

Rethinking informal and incidental learning in terms of complexity and the social context

VICTORIA J. MARSICK^{1*}, KAREN E. WATKINS², ELLEN SCULLY-RUSS³ and ALIKI NICOLAIDES²

¹Department of Organization and Leadership, Teachers College, Columbia University, New York, NY, USA

²Department of Lifelong Learning, Administration, and Policy, The University of Georgia, Athens, GA, USA

³Human and Organizational Learning Department, The George Washington University, Washington DC, USA

(Received: July 18, 2016; accepted: October 30, 2016)

Background and aims: Informal workplace learning research suggests that it is highly contextual and social. Early models of such learning emphasized individual agency and control, but subsequent theorizing based on sociocultural and complexity theory unveils different interpretations of the dynamics of informal and incidental learning. The aim of this article is to critique and revisit conceptualizations of informal and incidental learning in light of recent research and theorizing that account for the dynamic complexity of learning that occurs on multiple planes or domains in the workplace. *Methods:* In this conceptual article, drawing on the literature, the authors trace the development of informal and incidental learning theory from early conceptualizations of individual learning to today's perspectives that account for the social and contextual nature of learning in the workplace. To extend current theory, we examine informal and incidental learning from the theoretical perspectives of sociocultural-historic and complexity sciences. *Results and conclusion:* The results identify implications for how informal and incidental learning is described and theorized on a number of dimensions. We conclude that these more complex and dynamic theories give rise to an enriched understanding of informal and incidental learning as organic self-organizing systems and explore implications for how adult and workplace learning is conceptualized.

Keywords: informal learning; incidental learning; social context; workplace learning

RETHINKING INFORMAL AND INCIDENTAL LEARNING IN TERMS OF COMPLEXITY AND THE SOCIAL CONTEXT

Adult and workplace education in the knowledge era has increasingly embraced informal learning as a complementary partner to more structured training and development. Learner interests and motivation as much as, or more than, those of employers drive informal learning. Informal learning thus cannot be delivered, managed, or supported in the same way because choices surrounding such learning are not directly in the hands of the organization (Marsick, 2012). The purpose of this study is to critique and revisit a research-based conceptualization of this kind of informal learning (Marsick & Watkins, 1990) in light of sociocultural-historical theory (Billett, 2006; Holzman, 2008) and complexity science (Cilliers, 2007; Snowden & Boone, 2007; Stacey, 2001).

INFORMAL LEARNING RESEARCH ON PRACTICE

Informal learning is challenging to study because it is neither highly conscious nor easily observable or accessible at the point of learning. Early research focused on

describing what *could* be seen, particularly learning practices and processes including mentoring, self-directed learning, or communities of practice (Knowles, 1950; Tough, 1979). Yet much informal learning at work is tacit (Nonaka & Takeuchi, 1995), occurring in the context of solving problems or experimenting with solutions to challenges, hence, making it hard to separate from the work challenge that prompts it. Incidental learning, a subset of informal learning, is even more difficult to observe because it occurs as a by-product of some other activity (Marsick & Watkins, 1990), and therefore, it may not manifest immediately and it may not be recognized as learning by the learner and others.

To make tacit knowledge clearer to observe, manage, and research, many studies have focused on learning processes and practices. Eraut (2004) developed a typology, based on research with professionals, as a heuristic for studying areas of competence – which he defines as socially constructed and interdependent, in contrast to North Americans who define competence as “individual-centered” (p. 264). He then identified four main types of work activity that regularly gave rise to learning for professionals: “participation in group

* Correspondence: Victoria J. Marsick, PhD, Teachers College, Columbia University, 525 West 120th Street, 207 Zankel Hall, New York, NY 10027, USA; Phone: +1 212 678 3754; Fax: +1 212 678 3957; e-mail: marsick@tc.columbia.edu

activities,” “working alongside others,” “tackling challenging tasks,” and “working with clients” (pp. 266–267).

This focus of learning through work is echoed in other studies. Marsick and Volpe (1999) reviewed studies describing such learning as integrated with work routines, triggered by a jolt, not highly conscious, not well organized or structured, facilitated by reflection and action, and linked to the learning of others. Marsick, Watkins, Callahan, and Volpe (2009) reviewed studies emphasizing trial-and-error and learning from mistakes or experience as learning methods, along with self-directed learning projects. Watkins and Cervero (2000) identified formal, informal, and incidental learning practices by assessing what learning was available and actually undertaken by accountants. Using this assessment, Nurmala (2014) found that participation in informal and incidental learning was significantly correlated with a high learning culture in public health contexts.

Thus, research has increasingly used the lens of work itself – i.e., the nature of the organization and the job as well as the workplace context – to better understand these practices. For example, Poell, Yorks, and Marsick (2009) examined project-based learning and found that learning paths differ, given opportunities and constraints that are partially mediated by which “actor” catalyzes the learning, that is, vertical (management), horizontal (work teams), external (profession), or self-managed (employee). Raelin (2000) differentiated work-based learning from training and defined it “as acquired in the midst of action and dedicated to the task at hand” through “conscious reflection on actual experience” (p. 2). Scheeres, Solomon, Boud, and Rooney (2010) described particular kinds of everyday “integrated development practices” that are “embedded in work,” “independent of training,” and managed or implemented by people whose primary job function is not training or learning” (p. 14).

In summary, learning from and through experience – typically in interaction with others – is at the heart of how people learn informally, but their learning is prompted by, and intertwined with, work. Informal learning is highly contextual (Cseh, Watkins, & Marsick, 1999; Ellinger & Cseh, 2007; Eraut, 2004; Marsick et al., 2009). It is tied to tasks, processes, roles, and settings. Fuller et al. (2003) pointed out that the contextual, situated nature of learning requires “start[ing] from an analysis of the organizational context and work process in order to uncover and unpack what is being learned, how it is being learned and by whom” (p. 5). In the next section, the authors examine factors in the context that affect whether or not, and how people learn informally at work.

HOW WORK SHAPES INFORMAL AND INCIDENTAL LEARNING

We briefly discuss research that examines how individuals interact with the social context in their work and learning: cognitive psychology (Watkins, Marsick, & Fernández de Álava, 2014) and sociocultural theory. Billett (1996) identified problem solving “through interaction with social sources” (p. 267) as common ground between both perspectives, although each perspective understands this process differently. Both views, however, focus on

“goal-directed activity” through which individuals “access, manipulate and transform cognitive structures which are socially sourced, resulting in the construction and organization of knowledge” (p. 271).

Sociocultural theory draws from Vygotsky, elaborated below, and emphasizes *collective agency and shaping* of individuals through interactive norms and resources embedded in social settings. The cognitive perspective, by contrast, emphasizes *individual agency* even though it takes interaction with the social context into consideration – as do, e.g., Dewey (1938) and Lewin (1936), who explained behavior as a function of the interaction between individuals and their environment.

Marsick and Watkins (1990) originally argued that formal learning is “typically institutionally-sponsored, classroom-based, and highly structured,” whereas informal learning is not; and “control of learning rests primarily in the hands of the learner” (p. 12). They held that variability of outcomes, depth of learning, and potential for both serendipitous and errorful learning increased in more informal settings (Marsick & Watkins, 1990; Marsick, Watkins, & Wilson, 2002). Marsick and Watkins (1990) proposed that people learn from their experience when they face a challenge or problem that is new to them in some way, triggering a fresh look at the situation, followed by a search for alternative responses, taking action, and evaluating results. Learners’ ability to make meaning of the experience by framing the situation, to enact the solutions they envision, and to interpret lessons learned may limit what is learned informally.

The Marsick and Watkins’ (1990) model is an empirically based understanding of *how people informally and incidentally learn*. However, in practice, individuals may not set out explicitly to accomplish particular ends through preplanned means. Often, choices evolve from interaction with others in the midst of work activities. Sometimes people are conscious of choices; at other times, they remain unaware. Reflection is needed, not only to make learning more effective, but also to unearth erroneous assumptions and mistakes, and to identify and forestall unintended negative consequences.

Marsick and Watkins (1990) agreed with Fenwick (2006) that informal learning prompted by the organization’s needs can differ considerably from learning for one’s own purposes. Research shows that natural work groups and communities of practice influence learning processes and outcomes (Billett, 2002).

In organizations, learning often occurs in groups that have a life together outside of the classroom, one that may be continuous over time (Lave & Wenger, 1991; Wenger, 1998). These people may share norms, a culture, and meanings that are so mutually reinforced that individuals seldom consider the possibility that other meanings are thinkable. Questions arise, however, about the role of individual agency in negotiating power and finding ways to pursue intrinsic interests. The sociocultural perspective led us to rethink the social nature of informal and incidental learning as depicted in Watkins et al. (2014). In the revised model, informal and incidental learning are considered socially triggered, planned, and enacted. Meanings are collectively shared and shaped. In the following section, we consider what would be different if we used a deeper sociocultural-historical lens.

SOCIOCULTURAL-HISTORIC PERSPECTIVE

Scholars have adopted Vygotsky's principles of sociocultural-historic theory since the turn of the 20th century to explore learning in schools, communities, and the workplace. This line of research acknowledges the deep and formative role of social relations in individual learning and development, for example, through situated learning theory (Lave & Wenger, 1991), communities of practice (Brown & Duguid, 1991; Wenger, 1998), and cognitive apprenticeships (Collins, Brown, & Newman, 1988). All build on Vygotsky's basic premise that learning is social in both form and content (Wertsch, 1985).

Vygotsky's principles and informal and incidental learning

Vygotsky reinforces the dialectic unity of informal, incidental, and formal learning – especially for Western societies that have relied on formal education to socialize youth into society and workers into the workplace. Alheit (1996) pointed to the ubiquitous experience of formal education in Western society where the majority have experienced a medium to high level of formal education. Formal learning dictates the process and mechanisms through which people learn in all settings, which makes it difficult to distinguish between it and informal learning (Alheit, 1996). Individuals socialized through schooling can abstract from concrete situations in particular ways; they analyze problems and model solutions; they may also have the capacity for self-direction and critical reflection in the workplace (Shepel, 1999).

Yet, capacities fostered through formal education only provide the *basis* of informal learning; they cannot complete learning in the Vygotskian sense. Drawing on Vygotsky's (1987) views of thinking and speech, formal learning does not “fit” informal situations “like clothes off a rack” (p. 251). Rather, formal learning is restructured as it is transformed into actionable knowledge in the context of concrete situations. Accordingly, the formal learning is not *expressed in* – but *completed by* – the informal learning, which itself informs and transforms formal capacities in some way. Therefore, formal and informal learning cannot be opposites, as described in Marsick and Watkins (1990), nor can they be a continuum, as suggested by Billett (2004) and Watkins and Marsick (2014). Instead, they are a dialectical unity. One brings the other into existence and completes it in the context of real life situations that require adjustment, problem solving, and learning.

In addition, informal learning *emanates from* social relations. This view is contrary to contemporary thinking on work and learning from a sociocultural perspective that typically includes social relations as one of many contextual factors that influence informal learning, for example, resources, leadership and management support, structure, job, and organizational culture (Watkins & Marsick, 2014). According to Vygotsky, we learn *through* social processes, and what we learn is socially constructed. Therefore, social relations are not just factors; they are the very *source* of informal learning in the workplace (Veresv, 2010).

In this light, social relations do not *by their nature* constrain individual agency in informal learning, as some

scholars suggest (Glassman, 2001). Instead, informal learning is an inter-subjective, deeply relational endeavor. Gergen (2009) elaborated “...[V]irtually all intelligible action is born, sustained, and/or extinguished within the ongoing process of relationships... We are always already emerging from relationships; we cannot step out of relationship; even in our most private moments, we are never alone” (p. xv). This relational-centered, inter-subjective understanding of learning shifts the focus from “...the remote realms of social structure and individual subjectivity to the micro-social patterns, interdependent action, and the realm of the *in-between*” (Gergen, 2009, p. 217).

This inter-subjective *in-between* is found, ideally, in the social activities that invite people to complete each other and to grow and develop. In the case of informal learning for work, the *in-between* lies in the work itself. Therefore, to rethink informal and incidental learning, we must take work, and not learning, as our point of departure. From the sociocultural-historical perspective, informal learning would account for the quality and character of the social interactions or the relational dynamics of the inter- and the intra-psychological dialectic (social interactional dimension) – and, it would also heighten awareness of the influence of the institutional context, cultural tools, and material used to constitute social relations, as well as to perceive and make meaning of their experience of work and learning (Shepel, 1999; Wertsch, 1998). This speaks especially to the incidental learning portion of the Marsick and Watkins' (1990) model. In other words, a description of informal and incidental learning in the workplace from a sociocultural-historical perspective would account for its social origins in particular work situations, and explain how it is shaped by the sociocultural-historical context or institutional setting (Shepel, 1999).

On both levels of analysis, the focus is not on the individual who is engaging in informal learning; rather, the situation is primary. Researchers attend to work interactions and relations, and the cultural tools available to people and groups to perceive tasks, frame problems, and devise, implement, and evaluate solutions. Development gaps lie in cultural tools available, mediating relations (i.e., who does or does not have access to valuable tools) and the efficacy of relationships and tools in accomplishing tasks and performing required actions. Informal and incidental learning would thus explain the process by which people come to perceive and fill these material gaps – as well as how new or refined tools and relations, in turn, foster cultural development, social relations, and the cultural surround.

The aim of this analysis is not to describe phenomena like work and learning; rather, it is to help people foster the cultural development of one another and their relations and context. Therefore, in regards to rethinking informal and incidental learning, this perspective would first inquire about the significance of this project. What, for example, is going on in the broader environment, culture, discipline of education, and workplace learning that leads scholars to question the utility of the conceptual tools that inform our understanding of workplace informal learning? What are new cultural tools and materials available or needed by people so that they can more fully complete each other at work? Why is understanding learning at work so

important – is it because our historic understandings of work have changed so that it is experienced more like learning than traditional notions of work? These questions would lead scholars to seek gaps in our relations and tools to foster cultural development in our personal practice, our scholarly relationships, and the broader fields of adult education and workplace learning.

Sociocultural-historical critique of Marsick and Watkins' model

The original Marsick and Watkins' (1990) model saw informal learning as *contextually supported*, that is, factors at work either facilitate or inhibit informal learning. The sociocultural-historical perspective, by contrast, suggests that informal learning is *contextually constituted*, that is, how work and learning are perceived and unfold is sourced by cultural material within the broader institutional setting.

Second, the original model described an individual, self-directed process of problem solving; the updated model added a social dimension to acknowledge the role of social interaction and collaboration. However, this new social model may continue to view individuals as distinct and separate actors or thinking subjects who make sense of objects in their environment, including the thoughts and behaviors of others. In other words, this model remains rooted in *individual* learning and cognition, whereas the sociocultural-historical perspective sees informal learning as occurring in the dialectic unity of inter- and intrapsychological planes of work activity. People do not learn *from* one another; rather, they *complete* each other in a broader and ongoing cycle of cultural development.

Third, the original model located development gaps in the individual's knowledge and behaviors, whereas the updated model located gaps in frames of mind as well as knowledge on both the individual and group level. The sociocultural-historical perspective adds a focus on gaps in tools and mediating relationships that are located in the work context and practices. The aim of this analysis would be to develop the work: to help people refine and create new conceptual tools and practices that advance the state of work. Individual capacities would be affected, but change would emerge from within a broader solution; it could not be prescribed or fostered by formal training. Therefore, affecting individual change would not be the focus of efforts to understand informal learning.

Finally, both the original and updated social models focus on understanding informal learning in work – whereas the sociocultural-historical perspective seeks to understand and foster cultural development in and of work. Sociocultural-historical educators critically examine the efficacy of their own conceptual tools and mediating relationships, as well as helping others to do the same.

COMPLEXITY SCIENCE

In this section, we consider where informal learning is situated in the continuum of ambiguity and unpredictability of complex learning situations, and how this understanding might reshape our perspective of informal learning.

Foundational characteristics of the complexity perspective

Complexity is a way of thinking about the world that captures the dynamic interactivity of ontology (the nature of things), epistemology (the way we know things), and phenomenology (the way we perceive things) that are in constant relationship influenced by history, context, and degrees of uncertainty (Juarrero, 2010; Prigogine, 1997). Advances in complexity science, combined with the cognitive sciences, are applied to understand and inform human action. A fundamental assumption of organizational theory and practice is that a certain level of predictability and order exists in the world. This assumption, grounded in Newtonian science, encourages simplifications that are only useful in ordered circumstances. Circumstances change, however, and as they become more complex, simplifications fail (Snowden & Boone, 2007). Complex systems are dynamic, a mesh of interactions and relationships that are constantly evolving, creating ripeness for emergence, and a disruption of learned responses (Juarrero, 2010).

Complexity and informal/incidental learning

Complexity science helps us discern the characteristics of a context with regard to cause and effect, and if we pay attention, how to develop capacities to respond in ways that are closer to the reality of the context, situation, and/or event. There are four distinct domains, plus one overall domain, that describe contextual complexity. The four domains are: obvious, complicated, complex, and chaotic. The fifth domain, disorder, applies when it is unclear which of the four others is predominant.

In brief, "obvious" is the domain of good practice when there is a clear cause-effect relationship. The right answer is self-evident and undisputed. In this realm of "known knowns," decisions are unquestioned; all parties share an understanding and have skills to respond. "Complicated" is the domain containing multiple right answers. Although there is a cause-effect relationship, not everyone can see or understand it. In this realm of "known unknowns," expertise delivers best practices as possible solutions, since at least one right answer exists.

"Complex" is the domain of emergent practice where it is not possible to determine the source of cause and effect. In this realm of "unknown unknowns," we probe, sense, and respond as there are no right or wrong answers. In a "chaotic" context, searching for right answers would be pointless. Relationships between cause and effect are impossible to determine because they shift constantly and no manageable patterns exist – only turbulence. This is the realm of "unknowables" where we do not wait to act, reflect, or learn, but just action based on instincts to survive, which may lead to novel practice – new discoveries that both generate a path to return to a complex domain that is livable and discover something new (Cilliers, 2007; Snowden & Boone, 2007; Stacey, 2001).

How might complexity science inform the way informal and incidental learning occurs?

A heuristic in four domains [adapted from the Cynefin framework developed by Snowden and Boone (2007)]

Table 1. Models of informal and incidental learning in the workplace

	Original: model 1	Social: model 2	Sociocultural-historical: model 3	Complexity: model 4
What is informal and/or incidental learning in the workplace?	A challenge triggers a fresh look at the situation, followed by a search for alternative responses, taking action, and evaluating results; incidental learning is what occurs at the interstices – what emerges when we unintentionally learn something new	An informal learning cycle(s) that occurs through social interaction with others and social sources	A process by which groups engaged in work activities, come to perceive and address development gaps in structures and tools	A process of discerning cause and effect in the obvious and complicated domains – informal learning produces good and best practice results in response to a recognized problem
Perceived relationship forms of learning (formal, informal, and incidental)	Formal, informal, and incidental are a conceptual continuum of control over the learning process; on intentionality over what is learned.	Formal learning is controlled by someone else while informal and incidental learning are often co-created with and for others	Formal and informal are a dialectical unity – one form of learning is completed in the other	Informal is decoupled from incidental learning to enable a goodness-of-fit perspective of prevailing learning modalities in four domains. Informal fits with obvious and complicated domains; incidental fits with complex and chaotic domains.
Who learns	Individual	Individual in the social context and, through social interaction, others with whom the individual interacts	People complete each other in a broader cycle of ongoing cultural development of people, work practices, and cultural tools	The system learns – the past is integrated with the present as the elements evolve with one another and with the environment
How learning occurs (processes and practices)	Contextually supported, often self-directed process of problem solving In incidental learning, learning is a by-product of another activity that could be formal or informal learning (the hidden curriculum)	In goal-directed activity individuals and groups access, manipulate, and transform cognitive structures that are socially sourced, resulting in the co-construction and organization of knowledge	Learning processes and practices are situated; learning is contextually constituted, how work and learning are perceived and unfold is sourced by cultural material within the workplace and its broader institutional surround. Incidental learning results in greater awareness of this surround.	Relationships within the system are infused by contextual characteristics, history, and dynamic interactions such that understanding and perception emerge to generate action
Role of social interaction and social relations in learning	Unexplained	Social relations mediate as well as afford or constrain informal learning	Learning emanates from social relations – all learning occurs through inter-subjective processes and interdependent, coordinated action	Complex systems are dynamic, a mesh of interactions and relationships that are constantly evolving creating ripeness for emergence and a disruption of learned responses
Focus of workplace learning research and interventions	Individual learning processes and practices in the workplace context, as well as frames of mind on the individual level and the constraining and supporting role of the context such as a learning culture	Individual and social learning processes and practices, as well as frames of mind on the individual and group level	The work of adult and workplace educators as well as work itself, including the quality and character of social relations, influence of the institutional context, and development gaps in cultural tools, materials, and practices	The invisible cause and effect relationships and patterns of interaction that disrupt learned responses and give rise to a range of action from within learning

integrating different approaches to learning – formal, informal, incidental, and novel – in each of four quadrants offers a complexity science approach. In this, we decouple incidental from informal learning and suggest a “goodness-of-fit” stance that invokes a capacity to utilize learning approaches that fit the conditions of each quadrant (Nicolaidis & Marsick, 2016; Nicolaidis & Yorks, 2008). Looking through the lens of complexity science, informal learning seems to fit best with the “obvious” and “complicated” domains where learning produces best practices in response to a recognizable problem. Incidental learning may be a response to the “complex” and “chaotic” domains where unpredictability, emergence, and surprise are factors that support spontaneous incidental learning.

Complexity critique of Marsick and Watkins’ model

Simplistically, all learning is the relatively permanent acquisition of knowledge and skill. It can be acquired formally (e.g., classroom and training), informally (e.g., observation, connection, and conscious attention to experience), or incidentally (e.g., accidental and spontaneous) through conscious and at times unconscious, interaction within an experience, situated in a context (historical and relational). Marsick and Watkins’ understanding of adult learning has been influenced by Dewey (1938) and Lewin (1936) who describe learning as the result of having and reflecting on experience, which leads to some new action, decision, and impact.

A complexity science perspective embraces “messiness,” recognizing that – within the relationships infused by contextual characteristics, history and dynamic interactions – knowing, understanding, and perception emerge to generate action. This perspective opens up ways to think about how informal and incidental learning are situated in the context of the workplace. We see that incidental learning likely occurs in complex or chaotic contexts, and that it may grow emergent and novel responses. Informal learning sits on the inside borderline of the predominant workplace learning mechanistic paradigm, whereas incidental learning sits just on the outside of that boundary. Incidental learning is oblique and difficult to name and categorize, yet offers novel, emergent learning choices in complex or chaotic contexts. The complexity view generates distinctions that help humans “*see the invisible*,” so that people may act from within learning – formal, informal, incidental, and novel.

DISCUSSION AND CONCLUSION

If we look across the four models examined here – starting with original Marsick and Watkins’ model through to the complexity perspective – we can rethink informal and incidental learning in the workplace along at least six dimensions (see Table 1), including perspectives on learning, the relationship between forms of learning, the learner, learning processes and practices, the role of social relations in learning, and the focus of research and learning interventions. Informal and incidental learning in the workplace move from an ordered linear cycle of individual reflection and problem solving to a socially driven, contextually constructed process of expanding awareness and reflexive

action. This move serves to break down previously imposed boundaries among modes of learning, including formal, informal, incidental, and novel – to reveal how they work together to enable cultural development and creative action in a variety of workplace domains.

As our notions of the learner expand to include multiple agents, tools, and resources embedded in a dynamic, multi-dimensional workplace system, our theories of learning also shift to account for contextual characteristics and the historically situated perceptions of what learning is, and how it is sourced by historically constituted tools and knowledge in the workplace and its institutional surround. This dynamic and embedded understanding of the learner and the learning process brings forth new emphasis on the role of social interaction in learning. Once unexplained in the original model, social relations are now considered a primary source of workplace learning. Theory is now called upon to account for how these relationships, and their culturally sourced tools, evolve in ways that disrupt previously learned responses, while at the same time allowing for new ways to complete and re-create social practices. We also must consider how these new responses or practices, in turn, shape what people know and how they learn within and through work.

The implications for workplace learning research and interventions are too many to recount here. What can be said is that – as the view of workplace learning expands to include more agents, tools and resources, as well as to incorporate an account of multiple forms of learning in a deeply embedded and relational system of action and knowing – the discipline of workplace learning must also expand and develop capacity to respond in ways that are closer to the reality of the dynamic and complex workplace context today.

Clearly, learning in the workplace is much more complex than can be readily conveyed in the original Marsick and Watkins’ (1990) model, or even in its subsequent re-interpretations. Models can attempt to conceptualize the dynamic complexity of learning on multiple planes or domains in the workplace; but they are limited to two or at most three dimensions that may not adequately capture what learning is and how it emerges from within relationships within the system and over time. At the same time, underlying theoretical perspectives create and inform the model. Moving forward, as we rethink informal and incidental learning in the workplace, we contemplate what might emerge from other perspectives. For example, the ecological perspective (Lee, 2016) on learning and the emerging science of the mind (Kandel, 2013) offer different explanations for the interconnections among many planes within and across complex adaptive systems. Rather than end with an answer, we pose a question: What might these and other perspectives bring to this analysis, and how would these views further expand our awareness of what learning is and how it occurs in the workplace?

Funding sources: No financial support was received for this study.

Authors’ contribution: Each author contributed to the analysis and writing of this conceptual article. All authors had full

access to the references included in this analysis and take responsibility for the integrity and accuracy of the inquiry.

Conflicts of interest: The authors declare no conflict of interest.

REFERENCES

- Alheit, P. (1996). Changing basic rules of biographical construction: Modern biographies at the end of the 20th century. In A. Weymann, W. R. Heinz, & P. Alheit (Eds.), *Society and Biography: Interrelationships between social structure, institutions and the life course*. Weinheim, Germany: Deutscher Studien Verlag.
- Billett, S. (1996). Situated learning: Bridging sociocultural and cognitive theorizing. *Learning and Instruction*, 6(3), 263–280. doi:10.1016/0959-4752(96)00006-0
- Billett, S. (2002). Critiquing workplace learning discourses: Participation and continuity at work. *Studies in the Education of Adults*, 34(1), 56–67. doi:10.1080/02660830.2002.11661461
- Billett, S. (2004). Workplace participatory practices: Conceptualising workplaces as learning environments. *Journal of workplace learning*, 16(6), 312–324. doi:10.1108/13665620410550295
- Billett, S. (2006). Relational interdependence between social and individual agency in work and working life. *Mind, Culture, and Activity*, 13(1), 53–69. doi:10.1207/s15327884mca1301_5
- 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. doi:10.1287/orsc.2.1.40
- Cilliers, P. (2007). *Thinking complexity*. Mansfield, USA: ISCE Publishing.
- Collins, A., Brown, J. S., & Newman, S. E. (1988). Cognitive apprenticeship: Teaching the craft of reading, writing, and mathematics. *Thinking: The Journal of Philosophy for Children*, 8(1), 2–10. doi:10.5840/thinking19888129
- Cseh, M., Watkins, K. E., & Marsick, V. J. (1999). Re-conceptualizing Marsick and Watkins' model of informal and incidental learning in the workplace. In K. P. Kuchinke (Ed.), *Proceedings of the academy of HRD* (pp. 349–355). Baton Rouge, LA, USA: Academy of Human Resource Development.
- Dewey, J. (1938). *Experience and education*. New York, NY: Simon & Schuster.
- Ellinger, A. D., & Cseh, M. (2007). Contextual factors influencing the facilitation of others' learning through everyday work experiences. *Journal of Workplace Learning*, 19(7), 435–452. doi:10.1108/13665620710819384
- Eraut, M. (2004). Informal learning in the workplace. *Studies in Continuing Education*, 26(2), 247–273. doi:10.1080/158037042000225245
- Fenwick, T. (2006). Tidying the territory: Questioning terms and purposes in work-learning research. *Journal of Workplace Learning*, 18(5), 265–278. doi:10.1108/13665620610674953
- Fuller, A., Ashton, D., Felstead, A., Unwin, L., Walters, S., & Quinn, M. (2003). *The impact of informal learning at work on business productivity*. Leicester, UK: The Center for Labour Market Studies, University of Leicester.
- Gergen, K. J. (2009). *Relational being: Beyond self and community*. New York: Oxford University Press.
- Glassman, M. (2001). Dewey and Vygotsky: Society, experience, and inquiry in educational practice. *Educational Researcher*, 30(4), 3–14. doi:10.3102/0013189X030004003
- Holzman, L. (2008). *Vygotsky at work and play*. New York, NY, USA: Routledge.
- Juarrero, A. (2010). *Dynamics in action: Intentional behavior as a complex system*. Boston, MA, USA: The MIT Press.
- Kandel, E. R. (2013, September). *The new science of mind*. The New York Times, Sunday Review, SR 12.
- Knowles, M. S. (1950). *Informal adult education*. New York, NY, USA: Association Press.
- Lave, J., & Wenger, E. (1991). *Situated learning*. Cambridge, UK: Cambridge University Press.
- Lee, C. D. (2016). Expanding conceptions of how people learn over the decades through AERA Presidential addresses: Diversity and equity as persistent conundrums. *Educational Researcher*, 45(2), 73–82. doi:10.3102/0013189X16639045
- Lewin, K. (1936). *Principles of topological psychology*. New York, NY, USA: McGraw-Hill.
- Marsick, V. J. (2012). How organizations can support and facilitate informal workplace learning. In J. Gairín (Ed.), *Gestión del conocimiento y desarrollo organizativo: formación y formación corporativa [Knowledge management and organizational development: Corporate education and training]* (pp. 74–93). Madrid: Wolters Kluwer.
- Marsick, V. J., & Volpe, M. (Eds.). (1999). Informal learning on the job. In *Advances in Developing Human Resources*, No. 3. San Francisco: Berrett-Koehler Communications and the Academy of Human Resource Development.
- Marsick, V. J., & Watkins, K. E. (1990). *Informal and incidental learning in the workplace*. London, UK: Routledge.
- Marsick, V. J., Watkins, K. E., Callahan, M. W., & Volpe, M. (2009). Informal and incidental learning in the workplace. In M. C. Smith & N. DeFrates-Densch (Eds.), *Handbook of research on adult learning and development* (pp. 570–600). New York, NY, USA: Routledge.
- Marsick, V. J., Watkins, K., & Wilson, J. (2002). Informal and incidental learning in the new millennium: The challenge of being rapid and/or accurate. In M. Pearn (Ed.), *Individual differences and development in organisations: A Handbook in the psychology of management in organisations* (pp. 249–266). West Sussex, UK: Wiley.
- Nicoladies, A., & Marsick, V. (2016). Understanding adult learning in the midst of complex social “Liquid Modernity”. In C. Nanton (Ed.), *Tectonic boundaries: Negotiating convergent forces in adult education: New Directions for Adult and Continuing Education*, No. 149. San Francisco, CA, USA: Jossey-Bass.
- Nicolaides, A., & Yorks, L. (2008). Complexity and philosophy: An epistemology of learning through. *Emergence: Complexity and Organization*, 10(1), 50–61. doi:10.emerg/10.17357.62a84a1ca1f2a1fd0d7a10333d79a3c
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. New York: Oxford University Press.
- Nurmala, I. (2014). *The relationship of the dimensions of the learning culture and participation in professional development of public health professionals* (Unpublished doctoral dissertation). The University of Georgia, Athens, GA.
- Poell, R. F., Yorks, L., & Marsick, V. J. (2009). Organizing project-based learning in work contexts. *Adult Education Quarterly*, 60(1), 77–93. doi:10.1177/0741713609334138

- Prigogine, I. (1997). *The end of certainty, time, chaos and the new laws of nature*. New York: The Free Press.
- Raelin, J. (2000). *Work-based learning: The new frontier of management development*. In Addison-Wesley Series on Organization Development. New Jersey: Prentice-Hall.
- Scheeres, H., Solomon, N., Boud, D., & Rooney, D. (2010). When is it OK to learn at work? The learning work of organizational practices. *Journal of Workplace Learning*, 22(1/2), 13–26. doi:10.1108/13665621011012825
- Shepel, E. L. (1999). Reflective thinking in educational praxis: Analysis of multiple perspectives. *Educational Foundations*, 13(3), 69–88. Retrieved from <http://search.proquest.com/openview/e96e58c612c35d086619f91c0793bc93/1?pq-origsite=gscholar&cbl&cbl=2031152>
- Snowden, D. J., & Boone, M. E. (2007). A leader's framework for decision-making. *Harvard Business Review*, 85(11), 16–37. Retrieved from <https://hbr.org/2007/11/a-leaders-framework-for-decision-making>
- Stacey, R. D. (2001). *Complex responsive processes in organizations: Learning and knowledge creation*. London and New York: Routledge.
- Tough, A. (1979). *The adult's learning projects. A fresh approach to theory and practice in adult learning*. Toronto: Ontario Institute for Studies in Education.
- Veresv, N. (2010). *Reading 'Thinking and Speech' (Vygotsky) Part II*. Retrieved from Vimeo: <https://vimeo.com/10226589>
- Vygotsky, L. S. (1987). Thought and word. In R. W. Rieber & A. S. Carton (Eds.), *The collected works of L. S. Vygotsky* (Vol. 12, pp. 243–285). New York, NY, USA: Plenum Press.
- Watkins, K. E. & Cervero, R. M. (2000). Organizations as contexts for learning: A case study in certified public accountancy. *Journal of Workplace Learning*, 12(5), 187–194. doi:10.1108/13665620010336161
- Watkins, K. E., & Marsick, V. J. (2014). "Re-Cognizing" informal learning with a focus on the social context. Paper presented at the Annual AHRD Americas International Research Conference: Leading the Human Resource Development Field Through Research, Houston, TX, USA.
- Watkins, K. E., Marsick, V. J., & Fernández de Álava, M. (2014). Evaluating informal learning in the workplace. In T. Halttunen, M. Koivisto, & S. Billett (Eds.), *Promoting, assessing, recognizing, & certifying lifelong learning: International perspectives and practices*. Berlin, Germany: Springer-Verlag.
- Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge, UK: Cambridge University Press.
- Wertsch, J. V. (1985). *Vygotsky and the social formation of Mind*. Cambridge, MA, USA: Harvard University Press.
- Wertsch, J. V. (1998). *Mind as action*. New York, NY, USA: Oxford University Press.