Considering the Corporeal to Facilitate Research to Practice Transitions

Abstract

The authors suggest that the research-to-practice gap, such as that found in evidence-based management, is due in part to a lack of attention to embodied knowledge. The recommendation is for change agents to bring attention to embodied knowing when implementing change based on research. Three approaches for introducing increased corporeal understanding are proposed. These include embracing the embrained body including attending to kinesthetic resistance, exploring what research means for intersectional bodies, and working with corporeal metaphors.

Keywords: Research-to-practice, corporeality, evidence-based practice, knowledge transfer, change management, postpositivism, embodiment

Considering the Corporeal to Facilitate Research to Practice Transitions

Sonia M. Goltz and Patty Sotirin, Michigan Technological University

Change agents often find themselves in the position of negotiating the gap between the plans of change strategists, such as a government agency or top management team, and the unique circumstances of the change adopters or recipients. This is because change strategists often make assumptions based on generalizations, such as relying on data averaged across situations or sources, whereas implementation occurs within a context with specific features that can affect change adoption (Goltz *et al.*, 2020). Arguably, a primary contributor to this change strategist-adopter gap is another gap--the one found between scientific "knowledge" and practice. Change plans often are based on an examination of internal or external corporate data and scientific research. This may or may not translate well to on-the-ground change efforts. Usually it does not. In fact, a search on Google Scholar using the words "research-to-practice gap" at the time of writing this paper (December 2020) revealed more than a million articles on the topic since 2016 and four and half million papers published "anytime."

The existence of a gap between management research and practice in particular has been widely discussed (Aarons, Sommerfeld, and Walrath-Greene, 2009; Bansal *et al.*, 2012). In diversity management, for example, thousands of research articles have been written over decades (e.g., Holmes *et al.*, 2020; Sabharwal, et al., 2018), generating many ideas for diversity management practices. Yet, many organizations still find themselves struggling to diversify across positions and ranks as well as to be inclusive in policies and treatment (e.g, Goltz & Sotirin, 2014; Bernard & Cooperdock, 2018). Similarly, Underwood and Waterson (2013) noted that scientific knowledge based on accident analysis often did not transfer to

organizational practices by safety personnel. The management area is not alone by any means; the gap is also found in the applied sciences, education, and healthcare (e.g., Adesina & Chianu, 2002; Henderson & Dancy, 2011; Pattanayak, et al., 2003; Rolfe, 1998, 2011).

Surprisingly, the pervasiveness of the research-to-practice gap is even found within the area of evidence-based management, where one might have expected it would have been resolved. Evidence-based practice (EBP) began in the health care industry at the urging of an epidemiologist who desired randomized controlled trials (Mechanic, 1998). EBP became a buzzword in business after management scholars called for its application beyond healthcare (e.g., Pfeffer & Sutton, 2006a, 2006b; Rousseau, 2006). Evidence-based management involves making decisions by carefully examining several sources of data, including scientific research, expertise based on professional experience, organizational data, and stakeholder considerations (Barends, et al., 2015). Research suggests that managers are interested in evidence-based decision-making but do not use it much because of barriers such as not understanding the scientific research (Barends, et al., 2015; Briner, et al., 2009; Booker, et al., 2008). This gap has continued despite the existence of multiple EBP models designed to close the gap (see Schaffer, et al., 2013) as well as other efforts such as action research, a collaborative knowledge generation and problem-solving method (Coghlan, 2011; Goduscheit, et al., 2008).

It is not the case that the blame for this gap lies with the scientists. Indeed, much scientific research is conducted with the hope that the resulting knowledge will be applied to improve the world. Post tenure intrinsic, rather than extrinsic, factors have been found to motivate research, including researchers' desire to make contributions to their fields (Chen, et al., 2006). Intrinsic motivation, particularly the enjoyment obtained from problem solving and the desire to do social good, also plays an important role in the motivation of scientists who are involved in the

commercialization of scientific research (Lam, 2011). Despite this, research often does not result in successful application, which has been attributed in part to incentives for researchers to produce knowledge rather than apply it (Khurana, 2007; Van de Ven & Johnson, 2006), as well as to the postpositivism that dominates in science and emphasizes observable data in contrast to other methods for understanding reality (Rousseau, et al., 2008). Other differences between scientists and practitioners include practitioners' expectation of rapid implementation in contrast to the need for uninterrupted reflection time among scientists; also, the emphasis on precision of measurement in science does not align well with the untidiness of reality (Bansal *et al.*, 2012).

Within the management literature, additional insights can be gleaned from knowledge and change management. The literature on knowledge transfer, which mostly concerns the transfer of knowledge between units that are similar, such as between organizations within an industry or departments within an organization (Argotte & Farenkopf, 2016), suggests that the more similar and congruent the networks, the easier the transfer and the better the performance (Argote & Ingram, 2000). Certainly, the research-to-practice gap could be due to low similarity and congruency between scientists and practitioners such as in terms of the types of knowledge they are interested in, the incentive systems they work under and the methods of collecting and assimilating knowledge. Also, the "sensemaking" literature (e.g., Gioia & Chittipeddi, 1991; Gioia, et al., 1994), which discusses appraisals of the meaning of change as a factor in employee resistance (e.g., Bartunek, et al., 2006; Bartunek & Moch, 1987; George & Jones, 2001), has found that different groups use different language to discuss change, which can result in misunderstandings that can lead to resistance (Pieterse, et al., 2012). This effect might explain some of the research-to-practice gap since researchers and practitioners do not share the same discourse when discussing a change (e.g., Cook, et al., 2004).

However, we feel that there is another important aspect that has not been sufficiently considered. We discuss the gap between scientists and practitioners in terms of the incongruent ways in which they disseminate and assimilate knowledge and suggest that one factor that may help translate research-to-practice is to focus on how *research knowledge relates to corporeal knowledge*. Although with some exceptions management theories have largely ignored the role of the body in organizations (Ropo & Parviainen, 2001), corporeal knowledge most likely plays an important role given that management involves human interaction within physical workspaces, and human interaction with other humans or material things is of a corporeal nature even when it is virtual. Therefore, change scholarship and practice may benefit from including rather than excluding considerations of bodily experience.

To this end, we discuss two challenges for bridging the research-to-practice gap as well as provide three suggestions for transcending the gap. We begin with an overview of limitations of the typical paradigm found in science. These limitations, which involve highly valuing abstracted knowledge and devaluing other forms of knowledge, mean that corporeal knowledge is not as available to practitioners wishing to use research to inform practice. Next, we consider how people are known to integrate new learning so that it can be accessed, which is critically important for the change process. Typically, this begins with concrete experience and then becomes abstracted. Finally, we conclude with several suggestions for how organizations and researchers can work to transcend the research-to-practice gap by understanding that scientific knowledge must not only be conveyed to the mind of the individual, but also to the body, in order to facilitate behavioral change.

Two Key Challenges in Transitioning from Research to Practice

Challenge 1: The Limitations of Postpositivist Methods

The view of science by the general public is that science should bring us closer to an objective knowledge of the "truth" by producing "facts" (de Regt & Baumberger, 2020). This notion of objective truth has been questioned within philosophy of science and in constructivist schools of social science and management studies. The conclusions of scientific study are affected by its practices including how research is conducted, such as the chosen instruments, theories, laboratories, and statistical methods (Gherardi, 2001; Latour & Woolgar, 1979). Kuhn (1962) famously argued that consensus on a paradigmatic framework determines what counts as objective scientific knowledge. However, the notion of objectivity persists--even a postpositivist scientistic perspective views objectivity as a "regulatory ideal" that nonetheless can be approached through precise, prescribed research processes aimed at generalizable findings (Miller, 2000).

The dominance of a postpositivist framework advancing data-driven empirical-analytic research marginalizes alternative ways of knowing. For example, consider the emphasis in the scientific literature on using methods that avoid bias, including careful classifications of the different types of bias to watch for (e.g., Ioannidis, 2018; Peterson, 2020). Even qualitative research is still subject to examinations of its validity, reliability and transferability--for example, reflexivity is viewed as a way to come clean about the possible biases inherent in conducting the research (Finlay, 2002; Maso, 2003). These types of discussions both result from, and perpetuate, the notion that science is supposed to discover truths that are free from bias or, at the minimum, make discoveries through processes that freely admit to known or possible bias. This instrumental goal of understanding how the world works primarily to be able to predict and manipulate what happens devalues goals such as generating understanding for its own sake or appreciating differences in themselves (de Regt & Baumberger, 2020;

Habermas, 1971). Additionally, it focuses on a cognitive understanding of phenomena to the exclusion of the experiential and material. However, both research practices and everyday experiences are always *embodied*.

As phenomenological philosopher Merleau-Ponty stated, individuals are thrown into the world as bodies and are not related to their bodies in some external way, but instead their bodies define who they are (2012). Within bodily experience, perceptions are dependent on both one's history and one's projection of further experiences with the object; thus, perceptions are incomplete, missing a number of aspects that are momentarily sensorially absent (Wiltsche, 2019). The empirical norm of science conceals this perceptual orientation by treating objects as being determinate and attributing observer interpretations to a failure of objectivity (Merleau-Ponty, 2012).

Similarly, feminist theory criticizes science for not understanding how knowledge is situated within contexts, including the gender or sexual orientation of one's body (e.g., Harding, 1986), and notes that knowledge is always local and partial rather than universal and complete (Haraway, 1994). Taking knowledge to be partial and situated disavows a mind/body dichotomy in which the mind is the seat of knowledge while the body is bound to organismic needs and instincts. Instead, researchers and practitioners alike are thought of as actively engaged in embodiment as a way of knowing and, in the words of Merleau-Ponty, *being-in-the-world*. In other words, knowing is corporeal; "consciousness is always and only embodied, holistically integrated into the enfleshed subject" (Hoel, 2013, p. 35).

In fact, the irony is that many individuals who work in STEM fields relied on their embodied experiences as a basis for doing so, such as the embodied feelings they had as a child when doing well on math tests or suffering from a medical problem. Scientists' choice of

research topics likely has some corporeal basis as well. Mental and bodily feelings resulting from discrimination lead to research on gender equity, resulting in a higher percentage of women and minorities investigating diversity topics than majority men. In other words, *being-in-the-world* motivates many to produce scientific work, but, unfortunately, the process of becoming a scientist then encourages the discounting of embodied knowledge. Karen Barbour (2004), a dancer, discussed how she struggled as a Ph.D. student to reconcile her life experiences with academic knowledge that stressed the dualism of mind and body and mental reasoning as the primary way of knowing.

This shift to the cognitive at the expense of the corporeal contributes to ineffectiveness in terms of the dissemination and application of scientific findings. Within the medical field, for example, postpositivist assumptions include that facts are more important than feelings, disease can be controlled using cause-effect models, and the body can be understood through its parts (Tovar-Restrepo, 2014). However, as Moreno Leguizamon, et al. (2015) noted, health is not achieved by treating the body of an individual rather than the person suffering without respect to context. Incorporating other ways of knowing, such as those from the social sciences and humanities, is sorely needed for effective healthcare practices.

Occasionally research clearly reveals the unfortunate impact of this disembodied view of science. Assumptions about what is and isn't valuable knowledge was evident in the discourse of scientists in a study by Cook, et al. (2004) titled, "The Scientists Think and the Public Feels." The authors discovered that scientific discourse emphasized cause-and-effect and cost-benefit analyses in discussing genetic modification (GM), ignoring the concerns of other stakeholders that dealt with ethical, political, and economic considerations. The scientists treated scientists and the public as binary categories that are in opposition, neglected the

variance in attitudes occurring among scientists, and seemed to forget that they themselves were also part of the public and similarly impacted by GM. They did not allow for any kind of expertise on the topic outside of the knowledge of scientists, nor did they seem to perceive that there are varying degrees of understanding of the topic among both scientists and the public. They also assumed that resistance to GM is because of an ignorance of the technology used, which is counter to research that indicates that a more technical understanding of the technology does not lead to decreased resistance (Bucchi & Neresini, 2002). Another study revealed how scientists are suspicious of embodied and experiential knowledge even when they themselves are the focus of change efforts (Goltz & Sotirin, 2014). Academics, mostly scientists and engineers, completed an online workshop to increase their awareness of implicit bias directed at women in the STEM (Science, Technology, Engineering and Math) fields, who often face "chilly" workplace climates. Unfortunately, many of the STEM faculty completing the workshop dismissed research findings about biases in recruitment and retention by discrediting the procedures and statistical methods, with some concluding "there may be bias but you haven't convinced me with this study" (p. 99). Some faculty also rejected their own results from the Implicit Association Test (IAT) as untenable and disciplined women faculty members in the workshop whose stories about experiences of bias were discouraged as "getting us off track" or "water under the bridge." Thus, even for those most schooled in its methods, a postpositivist way of knowing can constrain learning from and applying research.

In our view, the second major challenge related to the research-to-practice gap is that behavior change requires a certain kind of learning. Learning models suggest that knowledge does not transfer in a simple, automatic way once it is taught; instead, individuals learn by integrating new knowledge within their existing knowledge structures (e.g., Vosniadou, 2007).

These existing structures are often based very much on *being-in-the-world*. We introduce this here because our concern is that the cognitive emphasis of science to the exclusion of bodily experience does not align well with the typical way new knowledge is integrated so that it can be applied. We believe that change agents need to keep this disconnect in the forefront of their thinking when attempting a research-to-practice implementation.

Challenge 2: Behavior Change Requires a Certain Kind of Learning

According to Vosniadou's framework theory (e.g., Vosniadou & Verschaffel, 2004), when faced with new information, learners must modify their intuitive, domain-specific conceptions of the world that were created based on everyday experience within the context of cultural norms. Similarly, experiential learning theory describes how individuals both assimilate concrete knowledge with abstract knowledge and transform experience by reflecting and experimenting (Kolb & Kolb, 2005). The problem with trying to get research knowledge across to a learner through a method such as a lecture or abstract instructions is that during the assimilation process, the scientific information destroys the coherence of the individual's previous knowledge structures because of incompatibilities (Vosniadou, 2003, 2007; Vosniadou & Brewer, 1994). During this process, in the learner's attempts to fill in gaps in knowledge and restore coherence, misconceptions occur (Vosniadou, 2007). Therefore, metacognitive activities are needed on the part of the learner to identify where misconceptions are occurring and correct them. This doesn't tend to occur naturally, and when it does, it requires a long, slow, timeframe with lots of trial and error. For a learner to apply new knowledge more quickly than might occur naturally, support is required in terms of extensive interactions that allow for comprehension, including combining both research-based information and meaningful practice, which Vosniadou (2007) calls "sociocultural support." Not understanding this process can lead to problems such as

the belated discovery, based on several studies across situations, that increased math knowledge has little effect on how people practice arithmetic in their everyday lives (e.g., Carraher, et al., 1985; Lave, 1988; Scribner, 1984).

Providing sociocultural support for maximizing or speeding up the integration of knowledge within the existing knowledge structures of the individual is beneficial, but we wonder if it might be just as helpful to introduce new knowledge in a way that encourages such integration. Models of knowing-in-practice try to get away from dualism entirely by emphasizing the importance of everyday actions to knowledge acquisition (Feldman & Orlikowski, 2011): "Such an understanding rejects the traditional dualism set up between knowledge that exists 'out there' (encoded in external objects, routines, or systems) and knowledge that exists 'in here' (embedded in human brains, bodies, or communities)" (p. 1243).

We suggest that knowing-in-practice involves centrally what Ropo and Parviainen (2001) called bodily knowledge. They defined bodily knowledge as being a type of tacit knowledge that involves knowing in and through the body, allowing an individual to negotiate with a situation, choosing appropriate movements (Ropo & Parviainen, 2001). Bodily knowledge is somatic and sociocultural, involving a complex synthesis of sensory perceptions and sense-making that resists dualisms of internal and external in ongoing somatic experiences (Paterson, 2009, p. 780). This has also been called experimental knowledge, a tool-and-result method that has to do with our "being in the world, our stance in relating ourselves to our surroundings" (Shotter, 1996, p. 309). We believe that putting the body back into learning is especially important for behavioral change.

Embodied Knowing to Support Practical Change

To summarize to this point, it is clear that bodies rarely are taken into consideration as

part of the strategies for converting research to practice. However, change disrupts embodied practices. To close the research-to-practice gap perhaps approaches to implementing change should begin with the body rather than with research findings or managerial strategies for change. Beginning with the body could help undermine the dichotomies that remain entrenched in commonplace assumptions about what is of value that limit both research and practice: rational mind/emotional body, male mind/female body, moral mind/indulgent body, objective mind/subjective body, knowing mind/sensing body, higher mind/lower body (Ellingson and Ellis, 2008). This requires increasing attention to embodied knowing-in-practice when introducing change.

We do not believe there is one formula for doing this; instead, the needed sociocultural support will depend on aspects of the type of research knowledge, the individual's characteristics, and the setting (e.g., industry) in which the knowledge is being applied. Providing multiple supports for learning is important as indicated by research on knowledge transfer effectiveness that suggests that having multiple channels for transfer as well as frequent interactions increase the effectiveness of the transfer (e.g., Iorio, et al., 2017). Our point is that a robust and concerted change program must include embodied ways of knowing.

Therefore, we suggest three approaches for centering the body in efforts to bring research findings to applied organizational practices. Our suggestions assume that knowing through the body side-steps the cognitive mismatch between what counts as useful knowledge to researchers and practitioners (Weick, 1995). We take the perspective that both research and practice are embodied and view embodied learning as the basis for establishing and changing habitual routines to provide a powerful intervention in everyday patterns.

Embracing the embrained body and attending to kinesthetic choreographies

The value of taking the body into account in both research and practice is evident in the field of neuroscience, the study of how the brain works. Feminist neuroscientist Pitts-Taylor (2016) argues against the mind/body dichotomy in neuroscientific research, advancing the idea that mind is embodied and bodies are "embrained." Neuroscientific research using optogenetics—the combination of genetics and optical tools to stimulate neurons—to investigate how the brain generates seemingly "internal" states like anxiety or loneliness has begun to turn from drug therapies to measuring brain activity in order to intervene in mental health problems (Tye, 2020).

Certainly, the correspondence between anxiety and workplace change offers an opportunity to incorporate this research. Yet most organizational change efforts remain focused on whether people understand the change cognitively because of the assumption that the mind disciplines the body; hence, reducing uncertainty, for example, can help to alleviate anxiety about change. Even when anxiety has been directly addressed in change efforts, there is a cognitive bent. To their credit, Baruch and Lambert (2006) introduced a model that extensively considered individual and organizational anxiety produced by change. However, the proposed solutions were very much centered on individuals *regaining control* over their response tendencies through mostly cognitive techniques, such as cognitive behavioral therapy and cognitive reframing. We are not suggesting that these primarily cognitive solutions are wrong—we are suggesting they are incomplete and therefore necessarily limited in the extent to which they can be effective. If, instead, anxiety is recognized as an embodied response, addressing anxiety in the face of change might be done quite differently, for example, through the use of light therapies. This is the case with Seasonal Affective Disorder (SAD) and the use of light in

the office for such conditions is largely accepted among practitioners. In other words, instead of prioritizing motivational change that encourages a mind to gain control over a body, research and practice could enable interventions that work with rather than against embodied routines and contingencies to enable meaningful change.

Another example of enabling change by invoking the embodied is found in safety training in the construction industry. Safety training traditionally has used instruction that is not interactive or hands on, which has been fairly ineffective within an industry that has high injury and death rates (Guo, et al., 2017). Construction management safety training has begun, therefore, to use VR technology to help workers identify onsite hazard areas; however, given that most provide only visualization, adding worker motion detection has been suggested (Guo Yu, & Skitmore, 2017). Furthermore, since research suggests that additional sensory stimuli such as smells could be added to enhance the embodied sense of place (Ferrari, 2018), presumably odors simulating those of an electrical fire could be added to construction management VR safety training technology. Sensory technology such as this could be also used to help employees or customers imagine a planned change, such as how a new building will feel. This increase in sensory stimulation to enable the embodied experience of place has been called "geo-virtual immersion" (Ferrari, 2018) and suggests we have only scratched the surface in terms of introducing change with a focus on the embrained body.

Embracing the embrained body not only offers novel solutions that might be more productive, but also encourages paying more careful attention to the embodiment of resistance to change. In fact, it is noteworthy that a discussion of embodied resistance is relatively absent from the organizational literature since it has been a topic often considered within the sociological, religious, and political academic literatures. Parviainen (2010) noted, for example,

that the vulnerability of the body has been leveraged effectively by political activists in creating resistance, including not just in marches down streets, but also by being chained to trees and laying down in front of bulldozers. She applied the term "resisting choreographies" to these bodily performances, which include both small impulsive gestures and grand planned ones, such as the crawling performed by striking nurses in the center of Helsinki in 2007. Similarly, one could expect that kinesthetic resistance, in the form of "resisting choreographies"—both intended and naturally emergent, is present within organizations that are in the midst of change. An awareness of the embodiment of resistance to change seems especially important given research that indicates that much of resistance appears to be covert (Cinite & Duxbury,2018). In other words, it is likely to be unspoken and present in nonobvious ways, such as through subtle changes in facial expressions or how one holds the body. Additionally, individual responses to change are typically more complex than normally thought, and often include attitudinal ambivalence, meaning the coexistence of both positive and negative attitudes (Larsen, 2007; Piderit, 2000). Embodied responses to change are likely to reveal this ambivalence whereas spoken ones may not.

Increasing our attention to the embodiment of change—how it is held in the body--may reveal that much of what appears to be resistance to change is not. We tend to make the fundamental attribution error—attributing nonperformance to factors internal to the person when they are not (e.g., Berry & Frederiksen, 2015). Certainly, facial expressions may reveal feelings that the person is hoping to hide. However, if a person keeps going to the right when they are supposed to go to the left, this could be a red flag that indicates something that should be addressed, such as that the physical layout is poorly structured to support the change. As Harbin (2012) discussed, disorientation of the body is a factor stimulating the motivation to change. This

includes “human experiences of feeling positioned such that relevant goals are not evident and reachable” (p. 262) and consists of the disruption of everyday practices of interaction with spaces, objects, people, events, ideas, and norms. Attentiveness to *being-in-the-body* by both the change agent and change adopter when change is implemented could be a productive way to align change plans to the reality of the situation so that the change can be more effectively implemented.

Including intersectional bodies

Intersectionality is a concept that has generated considerable research yet there remains a gap between practitioner applications and research conceptualizations. We suggest that understanding intersectionality as embodied may be a useful strategy for bridging the research/practice gap. Intersectionality refers to the multiplicative impact when various systems of oppression such as racism, sexism, ableism, and classism intersect experientially, institutionally, socioculturally, and historically (Crenshaw, 2017). This concept calls attention to “major axes of social divisions in a given society at a given time, for example, race, class, gender, sexuality, dis/ability, and age operate not as discrete and mutually exclusive entities, but build on each other and work together” (Collins and Bilge, 2016, p. 4). Although all individuals’ experiences are intersectional, meaning that each person exists within the intersections of a certain age group, a certain sexual orientation, a certain gender and so forth, the concept is particularly important when considering the experiences of minorities since intersectionality is concerned with the multiple impacts of biases against certain groups of people. Some people experience many biases all at once because they inhabit a body that is the target of several types of bias—e.g., bias toward the disabled, women, and the aged. In fact, the concept emerged in the context of the impact of systemic racism and sexism on the lives of women of color; “the raced

and gendered body is the intersection of multiple discourses and structures of oppression: She is the point at which racism and sexism collide" (Sekimoto, 2012, p. 234). We suggest that researchers might bridge the research/practice gap by taking intersectional bodies as central to their inquiries.

However, there has been a relative lack of research on intersectional bodies. The concept of "intersectional invisibility" refers to the lack of attention to how intersectionalities affect experience; for example, black women exist within the intersection of racism and sexism but these experiences often are not recognized (Coles & Pasek, 2020). Researchers often choose to simplify what they are studying by narrowing the range of participants, such as by age, race, or gender, an accepted research practice. Unfortunately, these restrictions significantly reduce what is known about intersectionality. For example, initial research on the COVID vaccine excluded pregnant women (e.g., Costantine, et al., 2020), leading many of these women to wonder whether they should get the vaccine. This occurred in AIDS research as well, resulting in poor guidelines for treating HIV-infected pregnant women (e.g, Krubiner *et al*., 2017). Even when participants are not excluded from research based on these dimensions, results are often aggregated across these dimensions when they are reported, losing important information about effects on those groups.

Returning to contemporary perspectives in neuroscience, we note that researchers have begun to advocate for using intersectional research designs: "Intersectional perspectives help to outline the entanglements of categories in neuroscientific research, for example, when racism and ageism are connected with gender" (Schmitz & Höppner, 2014, p. 3). For example, Alzheimer's research has begun to look beyond aging to consider the intersections of race and gender. While whites constitute the largest percentage of Alzeheimer's diagnoses in the U.S.,

Blacks and Latinx are more likely to develop the disease (alzimpact.org). Yet there is little genetic risk for Alzheimer's in these groups, undermining the assumption that race and ethnicity are important factors. Rather, socioeconomic risk factors are proving quite critical and these impact the chances of early diagnosis as well. Put simply, people living in poverty cannot afford healthcare which obviates early diagnosis and treatment of a condition like Alzeheimers. By considering the embodied lives of their patients, scientific studies have begun to address such intersectional complexities not as abstract demographic categories but as embodied conditions that link disproportionate exposures to social and environmental stressors to significantly higher morbidity rates for under-represented groups.

The following story illustrates how recognizing embodied intersectionalities can help to bridge the gap between research and the lives of practitioners.

> Talmadge King, Jr., MD, dean of the UCSF School of Medicine, tells the story of an ER physician who had lost a document and was searching frantically for it in the garbage bins behind Zuckerberg San Francisco General Hospital and Trauma Center. What he found instead in the mountain of rubbish were crumpled prescription slips that patients had tossed in hospital trash cans throughout the week. "Going forward, the conversations that ER doctor had with his patients changed. They became, 'Well, you need these drugs. Which can you afford? How can I help?'" relates King. "Often it's not that the patients aren't adhering to advice. It's that they can't pay for the drugs, didn't understand why they should take them, or simply that they did not feel the doctor even listened to them." (Conway, 2016).

In this case, "resistance" to interventions had little to do with convincing people to accept the benefits of the prescriptions, and more to do with lived conditions of poverty and access. Once

again, this is an instance of moving from trying to "motivate" people to change using cognitive mechanisms such as persuasion or reframing to addressing the structural factors that constrain them from making the changes by perceiving them more fully as embodied beings living within a material reality. It is interesting that, to gain his insight, the doctor had to first move his own body into the middle of the trash heap. It suggests that change agents may need to immerse themselves *bodily* within a particular situation in order to increase their sensitivity to the lived experiences of change adopters. This makes a case for embodied research along with integrating embodiment into research (Ellingson, 2017; Thanem & Knights, 2019).

Embodying learning

Following Merleau-Ponty's argument that embodiment is how we experience being-in-the-world, Stolz (2015) advocates embodied learning designed to "relearn" the way we perceive the world, in which the learner can "experience him or herself as a holistic and synthesised acting, feeling, thinking being-in-the-world, rather than as separate physical and mental qualities." This is "an ongoing process and never ends because as beings-in-the-world we are in an open dialogue with the world we inhabit" (online version, no pp.). The point is that learning is holistic rather than being purely a mental activity, and it requires being complexly engaged with the specificities and trajectories that constitute being-in-the-world. Put more radically, "Our bodies and their perceptually guided motions through the world do much of the work required to achieve our goals, *replacing* the need for complex internal mental representations" (Wilson & Golonka, 2013, p. 1). Among other benefits, embodied learning stimulates affective learning more than typical pedagogical methods (Hinchliffe, 2000).

One form of mental representation that has been associated with learning new

associations is the metaphor. Metaphors are often used to make the unfamiliar more familiar by relating a known construct with one that is unknown, thereby highlighting shared qualities that can then reframe the unknown construct. In this way, metaphors can ease the assimilation of new information; however, they are also thought to make knowledge more concrete and easier to visualize. Research on embodied cognition includes findings about embodied metaphors. In a study by Leung and her colleagues (2012), people were asked to engage in embodied actions based on metaphors such as literally "thinking outside the box" by sitting outside an actual box or considering something "on one hand, and on the other hand" by holding out their palms and moving one up and down and then the other. They found that those engaged in such embodied metaphors also engaged in more original, flexible, and fluid idea generation. The researchers concluded, "Creativity-implicating physical acts may be conducive for creative problem solving because they activate the processes involved in overcoming mental fixedness or the processes involved in forging new connections among distinct ideas" (p. 507). In a review of research on embodied creativity, Frith, et al. (2019) found that "embodied movement robustly enhanced creativity" (p. 1). Thus, embodied metaphors may facilitate more creative responses to the implementation of research findings in practice.

We offer our own thought experiment in this regard based on an analogy that the first author has used to encourage an understanding of discrimination when teaching about the reasons for affirmative action, which many students who are not members of underrepresented groups have difficulty grasping. She asks listeners to imagine two runners lining up to the starting line and being asked to run a race. On the surface, this is a fair competition. However, then it is revealed that one runner has had no practice time, has very poor running shoes, and has been given bad advice about how to win a race while the other runner had good nutrition, a

trainer, and was allowed to practice. Then the question is posed: is this a "fair" race? Rather than leaving this as a mental exercise, we suggest the value of an embodied metaphor in which students might asked to "weigh" the advantages and disadvantages of each runner using their outstretched palms as the weight scales. Embodiment could be taken even further by placing nutritious food next to one person in class and junk food next to the other, having them put on poor or good running shoes, and assigning a "trainer" to stand next to the student who has the good nutrition and running shoes (and no trainer for the other). Then the students who are the "runners" could be asked how confident they are that they are prepared for the race.

Certainly, we know from research that diversity training programs result in cognitive learning in the short run but these often do not translate into longer-term learning or behavioral change (e.g., Bezrukova, et al., 2016). Bringing in more of these embodied metaphors during training could help change that. It is more difficult to discount or forget the role of having poor resources when the shoes with the holes in the soles are on your feet and you are expected to race with them, even if the race is only mimed. Also, given the aforementioned research indicating embodied movement enhances creativity, this method could generate more unique and helpful solutions for addressing organizational inequities.

So far, we have been discussing how to make metaphors more embodied to enhance learning; however, the opposite is also possible—embodied experiences can be used to create metaphors that help learning. Management training, in fact, often relies on outdoor physical challenge activities to create metaphors for management learning (Hinchliffe, 2000). Using a rope to move a group of people and a bucket of water across a "toxic zone" to an imaginary island (a wooden platform), building a rope bridge across a river, creating a home-made raft, or orienteering to complete a treasure hunt are not about the activities themselves, but allow for a

range of "performances" to occur. Parallels between the emerging behaviors and life in a work place are then considered and explored. Typically in these sessions, there is a movement from concrete activity to reflection and back again (Hinchliffe, 2000). Within this structure, people are invited to use their bodies in unfamiliar ways, engage in play, and experiment to creatively bring forth the world, which all serve to recast the participants' working lives (Hinchliffe, 2000). In order words, challenge courses can be embodied experiments prompting creative rethinking by the "embodied brain." Hinchliffe (2000), notes, however, that to be useful, they must seed other performances, meaning that the opportunities they open up in terms of changing peoples' ways of thinking have to travel beyond the immediate setting.

Conclusion

We have suggested that the research-to-practice gap occurs in part due to the mostly disembodied nature of research knowledge as well as strategies for converting that knowledge to practice. We discussed two specific challenges: the high value placed on abstracted knowledge to the relative exclusion of other knowledge forms and the mismatch between this abstracted knowledge offered by researchers and the tendency of learners being asked to put it to practice to start their learning using concrete experience. We recommend that change agents remain continuously aware of this disconnect as they implement change and use methods that help transcend the research-to-practice gap where appropriate. We described three strategies that can help achieve this but also recognize that there are others that we did not consider. We believe that many change efforts facing challenges in organizations could benefit from a consideration of how change is embodied.

References

Aarons, G.A., Sommerfeld, D.H. & Walrath-Greene, C.M. (2009). Evidence-based practice implementation: The impact of public versus private sector organization type on organizational support, provider attitudes, and adoption of evidence-based practice. *Implementation Science*, 4**(**83): 1-13. doi.org/10.1186/1748-5908-4-83

Adesina, A.A., & Chianu, J. (2002). Determinants of farmers' adoption and adaptation of alley farming technology in Nigeria. *Agroforestry Systems, 55*: 99-112. https://doi.org/10.1023/A:1020556132073

Argote, L. & Fahrenkopf, E. (2016). Knowledge transfer in organizations: The roles of members, tasks, tools, and networks", *Organizational Behavior and Human Decision Processes*, *136*: 146-159. https://doi.org/10.1016/j.obhdp.2016.08.003

Argote, L. & Ingram, P. (2000). Knowledge transfer: a basis for competitive advantage in firms. *Organizational Behavior and Human Decision Processes*, *82*(1): 150-169. https://doi.org/10.1006/obhd.2000.2893

Bansal, P., Bertels, S., Ewart, T., MacConnachie, P., & O'Brien, J. (2012). Bridging the research-practice gap. *Academy of Management Perspectives, 26*: 73-92. https://doi.org/10.5465/amp.2011.0140

Barbour, K. (2004). "Embodied ways of knowing. *Waikato Journal of Education*, *10*: 227-238. https://doi.org/10.15663/wje.v10i1.342

Barends, E.; Rousseau, D.M., & Briner, R.B. (2015). Evidence-based management: the basic principles. E. Barends (Ed.), *In search of evidence* (pp. 201-218). Center for Evidence-Based Management, University of Amsterdam.

Barends, E., Villenueva, J., Briner, R., & ten Have, S. (2015). Manager's attitudes and perceived barriers to evidence-based management: an international survey. E. Barends (Ed.), *In search of evidence* (pp.143-179). Center for Evidence-based Management, University of Amsterdam.

Baruch, Y., & Lambert, R. (2007). Organizational psychology: Applying psychological concepts into organizational theory. *Journal of Managerial Psychology, 22*(1): 84-99. https://doi.org/10.1108/02683940710721956

Bartunek, J.M., & Moch, M. (1987). First order, second order, and third order change and organization development interventions: A cognitive approach. *Journal of Applied Behavioral Science, 23*(4): 483-500. https://doi.org/10.1177%2F002188638702300404

Bartunek, J., Rousseau, D. M., Rudolph, J., & DePalma, J. (2006). On the receiving end: sensemaking, emotion, and assessments of an organizational change initiated by others. *Journal of Applied Behavioral Science, 42*(2): 182–206. doi.org/10.1177%2F0021886305285455

Bernard, R.E., & Cooperdock, E.H.G. (2018). No progress on diversity in 40 years. *Nature Geoscience*, 11: 292-295. doi.org/10.1038/s41561-018-0116-6

Berry, Z., & Frederickson J (2015). Explanations and implications of the fundamental attribution error: A review and proposal. *Journal of Integrated Social Sciences*, 5(1): 44–57. https://www.jiss.org/documents/volume_5/issue_1/JISS%202015%205(1)%2044-57%20FAE.pdf

Bezrukova, K., Spell, C.S., Perry, J.L., & Jehn, K.A. (2016). A meta-analytical integration of over 40 years of research on diversity training evaluation. *Psychological Bulletin,* 142(11): 1227–1274. doi: 10.1037/bul0000067

Booker, L. D., Bontis, N., & Serenko, A. (2008). The relevance of knowledge management and intellectual capital research. *Knowledge and Process Management,* 15(4): 235–246. doi.org/10.1002/kpm.314

Briner, R. B., Denyer, D., & Rousseau, D. M. (2009). Evidence-based management: concept cleanup time? *Academy of Management Perspectives*, 23(4): 19 -32. doi.org/10.5465/amp.23.4.19

Bucchi, M. & Neresini, F. (2002). Biotech remains unloved by the more informed. *Nature,* 416: 261. doi.org/10.1038/416261a

Carraher, T. N., Carraher, D. W., & Schliemann, A. D. (1985). Mathematics in the streets and in schools. *British Journal of Developmental Psychology,* 3(1): 21–29. doi.org/10.1111/j.2044-835X.1985.tb00951.x

Chen, Y., Gupta, A., & Hoshower, L. (2006). Factors that motivate business faculty to conduct research: an expectancy theory analysis. *Journal of Education for Business*, 81(4): 179–189. doi.org/10.3200/JOEB.81.4.179-189

Cinite, I, & Duxbury, L.E. (2018). Measuring the behavioral properties of commitment and resistance to organizational change. *Journal of Applied Behavioral Science*, 54(2): 113-139. doi.org/10.1177%2F0021886318757997

Coghlan, D. (2011). Action research: Exploring perspectives on a philosophy of practical knowing. *Academy of Management Annals,* 5(1): 53-8. doi.org/10.5465/19416520.2011.571520 7

Coles, S. M., & Pasek, J. (2020). Intersectional invisibility revisited: How group prototypes lead to the erasure and exclusion of Black women. *Translational Issues in Psychological Science,* 6(4): 314–324. doi.org/10.1037/tps0000256

Collins, P. H. & Bilge, S. (2016). Intersectionality. Polity.

Conway, C. (2016). *Poor health: When poverty becomes disease*. University of California. www.ucsf.edu/news/2016/01/401251/poor-health-when-poverty-becomes-disease

Cook, G., Pieri, E., and Robbins, P. T. (2004). "The scientists think and the public feels": Expert perceptions of the discourse of GM food. *Discourse and Society*, 15(4): 433–449. doi.org/10.1177%2F0957926504043708

Costantine, M. M., Landon, M. B., & Saade, G. R. (2020). Protection by exclusion: Another missed opportunity to include pregnant women in research during the coronavirus disease 2019 (COVID-19) pandemic. *Obstetrics and Gynecology*, 136(1): 26–28. doi.org/10.1097/AOG.0000000000003924

Crenshaw, K.W. (2017). *On intersectionality*: *essential writings*. New Press.

de Regt, H.W. & Baum, C. (2020). What is scientific understanding and how can it be achieved? K. McKain & K. Kampourakis (Eds.), *What is scientific knowledge? An introduction to contemporary epistemology of science* (pp. 66–81). Routledge.

Ellingson, L. L. (2017). *Embodiment in qualitative research*. Routledge.

Ellingson, L. L. & Ellis, C. (2008). Autoethnography as constructionist project. J.A. Holstein & J.F. Gubrium (Eds.), *Handbook of constructionist research* (pp. 445-465). Guilford Press.

Feldman, M.S. & Orlikowski, W. J. (2011). Theorizing practice and practicing theory. *Organization Science*, 22(5): 1240-1253. doi.org/10.1287/orsc.1100.0612

Ferrari, A.M. (2018). Exploring the geosensory in geography: Examining olfaction and geo-virtual immersion as contributors to a sense of place and embodiment. Graduate theses, dissertations, and problem reports, 7175. researchrepository.wvu.edu/etd/7175

Finlay, L. (2002). "Outing" the researcher: The provenance, process, and practice, and of reflexivity. *Qualitative Health Research,* 12(4): 531-545. doi.org/10.1177%2F104973202129120052

Frith, E., Miller, S., & Loprinzi, P. D. (2019). A review of experimental research on embodied creativity: Revisiting the mind-body connection. *Journal of Creative Behavior*. Online doi: 10.1002/jocb.406

George, J. M., & Jones, G. R. (2001). Towards a process model of individual change in organizations. *Human Relations,* 54(4): 419-444. doi.org/10.1177%2F0018726701544002

Gherardi, S. (2001). From organizational learning to practice-based knowing. *Human Relations,* 54(1): 131-139.

Gioia, D. A., & Chittipeddi, K. (1991). Sensemaking and sense giving in strategic change initiation. *Strategic Management Journal,* 12(6): 433-448. doi.org/10.1002/smj.4250120604

Gioia, D. A., Thomas, J. B., Clark, S. M., & Chittipeddi, K. (1994). Symbolism and strategic change in academia: The dynamics of sensemaking and influence. *Organization Science,* 5(3): 363-383. doi.org/10.1287/orsc.5.3.363

Goduscheit, R. C., Bergenholtz, C., Jørgensen, J. H., & Rasmussen, E. S. (2008). Action research in interorganisational networks: impartial studies or the Trojan horse? *Systemic Practice and Action Research,* 21(4): 267– 281. doi:10.1007/s11213-008-9096-6

Goltz, S.M., Orr, B. & Mayer, A.L. (2020). Applied behavior analysis as a development tool: Examples from agroforestry. *Journal of Sustainable Development*, 39(8): 785-799. doi.org/10.1080/10549811.2020.1730906

Goltz, S. M., & Sotirin, P. J. (2014). From academics to change agents in a gender equity initiative. *Organizational Management Journal,* 11(3): 194-207. doi.org/10.1080/15416518.2014.947531

Guo, H., Yu, Y., & Skitmore, M. (2017). Visualization technology-based construction safety management: A review. *Automation in Construction,* 73: 135-144. doi.org/10.1016/j.autcon.2016.10.004

Habermas, J. (1971). *Knowledge and human interests*. Trans. J.J. Shapiro. Beacon Press.

Haraway, D.J. (1994). A game of cat's cradle: science studies, feminist theory, cultural Studies." *Configurations*, 2(1): 59-71. doi.org/10.1353/con.1994.0009

Harbin, A. (2012). Bodily disorientation and moral change. *Hypatia,* 27(2): 261-280. doi: 10.1111/j.1527-2001.2011.01263.x

Harding, S. (1986). *The science question in feminism*, Cornell University.

Henderson, C., & Dancy, M. (2011). Increasing the impact and diffusion of STEM education innovations. National Academy of Engineering Forum – The Impact and Diffusion of Transformative Engineering Education Innovations, New Orleans, LA, Feb. 7–8, 2011.

Hinchliffe, S. (2000). Performance and experimental knowledge: Outdoor management training and the end of epistemology. *Environment and Planning D: Society and Space*, 18(5): 575-595. doi.org/10.1068%2Fd192t

Hoel, N. (2013). Embodying the field: A researcher's reflections on power dynamics, positionality, and the nature of research relationships. *Fieldwork in Religion*: 27-49. doi: 10.1558/fiel.v8i1.27

Holmes IV, O., Jiang, K., Avery, D.R., McKay, P.F., Oh, I.-S., & Tillman, C.J. (2020). A meta-analysis integrating 25 years of diversity climate research. *Journal of Management,*

Online First. doi.org/10.1177%2F0149206320934547

Ioannidis J.P.A. (2018). Meta-research: why research on research matters. *PLoS Biology*, 16(3). doi.org/10.1371/journal.pbio.2005468

Iorio, R., Labory, S., & Rentocchini, F. (2017). The importance of pro-social behaviour for the breadth and depth of knowledge transfer activities: An analysis of Italian academic scientists. *Research Policy,* 46(2): 497-509. doi.org/10.1016/j.respol.2016.12.003

Kolb, A. Y., & Kolb, D. A. (2005). Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of Management Learning and Education*, 4(2): 193-212. doi.org/10.5465/amle.2005.17268566

Khurana, R. (2007). *From higher aims to hired hands: the social transformation of American business schools and the unfulfilled promise of management as a profession*. Princeton University Press.

Krubiner, C. B., Faden, R. R., Cadigan, R. J., Gilbert, S. Z., Henry, L. M., Little, M. O., Mastroianni, A. C., Namey, E. E., Sullivan, K. A. & Lyerly, A. D. (2016). Advancing HIV research with pregnant women: navigating challenges and opportunities. *AIDS (London, England)*, 30(15): 2261–2265. doi.org/10.1097/QAD.0000000000001214

Kuhn, T. (1962). *The structure of scientific revolutions*. University of Chicago Press.

Lam, A. (2011). What motivates academic scientists to engage in research commercialization: 'Gold', 'ribbon or 'puzzle'? *Research Policy*, 40(10): 1354-1368. doi.org/10.1016/j.respol.2011.09.002

Larsen, J. T. (2007). Ambivalence. R. F. Baumeister & K. D. Vohs (Eds.), *Encyclopedia of social psychology* (pp. 31-34). Sage.

Latour, B. & Woolgar, S. (1979). *Laboratory life: The construction of scientific facts*. Sage.

Lave, J. (1988). *Cognition in practice: mind, mathematics and culture in everyday life,* Cambridge University Press.

Leung, A. K. Y., Kim, S., Polman, E., Ong, L. S., Qiu, L., Goncalo, J. A., & Sanchez-Burks, J. (2012). Embodied metaphors and creative "acts". *Psychological science*, *23*(5): 502-509. doi.org/10.1177/0956797611429801

Maso, I. (2003). Necessary subjectivity: Exploiting researchers' motives, passions and prejudices in pursuit of answering "true' questions." L. Finlay & B. Gough (Eds.), *Reflexivity: A practical guide for researchers in health and social sciences* (pp. 39-51). Blackwell Science.

Mechanic, D. (1998). Bringing science to medicine: The origins of evidence-based practice. *Health Affairs,* 17(6): 250-251. doi: 10.1377/hlthaff.17.6.250

Merleau-Ponty, M. (2012). *The phenomenology of perception.* Routledge.

Miller, K.I. (2000). Common ground from the post positivist perspective: From "straw person" argument to collaborative coexistence. S. R. Corman and M.S. Poole, (Eds.), *Perspectives on organizational communication: Finding common ground* (pp. 46-67). The Guilford Press.

Moreno Leguizamon, C.J., Patterson, J.J., & Gómez Rivadeneira, A. (2015). Incorporation of social sciences and humanities in the training of health professionals and practitioners in other ways of knowing. *Research and Humanities in Medical Education,* 2: 18-23. http://www.rhime.in/ojs/index.php?journal=rhime&page=article&op=view&path%5B%5D=3

Parviainen, J. (2010). Choreographing resistances: Spatial-kinaesthetic intelligence and bodily knowledge as political tools in activist work. *Mobilities Journal*, 5(3).

http://www.tandf.co.uk/journals/titles/17450101.asp

Pattanayak, S.K., Mercer, D.E., Sills, E., & Yang, J.-C. (2003). Taking stock of agroforestry adoption studies. *Agroforestry Systems*, 57: 173-186. doi.org/10.1023/A:1024809108210

Paterson, M. (2009). Haptic geographies: Ethnography, haptic knowledges and sensuous dispositions. *Progress in Human Geography*, 33(6): 766-788. doi.org/10.1177%2F0309132509103155

Peterson, E.L. (2020). Can scientific knowledge sift the wheat from the tares? A brief history of bias (and fears about bias) in science. K. McCain & K. Kampourakis (Eds.), *What is Scientific Knowledge? An Introduction to Contemporary Epistemology of* Science (pp. 195-211). Routledge.

Pfeffer, J. & Sutton, R.I. (2006a). Evidence based management. *Harvard Business Review,* 84: 62-74.

Pfeffer, J. & Sutton, R.I. (2006b). Management half-truths and nonsense: How to practice evidence-based management. *California Management Review,* 48(3): 77-100.

Piderit, S. K. (2000). Rethinking resistance and recognizing ambivalence: A multidimensional view of attitude toward an organizational change. *Academy of Management Review,* 25(4): 783-794. doi.org/10.5465/amr.2000.3707722

Pieterse, J.H., Caniëls, M.C.J., & Homan T. (2012). Professional discourses and resistance to change", *Journal of Organizational Change Management*, 25(6): 798-818. doi.org/10.1108/09534811211280573

Rolfe, G. (1998). The theory practice gap in nursing: From research-based practice to practitioner-based research. *Journal of Advanced Nursing 28*: 672– 679. doi.org/10.1046/j.1365-2648.1998.00806.x

Ropo, A. & Parviainen, J. (2001). Leadership and bodily knowledge in expert organizations: epistemological rethinking. *Scandinavian Journal of Management,* 17(1): 1-18. doi.org/10.1016/S0956-5221(00)00030-0

Rousseau, D.M. (2006). Presidential address: Is there such a thing as 'evidence-based management'? *Academy of Management Review,* 31(2): 256–269. doi.org/10.5465/amr.2006.20208679

Rousseau, D. M., Manning, J., & Denyer, D. (2008). Evidence in management and organizational science: Assembling the field's full weight of scientific knowledge through syntheses. *Academy of Management Annals,* 2(1): 475–515. doi.org/10.5465/19416520802211651

Sabharwal, M., Levine, H.,& D'Agostino, M. (2018). A conceptual content analysis of 75 years of diversity research in public administration. *Review of Public Personnel Administration,* 38(2): 139-166. doi.org/10.1177%2F0734371X16671368

Schaffer, M.A., Sandau, K.E. & Diedrick, L. (2013). Evidence-based practice models for organizational change: overview and practical applications. *Journal of Advanced Nursing,* 69(5*):* 1197–1209. doi: 10.1111/j.1365-2648.2012.06122.x

Schmitz, S. & Höppner, G. (2014). Neurofeminism and feminist neurosciences: A critical review of contemporary brain research. Frontiers in Human Neuroscience, 8, Article 546. Doi: 10.3389/fnhum.2014.00546

Scribner, S. (1984). Studying working intelligence. J. Lave & B. Rogoff (Eds.), *Everyday cognition: Its development in social context* (pp. 9-40). Harvard University Press.

Sekimoto, S. (2012). A multimodal approach to identity: Theorizing the self through embodiment, spatiality, and temporality. Journal of International and Intercultural

Communication, 5: 226-243.

Shotter, J. (1996). Living in a Wittgensteinian world: beyond theory to a poetics of practices. *Journal for the Theory of Social Behavior*, 26(3): 293-311. doi.org/10.1111/j.1468-5914.1996.tb00292.x

Stolz, S. (2015). Embodied learning. *Educational Philosophy & Theory*, *47*(5): 474-487.

Thanem, T & Knights, D. (2019). *Embodied research methods*. Sage.

Tovar-Restrepo, M. (2014). *Castoriadis, Foucault, and autonomy: New approaches to subjectivity, society, and social* change. Bloomsbury Academic.

Underwood, P. and Waterson, P. (2013). Systemic accident analysis: examining the gap between research and practice. *Accident Analysis and Prevention,* 55: 154-164. doi.org/10.1016/j.aap.2013.02.041

Van de Ven, A. H., and Johnson, P. E. (2006). Knowledge for theory and practice", *Academy of Management Review,* 31(4): 802– 821. doi.org/10.5465/amr.2006.22527385

Vosniadou, S. (2007). The Cognitive–Situative Divide and the Problem of Conceptual Change", *Educational Psychologist,* 42(1): 55-66. doi.org/10.1080/00461520709336918

Vosniadou, S. (2003). Exploring the relationships between conceptual change and intentional learning. G.M. Sinatra & P.R. Pintrich (Eds.), *Intentional conceptual change* (pp. 377-406). Lawrence Erlbaum Associates, Inc.

Vosniadou, S., & Brewer, W. F. (1994). Mental models of the day/night cycle. *Cognitive Science,* Vol. 18 No. 1, pp. 123–183. https://doi.org/10.1207/s15516709cog1801_4

Vosniadou, S., & Verschaffel, L. (2004), "Extending the conceptual change approach to mathematics learning and teaching. L. Verschaffel & S. Vosniadou (Eds.*), Conceptual change in mathematics learning and teaching. Special Issue of Learning and Instruction,*

14(5): 445–451. doi/10.1016/j.learninstruc.2004.06.014

Wang, M.-T., Eccles, J. S., & Kenny, S. (2013). Not lack of ability but more choice: Individual and gender differences in choice of careers in science, technology, engineering, and mathematics", *Psychological Science*, 24(5): 770–775. doi.org/10.1177%2F0956797612458937

Weick, K. E. (1995). *Sensemaking in organizations*. Sage.

Wilson, A. D., & Golanka, S. (2013). Embodied cognition is not what you think it is. Frontiers in Psychology. Online. doi.org/10.3389/fpsyg.2013.00058

Wiltsche, H. A. (2019). Models, science, and intersubjectivity. F. Kjosavik, C. Beyer, & C. Fricke (Eds.), *Husserl's Phenomenology of Intersubjectivity. Historical Interpretations and Contemporary Applications* (pp. 339-358). Routledge.

Zahavi, D. (2019). *Phenomenology: The basics*. Routledge.