ: Lawrence Erlbaum Associates.

Barab, S. A., Hay, K. E., Barnett, M. G., & Keating, T. (2000). Virtual solar system project: Building understanding through model building. *Journal of Research in Science Teaching, 37*(7), 719–756.

Barab, S. A., & Kirshner, D. (2001). Guest editors' introduction: Rethinking methodology in the learning sciences. *The Journal of the Learning Sciences, 10*(1&2), 5–15.

Barab, S. A., Kling, R., & Gray, J. (in press). (Eds.). To appear as *Designing for Virtual Communities in the Service of Learning.* Cambridge, MA: Cambridge University Press.

Barab, S. A., MaKinster, J., Moore, J., Cunningham, D., & the ILF Design Team (2001). The Inquiry Learning Forum: A new model for online professional development. *Educational Technology Research and Development, 49*(4), 71–96.

Barab, S. A., MaKinster, J., & Scheckler, R. (in press). Designing system dualities: Characterizing a websupported teacher professional development community. In S. A. Barab, R. Kling, R., & J. Gray (Eds.), *Designing for virtual communities in the service of learning.* Cambridge, MA: Cambridge University Press.

Barab, S. A., & Plucker, J. A. (2002). Smart people or smart contexts? Cognition, ability, and talent development in an age of situated approaches to knowing and learning. *Educational Psychologist, 37*(3), 165–182.

Barab, S. A., Schatz, S., & Scheckler, R. (in press). Using Activity Theory to conceptualize online community and using online community to conceptualize Activity Theory. To appear in *Mind, Culture, and Activity.*

Barab, S. A., Thomas, M., Dodge, T., Carteaux, R., Tuzun, H., & Goodrich, T. (in press). Empowerment design work: Building participant structures that transform. In *The Conference Proceedings of the Computer Supported Collaborative Learning Conference,* Seattle, WA.

Barrows, H. S. (1985). *How to design a problem based curriculum for the preclinical years.* New York: Springer Publishing Co.

Barrows, H. S. (1992). *The tutorial process.* Springfield, IL: Southern Illinois University School of Medicine.

Bednar, A. K., Cunningham, D., Duffy, T. M., & Perry, J. D. (1992). Theory into practice: How do we link? In T. M. Duffy & D. H. Jonassen (Eds.), *Constructivism and the technology of instruction: A conversation* (pp. 17–35). Hillsdale, NJ: Lawrence Erlbaum Associates.

Berger, P., & Luckmann, T. (1966). *The social construction of reality: A treatise in the sociology of knowledge.* New York: Anchor Books.

Blackler, F. (1995). Knowledge, knowledge work and organizations: An overview and interpretation. *Organization Studies, 16*(6), 1021–1046.

Blanton, W. E., Simmons, E., & Warner, M. (2001). The fifth dimension: Application of Cultural-Historical Activity Theory, inquiry-based learning, computers, and telecommunications to change prospective teachers' preconceptions. *Journal of Educational Computing Research, 24*(4), 435–63.

Bonk, C. J., & Cunningham, D. J. (1998). Searching for learner-centered, constructivist, and sociocultural components of collaborative educational learning tools. In C. J. Bonk & K. S. King (Eds.), *Electronic collaborators: Learner-centered technologies for literacy,* *apprenticeship, and discourse* (pp. 25–50). Mahwah, NJ: Lawrence Erlbaum Associates.

Brooks, J. G., & Brooks, M. G. (1993). *In search of understanding: The case for constructivist classrooms,* Alexandria, VA: American Society for Curriculum Development.

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of The Learning Sciences, 2,* 141–178.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18,* 32–42.

Brown, J.S., & Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation. *Organization Science, 2*(1), 40–57.

Cognition and Technology Group at Vanderbilt (1991). Some thoughts about constructivism and instructional design. In T. M. Duffy & D. H. Jonassen (Eds.), *Constructivism and the technology of instruction: A conversation*. (pp. 115–119). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cognition and Technology Group at Vanderbilt (1992). Emerging technologies, ISD, and learning environments: Critical perspectives. *Educational Technology Research and Development, 40*(1), 65–80.

Cognition and Technology Group at Vanderbilt (1993). Designing learning environments that support thinking: The Jasper series as a case study. In T. M. Duffy, J. Lowyeh, & D. H. Jonassen (Eds.), *Designing environments for constructive learning* (pp. 9–36). Berlin: Springer-Verlag.

Cole, M. (1985). The zone of proximal development: Where cultural and cognition create each other. In J. Wertsch (Ed.), *Culture, communication, and cognition* (pp. 146–161). New York: Cambridge University Press.

Cole, M. (1996). *Cultural psychology: A once and future discipline*. Cambridge, MA: Harvard University Press.

Cole, M., & Engeström, Y. (1993). A cultural-historical approach to distributed cognition. In G. Salomon (Ed.), *Distributed cognitions: Psychological and educational considerations* (pp. 1–46). New York: Cambridge University Press.

Coleman, S. D., Perry, J. D., & Schwen, T. M. (1997). Constructivist instructional development: Reflecting on practice from an alternative paradigm. In C. R. Dills & A. J. Romiszowski (Eds.), *Instructional development paradigms* (pp. 269–282). Englewood Cliffs, NJ: Educational Technology Publications.

Collins, A. (1990): *Toward a design science of education [Technical Report #1].* Cambridge, MA: Bolt Beranek and Newman.

Collins, A., Brown, J. S., & Newman, S. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. Resnick (Ed.) *Knowledge, learning, and instruction*, (pp. 453–494). Englewood Cliffs, NJ: Erlbaum.

Cook, S. D. N., & Yanow, D. (1993). Culture and organizational learning. *Journal of Management Inquiry, 2*(4), 373–390.

Dabbagh, N., Jonassen, D. H., Yueh H. P., & Samouilova, M. (2000). Assessing a problem-based learning approach in an introductory instructional design course: A case study. *Performance Improvement Quarterly, 13*(3), 60–83.

Davydov, V. V. (1999). The content and unsolved problems of activity theory. Perspectives on activity theory. In Y. Engeström, R. Miettinen, & R. Punamaki (Eds.), *Perspectives on activity theory* (pp. 39–53). Cambridge, MA: Cambridge University Press.

Dewey, J., & Bentley, A. (1949/1989). Knowing and the known. In Jo Ann Boydston (Ed.), *John Dewey: The later works, volume 16* (pp. 1–279). Carbondale, IL: Southern Illinois University Press.

Driscoll, M. P., & Dick, W. (1999). New research paradigms in instructional technology: An inquiry. *Educational Technology Research & Development, 47*(2), 7–18.

Duffy, T. M., & Cunningham, D. J. (1996). Constructivism: Implications for the design and delivery of instruction. In D. J. Jonassen (Ed.), *Handbook of research for educational communication and technology* (pp. 170–198). New York: McMillan Library Reference USA.

Duffy, T. M., & Jonassen, D. H. (1991). New implications for instructional technology? *Educational Technology, 31*(3), 7–12.

Eisenhart, M. (2001). Educational ethnography past, present, and future: Ideas to think with. *Educational Researcher, 30*(8), 16–27.

Engeström, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research.* Helsinki, Finland: Orienta-Konultit.

Engeström, Y. (1993). Developmental studies of work as a test bench of activity theory: The case of primary care medical practice. In S. Chaiklin & J. Lave (Eds.) *Understanding practice: Perspectives on activity and context* (pp. 64–103). Cambridge, MA: Cambridge University Press.

Engeström, Y. (1999a). Activity theory and individual and social transformation. In Y. Engeström, R. Miettinen, & R. Punamaki (Eds.), *Perspectives on activity theory* (pp. 19–38). Cambridge, MA: Cambridge University Press.

Engeström, Y. (1999b). Innovative learning in work teams: Analyzing cycles of knowledge creation in practice. In Y. Engeström, R. Miettinen, & R. Punamaki (Eds.), *Perspectives on activity theory* (pp. 377–404). Cambridge, MA: Cambridge University Press.

Engestrom, Y. (2000). Activity Theory as a framework for analyzing and redesigning work. *Ergonomics, 43*(7), 960–974.

Engeström, Y., & Miettinen, R. (1999). Introduction. In Y. Engeström, R. Miettinen, & R. Punamaki (Eds.), *Perspectives on activity theory* (pp. 1–16). Cambridge, MA: Cambridge University Press.

Fodor, J. A. (1980). Methodological solipsism considered as a research strategy in cognitive psychology. *Behavioral and Brain Science, 3,* 63–109.

Gagne, R. M., Briggs, L. J., & Wager, W. W. (1993). *Principles of instructional design (4*th *ed).* Fort Worth, TX: Harcourt Brace.

Gardner, H. (1985). *The mind's new science.* New York: Basic Books.

Garrison, J. (2001). An introduction to Dewey's theory of functional "trans-action": An alternative paradigm for activity theory. *Mind, Culture, and Activity, 8*(4), 275–296.

Gherardi, S., Nicolini, D., & Odella, F. (1998). Toward a social understanding of how people learn in organizations: The notion of situated curriculum. *Management Learning, 29*(3), 273–297.

Gifford, B., & Enyedy, N., (1999). Activity centered design: Towards a theoretical framework for CSCL. *Proceedings of the Third International Conference on Computer Support for Collaborative Learning.*

Gilbert, L. S. (1999). Where is my brain? Distributed cognition, activity theory, and cognitive tools. In K. Sparks & M. Simonson (Eds.), *Proceedings of Selected Research and Development Papers Presented at the National Convention of the Association for Educational Communications and Technology [AECT]* (pp. 249–258). Washington, DC: Association for Educational Communications and Technology.

Greeno, J. G. (1989). A perspective on thinking. *American Psychologist, 44,* 134–141.

Greeno, J. G. (1997). On claims that answer the wrong question. *Educational Researcher, 26*(1), 5–17.

Hasan, H. (1998). Integrating IS and HCI using activity theory as a philosophical and theoretical basis. [Electronic version]. Retrieved July 6, 2002, from *http://www.cba.uh.edu/~parks/fis/hasan.htm#s5*

Hasu, M., & Engeström, Y. (2000). Measurement in action: An activity-theoretical perspective on producer-user interaction. *International Journal Human-Computer Studies. 53,* 61–89.

Hausfather, S. J. (1996, Summer). Vygotsky and schooling: Creating a social context for learning. *Action in Teacher Education 18*(2), 1–10.

Heinich, R. (1984). ERIC/ECTJ annual review paper: The proper study of instructional technology. *Educational Communication and Technology: A Journal of Theory, Research, and Development, 32*(2), 67–87.

Henricksson, K. (2000). *When communities of practice came to town: On culture and contradiction in emerging theories of organizational learning* (Working Paper Series No. 2000/3). Lund, Sweden: Lund University, Institute of Economic Research.

Hollan, J., Hutchins, E., & Kirsh, D. (2000). Distributed cognition: Toward a new foundation for human-computer interaction research. *ACM Transactions on Computer-Human Interaction, 7*(2), 174–196.

Holt, G. R., & Morris, A. W. (1993). Activity theory and the analysis of organizations. *Human Organization, 52*(1), 97–109.

Honebein, P. C., Duffy, T. M. and Fishman, B. J. (1993). Constructivism and the design of learning environments: context and authentic activities for learning. In T. M. Duffy, J. Lowyck, and D. H. Jonassen (Eds.) *Designing environments for constructive learning* (pp. 87–108). Berlin: Springer-Verlag.

Hung, D. W. L., & Chen, D. T. (2001). Situated cognition, Vygotskian thought and learning from the communities of practice perspective: Implications for the design of web-based e-learning. *Educational Media International, 38*(1), 3–12.

Hyppönen, H. (1998). Activity theory as a basis for design for all. *In Proceedings of the Technology for Inclusive Design and Equality [TIDE] Conference*. 23–25 June, Marina Congress Center Helsinki, Finland. [Electronic version]. Retrieved July 10, 2002, from http://www.stakes.fi/tidecong/213hyppo.htm

Jarz, E. M., Kainz, G. A., & Walpoth, G. (1997). Multimedia-based case studies in education: Design, development, and evaluation of multimedia-based case studies, *Journal of Educational Multimedia and Hypermedia, 6*(1), 23–46.

Jonassen, D. H. (1991). Objectivism versus constructivism: Do we need a new philosophical paradigm? *Journal of Educational Research, 39*(3), 5–14.

Jonassen, D. H. (1999). Designing constructivist learning environments. In C. M. Reigeluth (Ed.), *Instructional design theories and models: Their current state of the art. 2nd ed.* Mahwah, NJ: Lawrence Erlbaum Associates.

Jonassen, D. (2000, October). *Learning as activity.* Paper presented at the international meeting of the Association for Educational Communication and Technology, Denver, CO.

Jonassen, D., Davidson, M., Collins, M., Campbell, J. and Haag, B. B. (1995). Constructivism and computer-mediated communication in distance education. *The American Journal of Distance Education, 9*(2), 17–25.

Jonassen, D., & Hernandez-Serrano, J. (2002). Case-based reasoning and instructional design: Using stories to support problem solving, *Educational Technology Research & Development, 50*(2), 65–77.

Kaptelinin, V., Nardi, B., & Macaulay, C. (1999). Methods & tools: The activity checklist: A tool for representing the "space" of context. *Interactions, 6*(4), 27–39.

Koschmann, T. (1996). Paradigm shifts and instructional technology: An introduction. In T. Koschmann (Ed.), *CSCL: Theory and Practice of an Emerging Paradigm* (pp. 1–23). Mahwah, New Jersey: Lawrence Erlbaum Associates.

Kuutti, K. (1996). Activity theory as a potential framework for human–computer interaction research. In B. Nardi (Ed.), *Context and consciousness: Activity theory and human–computer interaction.* Cambridge, MA: The MIT Press.

Kuutti, K. (1999). Activity theory, transformation of work, and information systems design. In Y. Engeström, R. Miettinen, & R. Punamaki (Eds.), *Perspectives on activity theory* (pp. 360–376). Cambridge, MA: Cambridge University Press.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* New York: Cambridge University Press.

Leont'ev, A. N. (1974). The problem of activity in psychology. *Soviet Psychology, 13*(2), 4–33.

Leont'ev, A. N. (1978). *Activity, consciousness, and personality.* Englewood Cliffs: Prentice-Hall.

Leont'ev, A. N. (1981). *Problems of the development of mind.* Moscow: Progress.

Leont'ev, A. N. (1989). The problem of activity in the history of Soviet psychology. *Soviet Psychology, 27*(1), 22–39.

Luria, A. R. (1961). *The role of speech in the regulation of normal and abnormal behavior.* New York: Liveright.

Luria, A. R. (1966). *Higher cortical functions in man.* New York: Basic Books.

Luria, A. R. (1979). *The making of mind: A personal account of Soviet psychology*. Cambridge, MA: Harvard University Press.

Luria, A. R. (1982). *Language and cognition.* New York: Interscience.

Metz, M. H. (2000). Sociology and qualitative methodologies in educational research. *Harvard Educational Review, 70*(1), 60–74.

Mwanza, D. (2001). *Where theory meets practice: A case for an Activity Theory based methodology to guide computer system design.* (Tech. Rep. No. 104). United Kingdom: The Open University, Knowledge Media Institute.

Nardi, B. (Ed.). (1996). *Context and consciousness: Activity theory and human–computer interaction.* Cambridge, MA: The MIT Press.

Norman, D. (1990). *The design of everyday things.* New York: Currency Doubleday.

Petersen, M. G., Madsen, K. H., & Kjær, A. (2002, June). The usability of everyday technology: Emerging and fading opportunities. *ACM Transactions on Computer–Human Interaction, 9*(2), 74–105.

Preece, J. (2000). *Online communities: Designing usability, supporting sociability*. Chichester, UK: John Wiley & Sons.

Reeves, T. C. (2000). Socially responsible educational technology research. *Educational Technology, 31*(6), 19–28.

Reigeluth, C. M. (1997). Instructional theory, practitioner needs, and new directions: Some reflections. *Educational Technology, 37*(1), 42–47.

Resnick, L. B. (1987). Introduction. In L. B. Resnick (Ed.), *Knowing, learning and instruction: Essays in honor of Robert Glaser* (p. 1–24). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Rochelle, J. (1998). Activity theory: A foundation for designing learning technology? *The Journal of the Learning Sciences, 7*(2), 241–255.

Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context.* NY: Oxford University Press.

Salomon, G. (Ed.). (1993). *Distributed cognitions: Psychological and educational considerations.* New York: Cambridge University Press.

Savery, J. R., & Duffy, T. M. (1995). Problem based learning: an instructional model and its constructivist framework. *Educational Technology, 35*(5), 31–38.

Schwen, T. M. (2001, December). *The digital age: A need for additional theory in instructional technology*. Paper presented at the meeting of The Instructional Supervision Committee of Educational Technology in Higher Education Conference, Guangzhou, China.

Scribner, S. (1997). A sociocultural approach to the study of mind. In E. Toback, R. J. Flamagne, M. B. Parlee, L. M. W. Martin, & A. S. Kapelman (Eds.), *Mind and social practice: Selected writings of Sylvia Scribner* (pp. 266–280). New York: Cambridge University Press.

Sfard, A. (1998). On two metaphors for learning and the dangers of choosing just one. *Educational Researcher, 27,* 4–13.

Simon, H. A. (1981). *The science of the artificial, 2 ed.* Cambridge, MA: MIT Press.

Spindler, G., & Hammond, L. (2000). The use of anthropological methods in educational research: Two perspectives. *Harvard Educational Review, 70*(1), 39–48.

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks: Sage.

Stetsenko, A. P. (1999). Social interaction, cultural tools and the zone of proximal development: In search of a synthesis. In S. Chaiklin, M. Hedegaard, & U. J. Jensen (Eds.), *Activity theory and social practice: Cultural-historical approach* (pp. 225–234). Aarhus, DK: Aarhus University Press.

Trentin, G. (2001). From formal training to communities of practice via network-based learning. *Educational Technology,* 5–14.

Turner, P., Turner, S., & Horton, J. (1999). From description to requirements: An activity theoretic perspective. In S. C. Hayne (Ed.), *Proceedings of the International ACM SIGGROUP Conference on Supporting Group Work* (pp. 286–295). New York: ACM Press.

Vera, A. H., & Simon, H. A. (1993). Situated action: A symbolic interpretation. *Cognitive Science, 17,* 7–49.

Verenikina, I. & Gould. E. (1997) Activity Theory as a framework for interface design. ASCIIITE. Retrieved July 1, 2002. *http://www.curtin.edu.au/conference/ascilite97/papers/Verenikina/Verenikina.html*

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.

Vygotsky, L. S. (1987). *Thinking and speech*. In R. W. Rieber & A. S. Carton (Eds.), *The collected works of L. S. Vygotsky, Volume 1: Problems of general psychology.* New York: Plenum.

Wasson, B. (1999). Design and evaluation of a collaborative telelearning activity aimed at teacher training. In *Proceedings of the Computer Support for Collaborative Learning (CSCL) 1999 Conference,* C. Hoadley & J. Roschelle (Eds.) Dec. 12–15, Stanford University, Palo Alto, California. Mahwah, NJ: Lawrence Erlbaum Associates.

Wells, G. (1999). *Dialogic inquiry: Towards a sociocultural practice and theory of education.* New York: Cambridge University Press.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. New York: Cambridge University Press.

Wenger, E. (2000). Communities of practice and social learning systems. *Organization, 7*(2), 225–246.

Wertsch, J. V. (1985). *Vygotsky and the social construction of mind.* Cambridge, MA: Harvard University Press.

Yanow, (2000). Seeing organizational learning: A “cultural” view. *Organization, 7*(2), 247–268.

Yin, R. K. (1994). *Case study research: design and methods* (2nd ed.). Thousand Oaks, CA: Sage.