Building an Infrastructure for Organizational Learning:
A Multilevel Approach

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Organizational environments are increasingly turbulent, chaotic, and unpredictable thereby creating demands for organizational flexibility, agility, and adaptability (Terreberry, 1968). Organizations have responded to these pressures in a multitude of ways. They have made structural changes to organize work around teams (Lawler, Mohrman, & Ledford, 1995) to push expertise closer to the source of problems, to enable more rapid decision making, and to empower flexible action. They have made investments in information technology to manage knowledge acquisition, retention, and transfer (Argote, McEvily, & Reagans, 2003). Furthermore, they have invested in human capital to increase their collective knowledge stock and capacities (Davenport, 1999).

A key theme running through these responses is the need for learning and adaptive capabilities operating at multiple levels of the organizational system. Learning has been specified as a key individual capability that enables adaptation (Smith, Ford, & Kozlowski, 1997). The concept of learning has also been applied to teams (Edmondson, 2002; Kozlowski, Gully, Nason, & Smith, 1999) and organizations (Cyert & March, 1963) with respect to their capacity to acquire capabilities and to adapt to changes in their environments. Indeed, organization learning, from its early roots in the development of the science of organizational behavior, and particularly over the last decade, has evolved to become a multidisciplinary, vibrant, and diverse area of inquiry.

What is organizational learning and how can it be enhanced? The answer from the literature is diffuse. Since its inception as a concept in the 1960's, organizational learning has been very broadly conceptualized across different levels of analysis – often at the macro or organizational level; more rarely at the meso, work unit, or team level; and frequently at the micro or individual level (see Fiol & Lyles, 1985, for a review). Indeed, the particular level of interest is often not explicitly specified and an explanation can wander across multiple levels.

Organizational learning has been viewed as informal processes that promote knowledge acquisition (e.g., organizational culture, socialization, mentoring) and as more formal systems that capture and compile such knowledge (e.g., knowledge management, information systems). Moreover, the different and unique ways that organizational learning has been conceptualized cut across multiple disciplines and literatures that tend to be insular. The result is a very broad, fuzzy, and multifaceted concept that has much intellectual appeal. However, it also has limited operational utility so that the question posed at the beginning of this paragraph cannot easily be answered.

The conceptual challenge is a multilevel one. The process of *learning* can be reasonably well defined as an individual-level psychological phenomenon, but it is ill-defined and more amorphous when applied to higher levels of conceptualization. It is rooted in individual learning, but it is also much more than just a simple aggregate or summation of individual learning. Indeed, because learning is fundamentally psychological, the conceptual meaning and theoretical mechanisms of collective learning have to incorporate individual learning (as the theoretical origin), but they also have to encompass higher-level processes and linkages that capture how learning by individuals is combined, translated, and amplified to emerge as an analogous phenomenon at the collective level (Kozlowski & Klein, 2000).

The goal of this chapter is to bring a multilevel conceptualization to bear on this diffuse area of theory and research, with the goal of articulating how an *integrated infrastructure* can be created to foster learning across multiple levels of the organizational system. There are three primary points of contribution. First, we believe that the broad and diverse conceptualizations of organizational learning are amorphous and that making progress toward developing tools that can shape organizational learning requires specifics. Second, we believe that an appropriate point of departure for identifying those specifics is to focus on the informal and formal processes that shape how individuals learn in organizations; individual learning is the foundation for collective learning. Third, by applying principles of multilevel theory, we can understand how

learning by individuals coalesces, amplifies, and crystallizes as collective learning and ways to leverage and shape the emergence of collective learning as a multilevel phenomenon.

At the onset, we want to be clear that we are not conducting a comprehensive review of the literature on organizational learning. Rather, we offer a perspective; one that we think differs from more typical perspectives that tend to be primarily macro. We develop an integrative framework that provides a foundation for understanding organizational learning as a multilevel phenomenon. We pay primary attention to the individual level – because it is the origin of learning as a psychological process with knowledge and skill outcomes – and the team level – because work teams comprise the proximal social context that shapes and amplifies the emergence of learning as a collective phenomenon (Kozlowski & Klein, 2000). In our approach, organizational learning is enhanced by construction of a coherent infrastructure that aligns fundamental levels of the organizational system using both formal and informal developmental processes. These processes are often disconnected or misaligned. Our approach is designed to integrate them into an infrastructure that can provide operational utility for a multilevel conceptualization of the foundation for organizational learning.

We begin by highlighting seminal perspectives on organizational learning in order to identify the dimensions that structure our approach. We then develop our conceptual framework. We first briefly highlight fundamental principles of multilevel theory relevant to conceptualizing learning as a collective phenomenon, paying particular attention to organizational-level contextual effects that shape learning processes at the team and individual levels and to composition and compilation forms of emergence that are important for conceptualizing collective learning. We next elucidate our framework, focusing first on the informal processes that energize learning and then on the formal training, development, and leadership interventions that can leverage learning. We then consider the necessity for system alignment so that learning can be leveraged to higher levels to promote the emergence of collective learning. We close the chapter with implications of our conceptualization for research.

Organizational Learning

Theoretical musings on organizational learning have proliferated from its inception in the early 1960s to the present time; however, the field is fragmented and there is considerable debate on the nature of organizational learning (Roth, in press). It is a very broad, fuzzy concept that encompasses many distinct areas of inquiry, ranging from the use of human and machine metaphors to a sort of mystical process (Friedman, Lipshitz, & Popper, 2005). For example, Ashby (1960) characterized it using an organizational brain metaphor, while others have relied on an information processing perspective (e.g., organizational memory; Huber, 1991; March, 1991). It has been viewed as organizational culture (Fiol & Lyles, 1985); organizational development (Argyris, 1990, 1999), adaptation (Chakravarthy, 1982; March, 1991; Meyer, 1982), and change (Dutton & Duncan, 1983; Mintzberg & Waters, 1982); and communities of practice (Brown & Duguid, 1991; Lave & Wenger, 1991). This diversity in the conceptualization of organizational learning and its practice has yielded an amorphous literature and broad research streams subject to many differing interpretations (Ulrich, Jick, & von Glinow, 1993): "the concept of the learning organization has become a management Rorschach test. One sees whatever one wants to see." (p. 57). The research has not been cumulative nor is there much synthesis across different research groups (Huber, 1991).

We begin with Fiol and Lyles' (1985) rudimentary definition of organizational learning as "the process of improving actions through better knowledge and understanding" (p. 803). It is not just the sum of each individual's learning, but also the associations, cognitive systems, and memories that are developed and shared by past and present members of the organization (Fiol & Lyles, 1985). While an individual learns through processing information, an organization learns if it acquires knowledge that it recognizes as potentially useful to the organization (Huber, 1991). Although the literature on organizational learning lacks a unifying theory with integrated research, several key dimensions can be gleaned in the seminal exemplars of organizational learning that we believe are useful for crafting our integrative framework. They include key

dimensions tapping formal versus informal processes of learning, the distinction between learning as a process versus learning outcomes, distinctions between individual and collective learning, and exploration versus exploitation as distinctly different forms of collective learning. These dimensions are briefly highlighted below.

Learning can occur through *formal or informal processes*. Brown and Duguid (1991) submit that people actually perform work in ways that are fundamentally different from work described by formal manuals, training programs, and organizational charts. Formal systems often prescribe algorithms, decision trees, or standard operating procedures to guide work; yet actual work is often performed with improvisations, experimentation, and "work arounds." Brown and Duguid posit that much of an organization's learning and innovation is a result of informal interactions among an organization's communities-of-practice. These communities or networks of individuals work together to solve problems or explore opportunities that challenge current situated knowledge. Araujo (1998) extends this concept to include individuals outside the formal boundaries of an organization. Thus, informal communities can include customers, suppliers, professional peers, and others who may not share an organization's mission but can still contribute to that organization's learning. Organizations that recognize these informal processes can maximize their effectiveness by aligning formal structures and resources to support them. Organizational learning from aligned formal and informal processes can produce high-level learning that results in new cognitive frameworks (Hedberg, 1981), changes in organizational assumptions and values (e.g., douple loop learning; Argyris & Schőn, 1978), and more integrated and proactive interpretive schemes (Bartunek, 1984; Daft & Weick, 1984).

Organizational learning can also be distinguished as a *process* or as an *outcome.* As a process, organizational learning involves the acquisition of patterns of cognitive associations and structures that are developed through experience by individuals which are then apprehended at the group or organizational level (Duncan & Weiss, 1979; Hedberg, 1981). Thus, as a process, learning involves interaction and experience with the environment that

yields insight, meaning, and understanding. As an outcome, collective learning is captured by changes in knowledge and its representation (e.g., collective knowledge pool, shared knowledge structure; Ellis & Bell, 2005; Kozlowski & Bell, in press) that may then manifest in subsequent behavioral actions intended to improve organizational effectiveness and performance (Daft & Weick, 1984). Fiol and Lyles (1985) stress that the distinction between process and outcome is important because the process of learning and subsequent action may not be well matched. The process of organizational learning generates new organizational knowledge that may or may not be translated into behavioral development or change. For example, in 1979 Steve Jobs toured Xerox's research facilities to observe developments on the Alto computer. Although Xerox engineers created knowledge essential to today's personal computers, the management culture was unable to translate this knowledge into a successful consumer product. However, Steve Jobs and Apple Computers were successful in applying this knowledge to organizational action (Cringely, 1996). Thus, organizational learning requires alignment of process and outcomes to make best use of the new knowledge.

Distinctions between *individual* and *collective* levels of learning can be traced back to Cyert and March's (1963) notion that organizational learning was the aggregate or emergent learning across individuals. Since then, scholars have debated on how learning may be *organizational*. Duncan and Weiss (1979) assert that only individuals can learn, but they can also communicate their knowledge across a system. Fiol and Lyles (1985) and Levitt and March (1988) emphasize that organizational learning is more than the sum of individual knowledge and that new knowledge can emerge from the interactions of individuals; this is the essence of collective learning as a process of emergence. In this regard, Cohen and Levinthal (1990) introduced the term "absorptive capacity" to describe a firm's ability to exploit new knowledge by assimilating it into the existing knowledge base and using it as a competitive advantage. A firm's absorptive capacity is more than the sum of individuals' absorptive capacities because it can be influenced by firm-level attributes such as investment in research

and development. Furthermore, a firm's absorptive capacity relies on communication structures within an organization and between the organization and its external environment. Thus, macro characteristics define the context that can promote (or inhibit) learning as an emergent process of individual knowledge acquisition, amplification and crystallization through human interaction, and exploitation via firm level action.

Given the importance of the concept of organizational learning for organizations that face ever changing, turbulent, and unpredictable environments, the domain – though rich in ideas – has a relatively limited empirical foundation, particularly with respect to human processes, and actionable knowledge. We will use the dimensions of organizational learning highlighted above to structure our framework. Next, we consider basic issues in multilevel theory.

Collective Learning: Multilevel Considerations

There are four key multilevel considerations that are important to highlight, because they influence the way we construct our framework and the processes that we address. First, higher level contextual effects can influence lower level processes, so that learning at a lower level is shaped and constrained. Second, lower level processes like individual learning can have emergent or collective, higher-level manifestations. Third, system coherence in the form of compatible alignments within levels (formal techno-structure and informal enabling processes) and across levels (top-down and bottom-up linkages) provide a theoretical conduit to shape, leverage, and amplify collective learning. And, fourth, there are different forms of emergence that are often shaped by the context – composition and compilation (Kozlowski & Klein, 2000) – that have implications for achieving system coherence. We briefly elaborate each of these points, illustrating points one through three in Figure 1 and point four in Figure 2.

Contextual Effects

Collective learning is a multilevel phenomenon, shaped by contextual factors such as organizational strategy, structure, technology, and culture that emanate from the top-down. It is

noteworthy that these factors are often regarded as aspects or representations of organizational learning (Fiol & Lyles, 1985). For example, the contextual factors of organizational strategy, structure, and technology can create a press for innovation that, when supported by an aligned climate, prompts individuals to be on the technical cutting edge (Kozlowski & Hults, 1987); a cross-level effect. As illustrated in Figure 1, higher-level context factors can also directly shape lower level factors that are embedded under them. So, for example, macro technology and structure will tend to constrain meso technology and structure (House, Rousseau, & Thomas, 1995). It is also possible for macro factors (e.g., updating policies) to have direct effects on individuals (e.g., continuing education efforts), but the meso context is most proximal and thus the most potent contextual effect on individual perception and action (Kozlowski & Hults, 1987).

Emergence

On the other hand, collective learning is also shaped by emergent processes that emanate bottom-up. “A phenomenon is emergent when it originates in the cognition, affect, behaviors, or other characteristics of individuals, is amplified by their interactions, and manifests as a higher-level, collective phenomenon” (Kozlowski & Klein, 2000, p. 55). Emergent processes amplify, combine, and crystallize individual learning such that it manifests as a collective phenomenon. For example, individual learning in the context of team interaction can yield parallel, multilevel learning processes (DeShon, Kozlowski, Schmidt, Milner, & Weichmann, 2004) and emergent forms of knowledge representation such as team mental models (Cannon-Bowers, Salas, & Converse, 1993) and transactive memory (Wegner, 1986). Thus, collective learning is fundamentally rooted in the processes and outcomes of individual learning – teams and organizations don’t learn, individuals do (Kozlowski & Salas, 1997) – but individual learning can combine in different ways and emerge as different forms of collective learning.

System Coherence

However, collective learning is not merely an aggregate of individual learning. Collective knowledge, skills, and other capabilities for coping with uncertainty and change take on additional meaning at collective levels, and are inextricably entwined with techno-structural aspects of the organizational system. For example, the demands of unit-level technology and workflow structure have to have corresponding within-level alignments with team knowledge (both shared and distributed) and team coordination, or the team will not be able to effectively exploit the capabilities of the technical system. Informal processes and learning tend to occur spontaneously. However, there is no guarantee that informal learning processes yield capabilities that translate into meaningful team and organizational learning. Formal systems such as training and leadership can shape, align, and strengthen informal learning processes. Thus, key to our conceptualization is an alignment between formal and informal systems at multiple levels of the organization (within level) and across multiple levels of the organization (between level). Formal organizational systems and informal processes, when aligned, can encourage, enhance, capture, and amplify individual learning, thereby creating an organizational learning system.

Emergent Forms

Kozlowski and Klein (2000) posited that *"collective phenomena may emerge in different ways under different contextual constraints and patterns of interaction."* (p. 59). Figure 2 illustrates two qualitatively distinct, ideal forms of emergence – *composition* and *compilation* – that they contrasted as opposing forms bracketing other alternatives on a continuum of emergence types. They characterized the composition form of emergence as relevant when a higher level phenomenon emerges through shared and convergent processes (i.e., when the same elemental content is shared in common by all team members). In other words, composition represents the same construct at the lower and higher levels of analysis. It is both structurally (i.e., same content) and functionally equivalent (i.e., fills the same linking function) at

both levels of analysis (Kozlowski & Klein, 2000; Morgeson & Hofmann, 1999). In contrast, they characterized the compilation form of emergence as relevant when a higher level phenomenon emerges through divergent processes (i.e., when elemental content possessed by team members is different, yet creates a meaningful pattern). In other words, compilation represents a configuration like puzzle pieces; each element is distinct but when combined correctly creates a meaningful pattern. Compilation constructs are functionally equivalent, but not structurally equivalent across levels (Kozlowski & Klein, 2000; Morgeson & Hofmann, 1999).

As a composition example, scholars have hypothesized that team members working together on an interdependent task develop shared mental models that allow them to anticipate coordination needs (Cannon-Bowers, Salas, & Converse, 1993). Team mental models represent a collective construct in which team members share identical knowledge; the construct is parallel at the individual and team level. As a compilation example, scholars have hypothesized that team members may develop a networked memory system – transactive memory. In this example, each team member possesses unique knowledge, but each team member also shares knowledge of each other member's distinct expertise. This allows team members to collectively access knowledge as necessary by tapping the appropriate team member in the network (Mohammed & Dumville, 2001). Note that team members do not possess the same knowledge, but the transactive memory system performs the same linking function at the individual and team levels; transactive memory is configural.

The Foundation: Informal Learning Processes

Newcomer Socialization

Informal mechanisms of learning will focus on newcomer socialization. Newcomer socialization is defined as a process by which an employee who is new to the organization or to a particular business unit learns to fit into that group and is perceived as a valued member. Some of this learning may be formalized in orientation and training programs, but much is informally learned through everyday experiences on the job (Chao, Kozlowski, Major & Gardner,

1994). Research on newcomer (often referred to as organizational) socialization has contributed to our understanding of how individuals learn and adjust to their jobs, work groups, and organizations. As an informal learning process, socialization serves many purposes, involves many resources, and taps many content areas.

Socialization theory and research has generally focused on the individual fitting into an organization. The notion of fit has been refined to acknowledge different levels of fit between an individual and that person's job, group/team, and organization (Kristof, 1996). Generally, it is the adjustment of the individual that is the center of organizational socialization research. Theory, however, has recognized that an organization can learn from a new organizational member; thus, learning is a two-way process. Van Maanen (1978) described an investiture socialization tactic that essentially has an organization adjusting to a newcomer. This case may be seen when an organization seeks new ideas and leadership by bringing in "new blood" with the hire of a chief executive from outside the organization. In addition, Huber (1991) describes how organizations can "graft" new people and their knowledge onto the existing organizational knowledge base. March (1991) cautions that rapid socialization of newcomers may come at a cost to the organization. One of the strengths of new hires is the diversity of ideas and perspectives that are not encumbered by the organization. When new hires accept organizational perspectives and roles, they may be less likely to teach the organization different ways and ideas. Thus, March brings up an apparent paradox with organizational socialization. Swift socialization can efficiently transform an organizational newcomer into an organizational insider. This may be a desirable purpose for organizational assimilation and team building; but it may not be desirable for organizational learning. Future research should examine how organizations can maximize their learning from newcomers before they are fully assimilated into the organization.

Most of the organizational socialization literature is focused at the individual level. Newcomers learn how to perform their jobs, they learn about other organizational members, and

they may learn how to adjust their attitudes and behaviors to be successful organizational members. Several resources may be tapped for this learning. Ostroff and Kozlowski (1992) found that newcomers rely primarily on observation and experimentation to learn about task mastery, role responsibilities, getting along with coworkers, and the organizational culture. Thus, newcomers are proactive in this learning process. Three particular sources for information: the supervisor, team, and mentor, deserve special attention. Supervisors are often charged with the task of assimilating newcomers into the organization and have power to directly influence the newcomer. Team members are also often charged with the same assimilation task and although they may not have superior power over the newcomer; their interactions with a newcomer may be critical in time and influence. Lastly, some newcomers may find mentors in an organization who can serve as a professional advisor or coach. These three sources for information are primary interpersonal processes in organizational socialization and learning.

A newcomer's relationship with a supervisor develops very quickly. Liden, Wayne, and Stilwell (1993) measured newcomer expectations about their supervisors within the first week of the relationship. These early expectations were significant predictors of their relationship six months later. Thus, initial newcomer perceptions can have lasting effects. Major, Kozlowski, Chao, and Gardner (1995) found that a good relationship between a newcomer and supervisor or between a newcomer and his or her team was able to ameliorate the negative effects of unmet job expectations. Morrison (1993) found supervisors were primary sources for technical information, role expectations, and for getting feedback. In contrast, a newcomer's coworkers were primary sources for normative and social information. Thus, different resources were used to learn different lessons. These resources for learning also can be associated with different outcomes. For example, newcomers who learned more from their supervisors were more likely to be satisfied, well adjusted to the job and committed to the organization (Ostroff & Kozlowski, 1992).

Socialization research has only recently considered the mutual influence between organizational newcomers and team members (Kozlowski & Bell, 2003). Chen and Klimoski (2003) found a newcomer's experiences influence a team's expectations for that person. In return, the team's expectations can affect the newcomer's role performance. Furthermore, Chen (2005) found that the newcomer's early performance can affect subsequent overall team performance. Thus, one individual's performance can impact higher levels of performance. The extent to which new employees affect organizational outcomes will help define an organization's learning.

Traditionally, a mentor is defined as a senior organizational member who helps develop the career of a junior organizational member (i.e., protégé). It is an intense professional relationship where a mentor personally coaches, advises, protects, and befriends a protégé. A mentor's position and experience can offer a wealth of information that is unavailable through most other sources (Ostroff & Kozlowski, 1993). Information based on speculations, rumors, and organizational politics can be as valuable as conventional information related to work procedures and performance expectations. Furthermore, a mentor's senior position can promote and protect a protégé's experimentations or efforts to change the organization. Thus, an organization is more likely to learn from a protégé with an encouraging mentor than from someone without such support. Lankau and Scandura (2007) describe how the personal learning from mentors can enhance the development of social capital within an organization. Informal mentoring can create powerful informal ties between organizational members that transcend formal organizational structures. Managerial systems and organizational values can be communicated through storytelling and narratives that are shared in mentoring. Chao (2007) integrates mentoring and organizational socialization by describing a network of mentors who can help a protégé. Multiple mentors can expand a protégé's information base when one mentor is able to provide information and support that another mentor cannot. For example, one mentor with technical expertise can help a protégé's job performance; whereas another

mentor with a large professional network can help a protégé's career visibility. Building a network of mentors can help the protégé learn different lessons from different experts.

Given that supervisors, coworkers, and mentors can serve as powerful socialization agents, more research is needed to understand how this process can be effectively managed by organizations. For example, can supervisors and coworkers be trained to be effective socialization agents? This training may include diagnosing a newcomer's learning needs, providing multiple sources of support that can reinforce one another, and alignment of informal and formal processes with organizational goals and values. Furthermore, supervisors and coworkers can also be trained to explore how a newcomer's knowledge base can contribute to organizational knowledge. Results from such research may identify an optimal balance between individuals learning from the organization and organizations learning from an individual; March's (1991) contrast of exploitation versus exploration in organizational learning.

The different lessons in organizational socialization highlight the different content areas. What is learned? Chao et al. (1994) developed six dimensions of organizational socialization: performance proficiency, people, politics, language, goals/values, and history. Performance proficiency is a vital dimension because a newcomer must learn to be proficient on the job if he or she is interested in keeping that job. People and politics are important for the newcomer to learn to work well with others. The last three dimensions characterize a particular organization and how members define themselves as part of that organization. Thus, an organizational member understands the organization's goals and values, is knowledgeable about the organization's past, and is able to communicate with other organizational members using specific jargon, acronyms, and abbreviations that nonmembers may not know. Chao et al. (1994) found that individuals who learned more about their organization, in terms of these six content dimensions, were more likely to be satisfied and successful on the job.

Learning in these content areas may be explicit or implicit. Currently, all socialization research involves explicit learning – learning that the newcomer is aware of. However, much of

what is learned may be implicit, tacit knowledge. Chao (1997) recognized that organizational socialization can operate at the unconscious level through implicit learning. Learning about people and organizational politics are most likely to be affected by implicit learning since this knowledge can be gained from observations, social judgments, and interactions. Similarly, knowledge about performance proficiency and organizational goals/values can be explicit if there is a strong culture with clear performance expectations; or it may be more implicit if these areas are not well specified, or there is a perceived gap between what is espoused and what is practiced. Tacit knowledge created by implicit socialization learning can represent a default type of socialization. Newcomers learn a lot from observation (Ostroff & Kozlowski, 1992); but they cannot control the events they observe. Thus, the lessons learned from incidental learning conditions may or may not be to an organization's advantage. Nonaka (1994) describes how tacit knowledge is passed from one organizational member to another through a socialization process. From an organizational learning perspective, this is an important mode of knowledge conversion. However, because tacit knowledge is difficult to formalize and articulate, most theories of organizational learning do not incorporate aspects of tacit knowledge and socialization.

Team Learning

Some reviewers have observed that much of the research on team learning conducted thus far has focused on the outcome representations of team learning, such as team mental models and transactive memory (see fig?), with relatively little attention devoted to characterizing the process by which individual learning emerges and manifests as collective learning (Kozlowski & Bell, in press; Kozlowski & Ilgen, 2006). There are, however, some notable exceptions worth highlighting because they will help to identify the individual and team processes that should be targeted by interventions.

Edmondson (1999), for example, conducted a qualitative and quantitative examination of team learning in a field setting. Her research showed that when the team context supported

experimentation and risk-taking, team members exhibited more team learning behaviors which, in turn, were related to higher team performance. More specifically, her model postulated team psychological safety as a key contextual construct – a climate-like shared perception among team members that the team was a psychologically safe setting for interpersonal risk-taking – that promoted team learning behaviors as the basic elements of team learning as a process. Teams that perceived more psychological safety engaged in more learning behaviors such as sharing information, requesting assistance, seeking feedback, and discussing mistakes. Her work also showed that team psychological safety was influenced by a supportive organizational context and coaching by the team leader. There are two important points to highlight from this research. First, that contextual alignment across levels of the organizational system was instrumental to enabling team learning processes (Kozlowski & Salas, 1997). Second, that team learning as a process has its roots in individual characteristics – here behavioral action – but also encompassing cognition and motivational aspects as well (Kozlowski & Bell, in press).

In an effort to better unpack and reveal the processes underlying team learning, DeShon, Kozlowski, Schmidt, Milner, and Wiechmann (2004) focused on dynamic self-regulation and a parallel process of team regulation as a fundamental process mechanism accounting for learning, motivation, and performance in teams. There are several theories of *self*-regulation that, while distinctive, share key features. Goals serve an energizing function and direct effort toward goal accomplishment. Some level of performance results and, through feedback, a person compares their goal to their performance. During learning, the resulting level of performance is generally lower than the desired end state. This negative discrepancy prompts a self-evaluation of progress and reactions. If progress is deemed satisfactory, a person will likely feel capable and confident of success (i.e., self-efficacy), and will revise their learning strategies, redouble efforts, and iteratively persist toward goal accomplishment. If progress is judged to be unsatisfactory, self-efficacy will be undermined and a person will likely

be distracted by frustration, off-task thoughts, and anxiety which will interfere with their subsequent motivation and learning.

DeShon et al. (2004) noted that extant models of self-regulation focus on the accomplishment of a single goal at any given point in time. They argued that interdependent team tasks, however, necessitate multiple goal regulation – individual and team. In other words, learning and performing in a team necessitates dynamic regulation around an individual goal-feedback loop relevant to one's role on the team *and* regulation around a team goal-feedback loop when a person must assist a teammate, correct a teammate's error, or otherwise devote resources to the collective goal. DeShon et al. (2004) reasoned that this dynamic process of multiple goal regulation and resource allocation within individual team members would, over time, result in the emergence of a multilevel homology with parallel regulatory processes accounting for learning and performance at both the individual and team levels of analysis. Their evaluation of the multiple goal, multilevel of regulation provided a rare empirical assessment and support for their homologous model. Other research has also usefully employed regulatory processes as a theoretical foundation to model skill transfer and adaptation following training in dyads (Chen, Wallace, & Thomas, 2005) and to propose a broad-based model of team motivation (Chen & Kanfer, 2006). Although the findings by Chen et al. (2005) did not support a strict homology across levels, the research did show that regulation was a promising conceptual tool for modeling the link between learning and subsequent performance adaptation.

There are two important points to highlight from this work by DeShon et al. (2004) and others. First, team learning is emergent – fundamentally rooted in individual cognition, motivation, and behavior – but shaped and amplified by interaction over time to manifest at the collective level. In other words, trying to treat team learning as a solely collective concept is not meaningful because such an approach neglects the underpinnings of the process. Rather, one needs to understand team learning as a process encompassing multiple levels. Second, regulation is a potentially useful and potent leverage point for influencing team learning.

Influencing team learning, by necessity, means multiple levels of intervention or infrastructure creation.

Team Development

Given the high interest in work teams, it is remarkable that there is relatively little good descriptive data on the development of work teams (Kozlowski & Bell, 2003). Most of the work on this topic has been shaped by classic stage models of development (e.g., Tuckman, 1965), which have tended to focus on laboratory or other minimal social groups (i.e., groups independent of an organizational context, no distinct roles or interaction demands, few shared goals), or by the punctuated equilibrium model (PEM; Gersick, 1988), which examined 8 work groups and 8 student project groups. There are a variety of stage models, but they all share much in common and are well represented by Tuckman's classic model of forming, storming, norming, and performing. During the forming stage, members are uncertain about the group, their goals and roles, and how they will work together. As many voices offer differing ideas and approaches, members become frustrated and enter a storming stage as they compete to shape social structure to reduce uncertainty. With time, the team enters a norming stages as members begin to resolve their differences, develop norms to guide interactions, and ameliorate social uncertainty. Finally, with social structure in place, team members are able to focus on the task at hand and the team enters the performing stage. Although there is little hard descriptive data to substantiate this and other stage models, they have intuitive appeal and are the biggest class of team development models (Kozlowski et al., 1999).

In contrast to the process of linear progression that undergirds stage models, Gersick (1988) concluded that the groups in her sample exhibited a simpler pattern of development. Her groups were all project groups with a distinct timeline – a deadline – by which the project was to conclude. She observed that groups initially formed and created a work structure that persisted until approximately half way to the project deadline. At that point, the initial inertia was broken and there was a major discontinuous shift – the punctuated equilibrium – as the team structure,

member roles, and activities were reorganized. This revised structure then guided group interactions until project completion.

Although stage models and the PEM are often contrasted as competing models of group development, Chang, Bordia, and Duck (2003) showed that aspects of both models described team development processes of lab teams depending on the content examined and the timing used – smaller time units and a focus on group processes and structure related to linear development whereas larger time units and a focus task approach related to the PEM. Indeed, some models have integrated aspects of both approaches. For example, Morgan, Salas, and Glickman (1993) proposed a nine stage model: pre-forming, forming, storming, norming, and performing-I; reforming (i.e., the punctuated equilibrium), followed by performing-II, conforming, and de-forming. A key feature of the model is the conceptual distinction between taskwork (i.e., task relevant knowledge and skills) and teamwork (i.e., knowledge and skills that enhance coordination and the integration of action among members).

The normative theory of team development and performance compilation by Kozlowski and colleagues (1999) also draws on both models. In their theory, knowledge and skill development is viewed as a progressive process across four phases; with each phase focused on distinct content, learning processes, and outcomes; and with transitions across phases and emergent levels as target skills compile at the individual, dyadic, and team network levels. During phase 1, team formation, individual team members acquire interpersonal knowledge about teammates' abilities, personalities, and values and an orientation to the team in terms of goal commitment, norms, and climate. They transition to a task compilation phase in which individual team members develop self-regulation skills of goal setting, performance monitoring, self-efficacy, and resilience and establish their task proficiency. They are then able to shift to the dyadic level in the role compilation phase as they define their responsibilities, establish coordination patterns, and routinize task interactions. Finally, they transition to the team compilation phase where through team experimentation and regulation, the team continuously

improves its work processes and develops a repertoire of skills to enable adaptation. This conceptualization is useful, because it links back to regulation, which is garnering evidence as the theoretical engine of individual and team learning, motivation, and performance. Thus, interventions that target regulatory processes in teams are a potentially potent means to build an infrastructure to influence team and higher level learning processes.

Infrastructure Design: Formal Interventions

Prompting Individual Learning

Active learning. In the prior section, we reviewed theory and research that establishes regulatory processes as the theoretical engine for individual and team learning, performance, and adaptation. Bell and Kozlowski (this volume) describe active learning as a conceptual approach to learner-centered training design. The premise underlying active learning techniques is that trainees learn best when they are situated in the to-be-learned work context, or close approximations to it, and when they are actively engaged and self-directed in extracting relevant inferences relative to more passive, proceduralized approaches to training. Although the active learning approach encompasses a wide range of discrete training techniques, Bell and Kozlowski (this volume) argue that the techniques can be unified under an integrated theoretical framework. Their model posits that active learning methods operate via one or more self-regulatory process pathways – cognitive, motivational, or affective – and that each of these process pathways is primarily influenced by a corresponding core training design element: instruction (guided exploration), motivational induction (error framing), and emotion control (emotion regulation strategy), respectively.

Bell and Kozlowski (2007) provide empirical support for their active learning conceptual framework. In addition to tracing the process pathways, their work demonstrated the importance of individual differences in cognitive ability and goal orientation in understanding how learners reacted to the different core design elements. For example, learners with high cognitive ability responded better to guided exploration, compared to proceduralized training, because they

could gain more from their meta-cognitive processing as they explored the task domain. Thus, this evolving line of theory and research on active learning has the potential to be tailored to the individual characteristics, preferences, and progress, of learners (Bell & Kozlowski, this volume; Gully & Chen, this volume).

Embedded training. From the perspective of building an infrastructure for organizational learning, Bell and Kozlowski's integrated theoretical model of active learning is consistent with a companion model – the adaptive learning system (ALS; Kozlowski, Toney et al., 2001) – that is predicated on designing active learning interventions that can be embedded in computer-based workplace technology or in close approximations to the workplace such as synthetic learning environments (Cannon-Bowers & Bowers, this volume). The ALS model specifies three design components – training design, information provision, and trainee orientation – that influence the nature of the learning experience, characteristics of feedback, and motivational frame placed on trainees, respectively. The theoretical rationale of the model is that these design components can be combined to selectively influence the nature and quality of self-regulation as learners study and practice, monitor their progress, and reflect and react to their learning experience over time. The framework has be used to construct several effective active learning techniques, including Adaptive Guidance (Bell & Kozlowski, 2002), Mastery Training (Kozlowski & Bell, 2006; Kozlowski, Gully, Brown, Salas, Smith, & Nason, 2001), and Mastery Feedback (Nowakowski & Kozlowski, 2004, 2005).

In summary, we have developed a conceptual foundation that is beginning to unpack the core design elements and specific self-regulatory process pathways that undergird active learning and the development of adaptive capabilities. We have empirical research that supports the theoretical framework and evidences meaningful interactions for each core element and individual differences. With further research, we anticipate further refinement of the process pathways and the nature of the aptitude-treatment interactions, which will enable the design of more precise and tailored training experiences. And, we have a more pragmatic

companion model that has demonstrated effectiveness for designing active learning interventions. Altogether, this work provides a conceptual foundation and operational tools for embedding learning in work technology, simulations, or SLEs. It provides the basics for building a learning infrastructure in organizations.

Distributed learning systems. In addition to embedding training in the workplace, new and emerging technologies make it increasingly feasible and cost effective to distribute learning in space and time – the concept of distributed learning systems (DLS; Fiore & Salas, 2007). Kozlowski and Bell (2007) have formulated a theoretical framework to guide the design of such systems. The theoretical core of their approach is that DLS design should be guided by the complexity of the targeted knowledge and skill sets, and the corresponding learning processes that have to be stimulated for the targeted skills to be acquired. Simpler knowledge and skill sets, such as declarative and procedural knowledge, entail more basic learning processes, such as memorization and static practice, which can be delivered through less interactive and immersive, low bandwidth, and low cost technologies. More complex skill sets that entail these more basic skills, but also necessitate strategic and adaptive knowledge, require commensurately more complex learning processes, such as exploration, experimentation, and dynamic practice. For these latter skills, a DLS needs to be more realistic, immersive, and interactive, which means higher bandwidth, computing power, and cost. The point is, when combined with the prior models that can be used to design a tailored, learner-centered experience, this approach can help guide the design of the technology infrastructure needed to distribute learning across an organizational system.

Prompting Team Learning

Generic vs. context-specific competencies. One of the big challenges for team training is that it can be difficult and costly to train an entire team together at once. On the other hand, training individuals absent the team context may fail to deliver necessary competencies. Cannon-Bowers, Tannenbaum, Salas, and Volpe (1995) tackled this problem by developing a

typology that classified team competencies into those that are transportable (i.e., generic and generalizable across different task and team contexts) and those that are context-driven (i.e., specific to a team task and context). Thus, transportable competencies like interpersonal skills can be trained individually, whereas context-specific competencies like back-up and error correction that enable coordination should be delivered to intact teams in their task and team setting (Salas & Cannon-Bowers, 1997; Salas, Wilson, Priest, & Guthrie, 2006). Research has shown that training on generic teamwork competencies yields improvements in team planning, coordination, communication, and problem solving (Ellis, Bell, Ployhart, Hollenbeck, & Ilgen, 2005).

Vertical transfer. Taking a similar approach but applying multilevel theory, Kozlowski and colleagues (2000) addressed the question of whether team skills should be trained at the individual or team level by focusing on processes of vertical transfer. Vertical transfer refers to the upward propagation of training effects across levels of the organizational system (i.e., the collective emergence of learning), in contrast to the more typical training focus on horizontal transfer (i.e., transfer of training from the training to the performance context). They reasoned that the level of training delivery should be determined by the nature of team performance emergence; that is, whether team performance emerges from individual cognition, motivation, and action through composition or compilation processes. Although this summary is a simplification, in general, they argued that simpler forms of team workflow design in which team members perform parallel or additive tasks are composition in form and, thus, training could be delivered at the individual level since team performance was pooled individual performance, whereas more complex workflows that entail distinct roles, distributed expertise, coordination, and synchronization are compilation in form and, thus, training should be delivered to intact teams in their work context (or close approximations) to ensure vertical transfer.

Team training techniques. Once it has been determined that team training should be delivered at the team level, there is a wide range of effective techniques that can be employed

(see Salas & Cannon-Bowers, 1997, for a comprehensive review). Because the key challenge for compilation tasks is training team members to understand how distinct individual knowledge and action combine to yield team performance, context-specific team training techniques tend to focus on learning the roles of teammates (i.e., cross training), providing practice experience in realistic contexts (i.e., simulation training), or emphasizing skills that enable coordination and synchronization (i.e., adaptability training, coordination training, or crew resource management [CRM] training). In a recent meta-analytic investigation, Klein et al. (2005) summarized empirical evidence showing that each of these approaches is effective. Cross training team members on each others' role requirements (6 studies, 13 effects) yielded a 95% confidence interval (CI) of .376-.556 centered on .471. Simulation-based training (37 studies, 81 effects) yielded a 95% CI of .384-.504 centered on .446. And, team adaptation-coordination-CRM training (16 studies, 30 effects) yielded a 95% CI of .479-.698 centered on .600. These effect estimates were not corrected for unreliability suggesting that they are conservative. Thus, we have the necessary theoretical models and operational tools to design and deliver effective team training experiences (Salas, Stagl, & Burke, 2004). Moreover, the increasing penetration of computer technology and interactivity into all facets of the workplace allow generalization of the principles of active learning and embedded training to team level simulations and SLEs (Bell & Kozlowski, in press; Salas et al., 2006).

Team leadership, development, and regulation. A primary theme of this section has been to identify theories and operational tools that deploy training into the work setting. Thus far, the interventions discussed incorporate a technology component as a primary means to deliver information or experience, but it is also possible to use software in the form of people skills (i.e., knowledge of behavioral science principles) to intervene and shape experiences in the work setting. Kozlowski and colleagues (Kozlowski, Gully, McHugh, Salas, & Cannon-Bowers, 1996; Kozlowski, Gully, Salas, & Cannon-Bowers, 1996; Kozlowski, Watola, Nowakowski, Kim, & Botero, in press) have provided an evolving series of models that comprise

a theory of team leadership where the key purpose of the leader is to develop an expert team, capable of regulating its activity, and adapting to its operating environment.

By focusing on the middle range of the team level and context, rather than treating leadership as a more general set of dimensions applicable across all levels and contexts, the theory is able to achieve some precision in its prescription of appropriate leader actions, and the contingencies that should drive them. The theory is multilevel – it considers individuals, teams, and the surrounding organizational context – and dynamic – it considers task dynamics driven by the team's environment and developmental dynamics driven by team members learning progressively more complex skills. The theory conceptualizes the leader as a critical agent for (1) harnessing task dynamics to a regulatory process to prompt development targeted skills and (2) to transition the team to focus development on progressively more complex skill sets as capabilities are acquired. Thus, it is an integration of work that conceptualizes regulation as the theoretical engine of individual and team learning (DeShon et al., 2004) and the theory of team development that conceptualizes team skill compilation as a learning process across levels and time (Kozlowski et al., 1999).

Here we briefly sketch the two key dynamic features of the theory. First, the surrounding context is viewed as a source of variation in task complexity that makes corresponding demands on the team to align its processes to resolve the task demands. Moreover, task demands are not viewed as fixed, but rather as cycles that naturally vary in terms of the load placed on team member resources. Marks, Mathieu, and Zaccaro (2001) offer a similar perspective in their portrayal of team tasks as "episodic" patterns of transition (preparation), action, (engagement), and transition (reflection). Kozlowski and colleagues characterize this pattern as "cyclical," but the intent to capture variations in the ebb and flow of task demands is the same. Kozlowski and colleagues conceptualize the leader's function as one of explicitly linking regulation to the task cycles. During preparation, the leader should guide team members to set goals and plan strategies for the upcoming engagement. As the team engages the task,

the leader monitors performance relative to the goal and strategy, and provides advice for minor or major adjustments to individual action or team processes as necessary to maintain team performance. As an engagement concludes, the leader guides the team in reflection on their performance, diagnosis of areas for improvement, and intentions for further skill development. The process is iterative across subsequent task cycles, with the leader seeking opportunities to build targeted skills in the work setting.

Second, as targeted skills are acquired at a particular phase of development, the leader helps transition team members to (1) focus development on more complex skill sets and (2) to progress from an individual focus to a collective one as capabilities are acquired. This developmental progression tracks the skill compilation process posed by Kozlowski et al. (1999). The team formation phase is characterized by individual team members identifying with the team and committing to its mission; the task and role development phase centers on individuals developing proficiency on their tasks and role; the team development phase is characterized by the development of teamwork; cooperation, and coordination; and the team improvement phase centers on the ability of the team to regulate and adapt on its own.

Subsequent conceptual development has started to identify the specific competencies team leaders have to possess to operationalize the prescriptions of the model (Watola & Kozlowski, 2005). Moreover, although there are no direct tests of the theory in its entirety there is support for the theoretical engine of regulatory processes (e.g., Chen et al., 2005; DeShon et al., 2004) and for team developmental progression (Chang et al., 2003; DeShon, Kozlowski, Schmidt, Weichmann, & Milner, 2001). Research to more directly evaluate the regulatory functions of team leadership is in progress (Kozlowski, Jundt, Curran, & Kuljanin, 2007). Moreover, this is just one approach; there are other approaches that have been proposed that are complimentary with one or more of the processes specified in our approach (e.g., Hackman & Wageman, 2005; Klein, Ziegert, Knight, & Xiao, 2006; Zaccaro, Marks, & Rittman, 2001). Thus, we believe that leaders have the potential to be key agents for prompting the individual

and team learning that underpins learning at higher collective levels. We also believe that this potential has been relatively neglected.

Aligning the Organizational System – Leveraging the Infrastructure

Contextual Alignment

Organizational systems theory has long held the assumption that key features of the system context need to be in alignment or congruent (i.e., contingent fit) with organizational goals, strategy, technology, structure, and processes (e.g., Likert, 1961; Miles, Snow, Meyer, & Coleman, 1978; Thompson, 1967). Alignment serves to marshal resources, facilitate desirable behavior, and constrain undesirable behavior, thereby guiding the system toward goal accomplishment as an adaptive, regulating entity (Katz & Kahn, 1978). Facilitating factors could be in the form of explicit goals, feedback, and incentives that are consistent with organizational goals and strategy. Constraints could be in the form of explicit structures, policies, and practices designed to prevent deviant behavior. Explicit factors are those formal aspects of organizational design that are more or less the purview of rational management. However, facilitators and inhibitors can also be in the form of informal social organizational factors and processes, such as organizational climate, norms, and leadership, which are generally more challenging to align with the formal system (Likert, 1961; Katz & Kahn, 1978). Not coincidentally, this also represents a perspective that is widely applied to organizational learning (Fiol & Lyles, 1985). Consistent with the foundation of organizational systems theory and organizational learning, we view system alignment as critical for leveraging and amplifying the knowledge and skill capacities of individuals and teams that is provided by our infrastructure approach. Key alignments are illustrated in Figure 1.

The literature on organizational training identifies a number of contextual factors that influence the motivation to learn (pre-training), learning during training, and transfer of trained knowledge and skills back to the work setting (Baldwin & Ford, 1988; Ford & Weissbein, 1997). These factors are generally clustered into (a) situational constraints (i.e., insufficient money,

time, equipment, information) and (b) mediating perceptions of the context that represent how members of the organization “make sense” of the setting (i.e., organizational climate, transfer climate, support from leaders and peers). Both clusters are viewed as either hindering or supporting motivation to learn and interfering or facilitating the opportunity to apply skills (Kozlowski & Farr, 1988; Mathieu & Martineau, 1997; Noe & Wilk, 1993; Rouiller & Goldstein, 1993; Tracey, Tannenbaum, & Kavanaugh, 1995).

Vertical Transfer

The contextual alignment sketched above applies to the traditional focus in training research on transfer of skills from a training setting to the workplace, what Kozlowski, Brown, Weissbein, Cannon-Bowers, and Salas (2000) characterize as horizontal transfer. Although they summarize and acknowledge the importance of contextual alignment for supporting horizontal transfer, building on Kozlowski and Salas (1997) and incorporating multilevel theory, they assert that processes of vertical transfer – the propagation of trained knowledge and skills upward – comprise an important and unexplored aspect of training effectiveness. This goes directly to the challenge of characterizing organizational learning as an emergent, higher level phenomenon with roots in individual and team learning.

Kozlowski and Salas (1997) developed an integrative framework that was designed to highlight the importance of system alignment for promoting propagation of training effects to higher levels of analysis. There are three key conceptual themes underlying their model: level, focal content, and congruence. These themes structure Figure 1. Level is concerned with establishing the targeted level at which the effects of learning are desired and dealing with the complexities when the target is at a higher level than the intervention. Focal content addresses the nature of the knowledge and skill domain where learning is to be targeted for improvement. Techno-structural factors are linked to manifestations of technology and structural design that manifest in the system. Enabling processes capture the more intangible social psychological and human interaction mechanisms that operationalize a given technology system. Congruence

characterizes the nature of top-down contextual effects (embedding consistency) and cross-level effects (cross-content influences); within level alignment (alignment across content); and the bottom-up emergent effects that represent the emergence of collective learning across levels of the system.

One key element missing from the Kozlowski and Salas (1997) conceptualization is an explicit recognition that different forms of emergence – composition versus compilation – may necessitate different types of system alignment (Kozlowski et al., 2000). Composition forms of emergence are the result of processes of convergence that constrain elemental content to be similar across levels (i.e., isomorphism). The processes that yield composition are linear and additive so that each bit of similar content at the lower level contributes to the higher level. Composition processes are likely to be robust when the system is aligned. For composition processes, system alignment refers to the consistency of fit; the context is comprised of features that are consistent with and support the elemental content. This view of alignment is similar to March's (1991) notion of the *exploitation* aspect of organizational learning. For example, an organization might array its learning infrastructure to promote total quality management (TQM). There would be policies, rewards, and management support for TQM, and it would be a prominent strategic imperative of the organizational climate. Socialization and training would be rapid, so that desired perspectives and knowledge would be assimilated without deviation. Production personnel would be socialized to the importance of TQM. Embedded, active learning interventions would convey knowledge of the core principles and methodology to meet specific standards. Co-workers and leaders would support skill development and application so that individuals would all have TQM knowledge and skill sets. Deviations would be discouraged. As TQM knowledge emerges at the team level, members would share team mental models aligned with TQM practices. Similar knowledge and skills would emerge as a property of the collective.

In contrast, compilation forms of emergence are the result of processes of divergence that create a pattern, configuration, or meaningful whole at the higher level from distinct

differences in elemental content at the lower level (i.e., discontinuity). The processes that yield compilation are non-linear and more complex than composition, so the form of alignment is likely more complex as well. For compilation processes, system alignment refers to contingencies among contextual factors (i.e., if-then conditional linkages; moderating relations; temporal entrainment) that constrain a particular pattern or configuration. This view of alignment is similar to March's (1991) notion of the *exploration* aspect of organizational learning. For example, an organization might array its learning infrastructure to promote the development of adaptive teams. There would be policies, rewards, and management support for innovation, risk-taking, and experimentation, and agility would be a prominent strategic imperative of the organizational climate. Socialization and training would proceed more slowly, so that novel perspectives and knowledge held by newcomers could be explored and acquired by the collective prior to assimilation. Training and skill acquisition would more likely be an active role of the team leader, developing unique team member skills, roles, and responsibilities in context. Different team members would possess distinct knowledge and skills that could be combined to fit task contingencies. As basic skills compiled, the leader would shift the locus of development to skill integration among members. Transactive memory would emerge, enabling team members to access unique expertise as needed without having to share all knowledge in common. The team would evolve into a self-regulating, experimenting, and adaptive entity.

Team Networks

A final aspect of aligning the organizational system involves leveraging the infrastructure to facilitate informal processes that promote organizational learning. Araujo (1998) describes how informal networks are composed of interlocking and shifting relationships within and across organizations. These networks may bear little resemblance to formal organizational charts and structures. Interactions within a network allow individuals to share, synthesize, and interpret information in a variety of contexts. New ideas and solutions provide an opportunity for vertical transfer and the knowledge may be adopted in formal organizational structures and practices.

From an organizational socialization perspective, learning is shaped by a number of people formally or informally tied to the newcomer. Morrison (2005) examined newcomer relationships with organizational insiders and found different networks were related to different outcomes. Specifically, informational networks were instrumental to a newcomer's learning whereas friendship networks were tied to the newcomer's assimilation into the organization. Future research can examine how different networks contribute to an individual's socialization and an organization's learning from newcomers. For example, teams represent a dense network where each team member is tightly linked to all other team members. Research is needed to understand how a network's density might require newcomers to quickly adapt to the team or how the network's density might discourage team members from learning much or adapting to a newcomer.

Informal networks can bridge structural holes in formal reporting relationships. These informal ties can be critical communication links to transmit organizational knowledge. Organizations may be able to promote these links by fostering a culture that rewards mentoring or exploration. New research on organizational socialization can also be designed within different organizational strategies of exploitation and exploration (March, 1991). Organizations focused on exploiting their current strengths may benefit from swift socialization in dense networks. In this case, a newcomer learns what organizational insiders already know and can contribute improvements to existing products and strategies. Conversely, organizations focused on exploring new products or strategies may benefit from slower socialization in loosely coupled networks. In this case, a newcomer is expected to bring new ideas and knowledge into the organization that can contribute to knowledge creation for original innovations.

Research Agenda and Conclusion

Our basic thesis for this chapter is simple. Organizational learning is an important concept for understanding organizational effectiveness, given the unpredictable dynamics of change that characterize contemporary organizational environments. The concept of

organizational learning is richly conceived, diverse, and multidisciplinary. It is vibrant, but also amorphous, and it is mostly considered at the macro level of the organizational system. These points make it difficult to conceptualize and difficult to study empirically. Thus, the area of inquiry is characterized by lots of interesting ideas and approaches, but not very many well-developed, systematically evaluated, operational tools to promote and guide organizational learning.

Our approach was designed to get at specifics. We used multilevel theory as our conceptual framework and focused on areas of inquiry where there are well developed theories and systematic empirical research, that is, on the foundations and origins of organizational learning in the learning of individuals and teams. Thus, we focused on organizational learning as informal, emergent processes of individual and team learning, and on the formal infrastructure and system alignment that can be used to leverage and shape the emergence of collective learning. As we noted at the onset of the chapter, we offer a multilevel theoretical perspective applied to organizational learning – not a representation of the literature. Indeed, we think our perspective differs markedly from the literature (if it were even possible to typify it!). However, we believe that the approach we have taken is useful for identifying tractable research issues so that researchers can begin making systematic progress toward conceptual clarity, theory development, application, and operational value.

Research Agenda

Informal learning. Table 2 highlights research issues developed throughout the chapter which we briefly summarize in this section. We constructed our framework, bottom-up, first focusing on informal learning processes in organizations. Newcomer or organizational socialization is the dominant informal learning process whereby individuals entering the organization (or transitioning across major boundaries) are assimilated to new features of their context. Although it is often referred to as “organizational” socialization, the entire organization is not encountered. Rather, socialization takes place in the more proximal context of the work group, comprised of coworkers and supervisors.

Research suggests that insiders – supervisors in particular – have the potential to be key agents of newcomer socialization (Major et al., 1995; Ostroff & Kozlowski, 1992), but this issue has received little research attention. More importantly, socialization research has not always been sensitive to the proximal context of the work group, instead conceptualizing socialization as an organizational phenomenon (VanMannen & Schein, 1978), although some research shows that organizational socialization tactics wane over time while proximal work group influences remain significant (Chao et al., 1994). Finally, from an organizational learning perspective, understanding the influence of newcomers in teams and their influence on team level outcomes represents a new and exciting research direction (Chen, 2005; Chen & Klimoski, 2003). In particular, March's (1991) systematic simulation of exploitation-exploration yielded conclusions that slower socialization would yield more collective learning relative to fast assimilation. The appropriate balance of exploitation-exploration ought to be contingent on the context. Stable bureaucracies are likely to be better aligned by a balance tilted toward exploitation, whereas innovative systems are more likely to be better aligned by a balance tilted toward exploration. We think this is a very promising research issue.

Team learning is an area of increasing research interest and an area that is at the juncture of the individual and the organizational levels. Thus, it has the potential to be a key level for developing the conceptual underpinnings of organizational learning *and* a key leverage point for prompting organizational learning. We believe that the most pressing issue with respect to team learning is developing conceptual clarity. Much research treats team learning as types of collective knowledge representations (e.g., transactive memory, team mental models). Other theorists have asserted that conceptual progress for understanding team learning hinges on distinguishing the dynamic *process* of knowledge and skill acquisition from outcomes that capture knowledge representation (Kozlowski & Bell, in press). With respect to knowledge representations, there is well developed theory and research to support team mental models, and less well developed but promising research on transactive memory (Kozlowski & Ilgen,

2006). Although measurement issues abound and there is plenty of developmental work needed, these two forms of collective knowledge get most of the research attention. Many other alternative forms of collective knowledge emergence are conceivable (Kozlowski & Klein, 2000), but have been neglected. We think this has promise. Finally, although initial research on team regulation as a learning process to account for team learning, performance, and adaptation has been promising (Chen et al., 2005; DeShon et al., 2004), more attention needs to be paid to the specific regulatory process pathways by which effects manifest and on the dynamic interplay between self- and team-regulation during the emergence of team knowledge, skilled behavior, and performance (DeShon et al., 2004).

Team development has the potential to be an extraordinarily useful point in the lifecycle of a team to intervene, yet much of the formal effort to build teams occurs after teams have passed through the developmental phases; a missed opportunity (Kozlowski & Bell, 2003). Early intervention is likely to have a much bigger payoff, but the problem is that we have very little good descriptive data on the natural developmental progression of work teams. Good longitudinal descriptive research (no manipulations necessary!) is sorely needed. It would help inform theory development, especially the issues of phase shifts, timing, and temporal dynamics. Finally, basic research to evaluate the critical mechanisms underlying task cycles and developmental transition and progression proposed by normative models is needed. Because these models are complex, it is likely that research will have to isolate specific processes (e.g., task episodes or progression) and study them separately (e.g., DeShon et al., 2001; Marks & Panzer, 2004).

Formal interventions. In our framework, formal interventions are designed to prompt and shape learning to augment informal processes and to leverage learning toward targeted outcomes at multiple levels. We begin with a focus on active learning as a foundation because it is rooted in theories of self-regulation that have relevance and applicability at higher levels of conceptualization. Bell and Kozlowski (this volume) present a detailed agenda for research on

active learning, so we merely highlight key points here. The primary research needs are to (a) further refine the linkages between active learning design elements, self-regulatory process pathways, and learning outcomes and (b) map the interactions between individual differences and active learning design elements and their effects self-regulation. Both of these issues are relevant to improving the delivery of active learning experiences and, in particular, to tailoring the techniques to individuals and their progress as they learn; individualized training on demand.

Embedded training is theoretically related to active learning, but with a more pragmatic emphasis on the design of techniques that selectively stimulate self-regulation to influence its focus and quality during active learning. As research refines the integrative active learning model, those theoretical advances will need to be incorporated in the ALS model to improve intervention design. Moreover, as the stable of effective active learning techniques that can be embedded in technology expands, evaluation of their generality out of controlled lab simulations and into work technology systems needs to be undertaken. Do they work as effectively in work systems? How effectively can they be deployed and distributed in a broader DLS technology network? These are pragmatic questions, but they are critical questions to answer if we are to be able to realize the promise of these approaches. Finally, the other important research opportunity is to begin to generalize active learning techniques and embedded training to the team level. Virtually all of the research in on these models has been conducted at the individual level. Do the same processes manifest in the team learning context?

There is a wide range of team learning techniques that have evidence of effectiveness for specific applications (Salas & Cannon-Bowers, 1997). Choosing among the many techniques can be a challenge, although recent efforts to statistically summarize the research on team training effectiveness using meta-analysis is very promising (Klein et al., 2007). We encourage more of this work. Moreover, we would also encourage conceptual integration. The integrated active learning model identified a parsimonious set of core design elements that

accounted for a wide array of distinct active learning interventions, and the pathways by which they exhibit their effects (Bell & Kozlowski, this volume). By taking a similar approach, it might be possible to consolidate the wide array of team training techniques into a smaller set of intervention clusters linked to process mechanisms. That would simplify meta-analyses and would also promote theoretical parsimony.

Normative models of team leadership focus on the role functions of the team leader in harnessing the task cycles (discussed under team development), linking them to a regulatory cycle (setting goals, monitoring performance, intervening as necessary, and guiding process feedback) to build targeted skills, and shifting the locus of skill development as individual and team skills compile. As discussed above, the basic underpinnings of the normative model with respect to task cycles and skill compilation are in need of more research attention, although initial research is promising (Kozlowski & Bell, in press). However, specific to the models of team leadership, we need to evaluate how effectively the regulatory cycles can be prompted by leader functions or actions. We think leaders (or other agents) have high potential to leverage learning in the workplace, whether augmented by technology or not. If so, they are key to prompting developmental processes that underpin collective learning at higher levels of the organizational system. This is uncharted territory.

With the basic underpinnings of an infrastructure in place at the individual and team levels, research attention also has to extend to system alignment for qualitatively different emergence processes, and the ways the vertical transfer can be fostered so that collective learning propagates throughout the organizational system. The two primary forms of vertical transfer discussed by Kozlowski and colleagues (2000) are the composition and compilation forms. However, it should be noted that those two ideal types anchor the ends of a quasi-continuum of more specific types of emergence (Kozlowski & Klein, 2000). There are fairly specific propositions attached to each form of emergence and their implications for needs

assessment, training design and delivery, and evaluation that have not been evaluated. Evaluation of the basic forms of vertical transfer, and the more specific alternatives is warranted.

In this chapter we proposed that composition forms of emergence are more likely to be associated with (or would characterize more effective system alignment) when the organizational system is designed to promote exploitation as the form of organizational learning, whereas compilation forms of emergence are more likely to be associated with (or would characterize more effective system alignment) when the organizational system is designed to promote exploration as the form of organizational learning (March, 1991). We think this idea has conceptual merit, and would help to guide system design.

Finally, networks within and across teams may provide a way to research how learning emerges across members within a team and how collective learning propagates across the organizational system. Networks provide an approach for conceptualizing how knowledge from learning is accessed and synthesized from diverse sources, shared across nodes, and compiled to emerge as part of the vertical transfer process. It likely that both formal networks (i.e., task structure links) and informal networks (i.e., interpersonal links) are implicated.

Dense team networks may force more rapid newcomer socialization which could limit the degree to which a team can learn from newcomers before they are socialized. However, it is also possible that dense team networks could enable more rapid propagation of knowledge across team members once useful knowledge has been acquired and identified by a member. Thus, research on the effects of network density, both formal and informal, on intra-team socialization and learning is warranted.

At the higher level, parallel research is needed on how linkages across teams may similarly facilitate or inhibit collective learning. Moreover, if network connections enable collective learning as would be expected, research would be needed to address how gaps or structural holes in the unit network could be bridged to enable more uniform emergence of collective learning.

Conclusion

Organizational learning has been discussed in the literature on organizational behavior since at least the early 1960's but, although the concept is conceptually rich, it has not served as a major driver of research. We think that a big part of the limited research impact of organizational learning is the relative lack of more specific theories and interventions needed to provide process engines and actionable tools to guide the process, respectively. In this chapter we have proposed a multilevel framework in an effort to provide a conceptual and operational foundation to fill this gap. We hope that this chapter will help guide researchers to see the myriad promising ways that the underpinnings of organizational learning can be investigated and that as a result our field will begin to gain a better grasp on this important domain of applied psychology and organizational behavior.

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Table 1. Research Agenda

Informal Learning	
Socialization	▪ Research is needed to examine the effectiveness of training insiders, especially supervisors, to be effective socialization agents. ▪ Research is needed that is sensitive to the proximal context of socialization – the work team. Not just research on how insiders influence newcomer socialization, but also research on how newcomers influence insiders and the unit. ▪ Research is needed to identify the optimal balance or trade-offs of exploitation and exploration during socialization (prior to equilibrium) and congruence with the context.
Team Learning	▪ Learning as a process and its outcomes have to be distinct. ▪ Conceptual development is needed to clarify different representations of the collective knowledge pool. ▪ Research is needed to better link distinct individual and team learning *processes* to learning *outcomes.* ▪ Research is needed on the dynamic processes of individual and team regulation and the emergence of collective skill.
Team Development	▪ Descriptive research (longitudinal) is needed on work team development. ▪ Research is needed to test normative models of team development: task cycles and regulatory processes within phases and skill compilation across levels across phases.
Formal Interventions	
Active Learning	▪ Continuing research is needed to elaborate and refine the self-regulatory process pathways that link intervention elements to multidimensional learning and performance outcomes. ▪ Continuing research is needed to map interactions between learner characteristics and intervention elements. ▪ Need to generalize the approach to the team level.
Embedded Training	▪ Continuing research is needed to refine the development of specific active learning interventions. ▪ Research is needed to evaluate the effectiveness of embedding training capabilities in work technology. ▪ Need to generalize the approach to the team level.
Distributed Training	▪ Research is needed to evaluate the effectiveness of calibrating DLS technology design to the underlying model of learning. ▪ Need to generalize to teams and multi-team systems.
Team Training	▪ Continuing work to meta-analyze the effectiveness of team training techniques. ▪ Need for conceptual consolidation.
Team Leadership	▪ Research is needed to evaluate the normative models of team leadership, specifically the ability of the leader to prompt self-regulation and to shape team development.
System Alignment & Vertical Transfer	▪ Research is needed on configurations of system alignment and to evaluate vertical transfer emergence models. ▪ Research is needed on exploitation-exploration and vertical transfer. ▪ Research needed on intra team and between team networks as a means to promote collective propagation.

Figure 1.

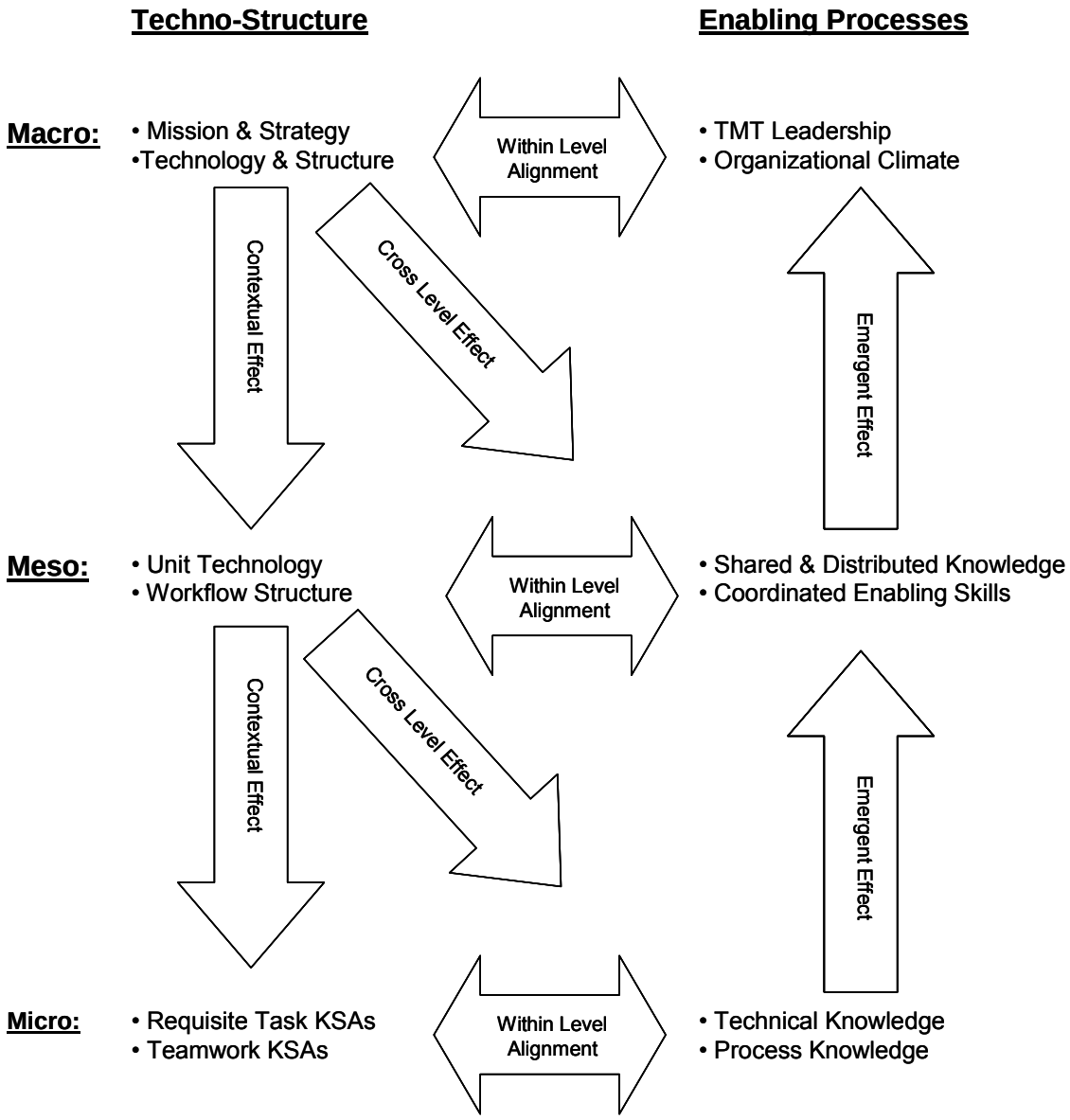
Techno-Structure
Enabling Processes
Macro:
• Mission & Strategy
•Technology & Structure
Within Level Alignment
• TMT Leadership
• Organizational Climate
Contextual Effect
Cross Level Effect
Emergent Effect
Meso:
• Unit Technology
• Workflow Structure
Within Level Alignment
• Shared & Distributed Knowledge
• Coordinated Enabling Skills
Contextual Effect
Cross Level Effect
Emergent Effect
Micro:
• Requisite Task KSAs
• Teamwork KSAs
Within Level Alignment
• Technical Knowledge
• Process Knowledge

Figure 2. Composition and Compilation Forms of Emergence.

Content:	Shared	Unique
Process:	Convergent	Divergent
Equivalence:	•Structural •Functional	•Functional
Example:	Team Mental Models	Transactive Memory

Figure 3. A Multilevel Foundation and Infrastructure for Organizational Learning.

	Organization Learning System		
	Informal Processes **OL Foundation**	**Formal Processes** **OL Infrastructure**	**OL Outcomes**
Macro	▪ Exploitation / Exploration ▪ Enabling Processes	▪ Exploitation / Exploration • Techno-Structure	▪ Exploitation / Exploration • Vertical Transfer
Meso	▪ Team Development ▪ Team Learning	▪ Team Leader Training ▪ Team Training Techniques	▪ Shared Mental Models ▪ Transactive Memory ▪ Knowledge Pool & Distribution
Micro	▪ Socialization and Mentoring ▪ Implicit Learning	▪ Distributed Learning Systems ▪ Active, Embedded Training	▪ Task-Relevant Knowledge ▪ Enabling Process Knowledge