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COMPLEXITY SCIENCE AND ADULT EDUCATION:

THE ROLE OF TRAUMA IN NURSES' EMBODIED LEARNING

A Dissertation in
Adult Education

by

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ABSTRACT

Every day nurses work in environments that expose them to trauma and they move through their professional space as embodied creatures with their own histories of trauma. Because trauma changes our bodies in multiple ways, these diverse, changed and changing embodied selves are the people who come to class when nurses engage in higher education. From Adult Education emerging interests in several discourses are present to inform this picture: complexity science and education, embodied learning, neuroscience, and trauma. Although the discourses have intersecting theoretical underpinnings, they are not yet interconnecting in explicit ways.

This mixed-methods, primarily qualitative research study grounded in a complexity science theoretical framework sought to understand how RN-BS clinical students learned through their bodies, how they formed new patterns of connection, and how these patterns related trauma. It examined, retrospectively, the learning that occurred for a group of 16 RN-BS students who took two courses in health assessment and complex clinical problems, using a pedagogy that included experiential anatomy, yoga trance dance, mindfulness exercises, reflective journaling, and clinical storytelling that attended to body experiencing. Course content incorporated an ethological neurobiological model of human development and trauma and a complexity science informed perspective of nursing and healthcare.

Outcomes were examined as new patterns of connection into the contexts of personal and professional lives. Findings revealed the ubiquitous presence of trauma in nurses’ clinical learning. The trauma arises from education and socialization processes and the paradoxes of hi-tech healthcare. Embodied connection with self emerged, branching into new patterns of connection as new personal / professional knowledge and actions.
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Now suppose that the completion times of a given human endeavor – writing a difficult report, for instance – are distributed according to a power law with an exponent $D = 1.5$, say. The expected completion time of the job is then $D/(D-1) = 3$ hours or days or whatever unit of time one chooses. Intuitively, one would expect, 5 days after starting the work and not having completed it, that the expected completion time would be considerably less than 3 days – after all, it was only 3 days at the START of the project. However, [the power law] equation tells us that the expected completion time is now 15 days. And after another 60 days without finishing the job, the expected completion time has moved on to 180 days! In other words, the longer one works on such a project without actually concluding it, the more remote the expected completion date becomes. Is this really such a perplexing paradox?.... Such jobs either get done soon or they never get done. (Schroeder, 1991, p. 157)

I wish to thank everyone connected with my life who didn’t say “No.”
CHAPTER 1
INTRODUCTION AND PURPOSE

We use our minds not to discover facts but to hide them. One of the things the screen hides most effectively is the body, our own body, by which I mean, the ins and outs of it, its interiors. Like a veil thrown over the skin to secure its modesty, the screen partially removes from the mind the inner states of the body, those that constitute the flow of life as it wanders in the journey of each day. The elusiveness of emotions and feelings is probably ... an indication of how we cover to the presentation of our bodies, how much mental imagery masks the reality of the body. (Damasio, 1999, p. 28)

This chapter provides an overview of a research study grounded in a complexity science theoretical framework, that sought to understand how RN-BS clinical students learned through their bodies, how they formed new patterns of connection, and how these patterns related to trauma. The chapter begins with an explanation of my personal and professional background relating to the topic of this study. It then goes on to discuss key aspects of trauma within the context of learning, and summarizes the adult education literature that intersects with trauma in setting up the purpose of the research. The chapter also includes the guiding research questions, theoretical framework, and an overview of research methodology.

Background Connections

Adult education and nursing education always happen in a context. A basic premise of this study was that learners are always in the process of what neuro-developmentalist Daniel Siegel (2001) refers to as integrating through self-organizing, as a result of learning through life experience, including those experiences related to fear and trauma. This means that a learner combines emotion, interpersonal relationship, and coherence in linking some aspects of past, future and present to create new meaning. In order to set the context of the study I’ll describe an example from my own life, as well as a description of how I’ve seen this in my patients and students, and consider how it relates to complexity.
When I returned to school for a second clinical graduate degree, following a serious post-traumatic depression, I was intensely aware of every labored leap in function my brain was making. I could feel it learning to learn again. Although the process finally became easy and enjoyable again, it felt different. In a nursing clinical specialist program I had learned to practice psychotherapy. Later in a nurse practitioner program I was learning under the apprenticeship model to practice medical diagnostics. Perhaps, I thought, these programs just called on divergent skill sets. This hypothesis was disproved when I began doctoral studies. My ability to grasp a big picture and see patterns was greater than ever, which could be attributed to age and experience. But the path to this knowing destination had also changed. I was much more reliant on senses other than auditory. Learning seemed to get caught up in my body’s conversations with adrenalin. Both moving and watching were integral to learning. When I had begun to direct my own recovery from depression, I simply FELT that I had to be very physically active with my entire body in order to heal my brain. Kelso (1995) would say my brain and I were self-organizing, Siegel (2001) would identify a process of self-organizing integration, and van der Kolk (2006) would notice the wordless need to move and say my changed neurological body was taking survival action. Activities using brain and body together were especially productive.

Returning to the classroom I experienced a similar sense of requiring visual stimulation. Writing tasks sent me on impulse driven film-watching binges that lead to flights of imagination and then to papers. I was intensely grateful when directed to ground my theoretical writing in experience, because for me, experience that contained a visceral component had become the place where all my thinking began. This too was part of my own self-organizing.

At the same time, as a nurse educator, facing classrooms full of registered nurses (RN’s) sometimes evoked feelings reminiscent of clinical situations. Students’ anxiety and fear were
present at the start of every clinical course. Sometimes the sense of familiar experience was so strong I could have been caring for someone, as I had in my past experience as a nurse, who was dying, or lost a limb or was burned. Other times students arriving straight from work at the hospital would carry along the strange contagion of a day spent with trauma, visible in their eyes, maybe expressed through a story, felt in the energy of the general tension enveloping them. When this happened, everyone in the class started remembering and telling about the last time they felt that way and the string of events leading up to that state. There is no collection of words that makes this state dissipate. No lecture or reading makes it understandable to the point of being able to keep working and remain healthy.

I became a full-time faculty member 6 years ago because someone appreciated the philosophical tone of my letter of interest. It stated my desire to teach holistically and nurture spirit in a way that taught RN’s alternative perspectives to biomedicine and helped them become healthier. With only my intention to guide me I began teaching the four clinical courses in an RN-BS program (health assessment, complex problems, family and community nursing) and electives on holistic health and forensic nursing topics. I also soon began taking adult education courses, that exposed me to research on spirituality in higher education (Tisdell, 2003) and transformative learning theory (Kegan, 2000; Mezirow, 2000; Taylor, 2005), and was excited to realize that a discipline other than the pathologizing fields of psychology, psychiatry and medicine could help me achieve my goal. A parallel serendipitous attendance at a complexity science and chronic illness conference introduced the neurophysicist/brain researcher Kelso’s (1995) idea of ‘brain as dynamical system’, unique, ever changing and non-linear. I recognized in this work the brain that I lived with. My dissertation focus was birthed.
The lack of connection between adult education theory and science was disturbing initially, however. Then, while researching complexity and transformation I experienced self-organization in an educational setting as facilitated transformative learning (Cranton, 2006). I accepted Danielle Flannery’s guidance to read Capra (1996) which provided an umbrella for understanding the more original sources I had been working through. Over time, I was able to trace a thread of connections from the education literature related to complexity science (Davis & Phelps, 2005; Davis & Sumara, 1997, 2006; Doll, Fleener, Trueit & St. Julien, 2005; Fenwick, 2000, 2003; Karpiak, 2000, 2003; Kincheloe, 2005; Mason, 2008; Stanley, 2003, 2006) with other aspects of the adult education literature. For example, adult education study on popular visual media forms and storytelling in organizations (Tisdell & Thompson, 2007; Tyler, 2006, 2007), harmonized with my own trauma mediated style of learning; further I found connections between the emerging discourse of neurobiology and learning (Calderelli & Taylor, 2001; Hill, 2001; Johnson & Taylor, 2006; Taylor, 2001), and research on embodied learning in the field (Freiler, 2007, 2008; Horst, 2007) with ideas from complexity theory.

For two years I engaged in this study, finding pieces that fit my experience and my ‘sense’ of a question, uncovering theoretical paths to follow and philosophical connections to be linked with science. Finally, a picture emerged. I translated this into a drawing and it became my guide for the third year of doctoral education. Long before this study was a question, or a proposal or a plan, it was a picture. When Seth Wolpert told me my question sounded like a vortex I knew to think of myself as water or air moving through my picture’s ideas. This picture is shared here in Figures 1 and 2, and is offered for those who relate to pictures more than words.
Figure 1. Nurses’ Embodied Learning and History of Trauma
Figure 2. Complexity Lens
In dynamic systems, or complex adaptive systems, the process of self-organization is always sensitive to initial conditions. Self-organization as it relates to intelligent behavior (connections among perceiving, knowing and acting) has been researched extensively within the research program of Embodied Cognitive Science. By integrating knowledge of neural systems with principles of physics (neurodynamics) Embodied Cognitive Science has lead to research on both artificial intelligence and human intelligent behavior. Neuroscientist Kelso (1995), working on studies of people, teaches us that when applying this concept of self-organization to learning, we must always begin with an understanding of the individual’s intrinsic dynamics, the tendencies and constraints already present, the history of experiences that create their unique ‘signature’ (Kelso, 1995, p.161). When new learning begins, it starts with the ordered pattern that already exists for each individual and builds on that pattern to greater complexity and a new pattern of order in a non-linear fashion (Kelso, 1995). This is partly a result of interaction with trauma, which will be taken up next.

Defining the Concept of Trauma in Context

From the moment we are born it is our job to survive and our bodies are uniquely evolved to help us do so in interaction with our environment. The broad category of survival learning occurs over a lifetime, varies in its details according to the context in which we live, and subsumes fear learning our physiological evolutionary response to mortal threat. In effect, survival learning is fear learning at its point of connection to context. This is durable, lasting learning with lasting physiologic effects, that doesn’t usually overwhelm our ability to cope. When it does overwhelm us, our learning is trauma learning. These types of learning will be discussed further below. Since this study examined trauma in relation to learning through the body, it is important to understand how trauma is defined and deployed for that purpose.
To be clear from the outset, trauma is not a natural category. “Trauma is a culturally constructed way to mark out certain classes of experience and events … a conceptual metaphor we use to reflect on the human prospect and predicament” (Kirmayer, Lemelson & Barad, 1997, p. 4). The trauma metaphor was borrowed from 17th century medical literature which adopted the ancient Greek word for wound when describing body wounds. The key concept underlying this metaphor is the capability of violent events to damage body structure and physiology as it simultaneously activates the body’s naturally evolved systems of response for survival, recovery and repair. This is a natural process. In her comprehensive genealogy of trauma, humanities scholar Leys (2000) points out that the association with psychic trauma only arose in the late 19th century with recognition of forms of violence associated with industrialization and emergent social concerns about the stress of modern life.

Changing definitions of trauma and disorder resulting from trauma have been influenced by multiple historical, social and cultural factors. In popular discourse trauma is now associated with disparate psychological notions, and a sense of damage, of shattering of both body and mind. Trauma researchers from a variety of disciplines (Erikson, 1995; Kirmayer, Lemelson, & Barad, 2007; van der Kolk, McFarlane, & Weisaeth, 1996) have recognized that the medicalization of a natural process can result in marginalization and limit the effectiveness of necessary political actions. Their work has spawned a new interdisciplinary approach to researching trauma across several levels of analysis and resulted in a return to the metaphor of trauma as the body’s natural survival response in the face of threat. After establishing that foundation and understanding empirically, the validity of the concept of disorder can be examined more accurately. As explained by van der Kolk, et al (1996), trauma is present when people perceive themselves to be overwhelmed by events beyond their capacity to cope. When
overwhelmed by perceived threats to safety, the natural neurobiological responses to threat are activated. When this happens a natural acute stress response occurs and the possibility of developing a more lasting post traumatic stress disorder exists.

The context for understanding trauma in this study has three aspects that are particularly relevant to this project: the concepts of: self organization through interaction with environment; interpersonal neurobiology of the developing mind; and survival, fear, and trauma learning. While these will be discussed further in Chapter 2, and again in Chapter 4, significant aspects of these concepts are highlighted here. (See Appendix D, p. 363 for evolving definitions of trauma).

*Self-Organization Through Interaction with Environment*

Self-organization as the formation of patterns of connections is the phenomenon this study sought to understand. The evolutionary perspective of organismic biology states that we are all the selective product of millennia of human-environment interaction (Rau & Fanselow, 2007). Living organisms are dynamic holistic beings who exhibit aliveness through the characteristic that marks all living systems – the ability to self-organize through creation of patterns. These patterns exist in communicating networks that self-replicate and also recreate themselves in new forms. A patterned network of interactions defines us as living at every systems level. This process is not consciously communicated but inherently understood by all interacting elements of a network (Camazine, et al, 2001; Capra, 1996; Kauffman, 1993).

The research of Bolles (1970) and several others (Rau & Fanselow, 2007; Sapolsky, 2005a) demonstrates that we are by nature involved in this process of change through interactions with perceived threats to our safety.

The way this process plays out developmentally has been the subject of research by developmentalist Thelen (1989). Thelen, who learned research methodology from Kelso (Kelso,
theorized the *embodiment hypothesis* which posits that intelligence is made in and realized through physical actions in the world. As part of this ongoing human developmental intersection with past and current threats, each of us learns through lasting and newly created patterns of connections in our nervous systems as they interact with these challenges through action in real life experience (Thelen, 1989). In other words, whatever didn’t kill us (or our ancestors) makes us who we are today. That is the substrate we each bring to the learning setting and the physiologic tool set we use for learning (Perry, 2006).

Recent and ongoing research is unraveling how we self-organize around trauma and what the lasting impacts are on our bodies. In a massive landmark study of the effects of adverse childhood experiences (ACE), defined as personal abuse and dysfunctional households, physician researcher Felitti et al (1998) showed that ACE’s have long term effects on health. They make lasting changes in the neural processing network that defines our personal uniqueness (Anda et al, 2006; Marmar, 2007; Shalev & Yehuda, 1998; Teicher, 2003; van der Kolk, 2003; Vermetten & Bremner, 2002a, 2002b). The changes continue throughout adulthood with exposures to stress and violence (Bremner, 2007; Yehuda, McFarlane & Shalev, 1998). These are the embodied, evolved beings who work in hospitals and come to my classes to learn.

*Interpersonal Neurobiology of the Developing Mind*

Are we each simply the sum of our nervous system’s responses to threat? The Interpersonal Neurobiology of the Developing Mind builds on neuroscience knowledge by offering an integrative framework that incorporates findings from several disciplines. This framework explores the idea of mind as emerging from the intersection of human relationships and the unfolding structure and function of the brain (Siegel, 2001). Grounded in complexity science, this framework describes human development in a social world as transactions between
the environment and the individual’s brain functions that give rise to the mind. At the core is a fundamental mechanism of integration, itself a form of self-organization, which is seen at a variety of systems levels, from the neurological to the interpersonal. According to Siegel (2001) the flexible integration of automatic responses through ‘thinking’ behavior of the prefrontal cortex is another form of integration. In the particular neuroscience perspective that Siegel (2001) expresses, what we “know” exists in the synaptic connections between neurons, the central nervous system cells, then extends this to patterns of neural network firing throughout the body’s entire nervous system.

This view is consistent with Hebbian learning (Hebb, 1949) and Edelman’s (1987) neural networks, both of which are described in more detail in Chapter 2. Hebbian connections across synapses which separate neurons are those that increase in strength when the connected neurons are coactive and are considered a possible basis for self-organizing parallel-distributed neural networks … nerve nets with a life of their own (Tucker, 2007, p.97). The Siegel model’s neuroscience conceptual sources are concerned with self-awareness as the ability to identify internal feelings and body sensation, also referred to as interoception (Sherrington, 1906, 1951). They are informed by a model of cognition and action that rejects stage models and likens cognitive development to nature’s patterns of concentric circles and spirals underlying apparent chaos (Thelen & Smith, 1994); thus, development for Siegel (2001) is seen as movement toward more complex states of processing over time, resolved in new stable patterns of order, the cycle beginning again with movement toward greater complexity.

Like the previously described ethological, neurobiological model of trauma, the dynamic systems approach to cognition and action (Thelen & Smith, 1994) which its creators describe as compatible with Vygotsky’s lineage of developmental theorists, declares brain activity as
foremost concerned with generating movement through a causal web of perception, action and cognition as a survival response, which it does in response to sensory input in fairly stable and predictable patterns (Damasio, 1999; LeDoux, 2002; Llinas, 2001). This complex ability which allows for flexible responding emerges over a lifetime and can be disrupted by various events that invoke fear and remove a sense of control (van der Kolk, 2006; van der Kolk, et al, 1996).

**Fear Learning, Survival Learning and Trauma Learning**

The role of trauma in learning was central to this study, and must be considered in light of a relationship among fear learning, trauma learning and survival learning. In particular the neurobiological fear conditioning model of trauma is used for this study. What is addressed in this section is the fact that in current adult education literature there are two related terms linked to learning: fear and traumatic. Fear learning is a well researched biological concept applied across animal species that contributes understanding under many metaphors of trauma. It is written about primarily in relation to disorder (PTSD) and is described in relation to the classroom by Perry (2006). Traumatic learning is a term coined by physician /linguist Janik (2005). Traumatic learning describes the intentional or unknowing use of classical conditioning to link a trigger with fear in the process of imposing one person’s ideas on another. Adult education literature needs to clarify and differentiate fear learning and traumatic learning so the two are not conflated. This study contributes some clarification. Because this study looked at embodied learning in relation to trauma, the discussion of trauma and learning begins at the level of the body and progresses outward into the environmental context, from fear learning to trauma learning then survival learning.

**Fear Learning** derives from a gift of our evolutionary heritage and is widely discussed in trauma research as an essential component of the fear conditioning model and cognitive
behavioral models of PTSD (Bouton & Waddell, 2007; Shalev, 2007). Since fear evolved as a strategy to assess and respond to threats, it is learned rapidly as a component of a functional behavioral system designed to thwart predators. Neurobehavioral researcher LeDoux (2002) and others (Quirk, Milad, Santini & Lebron, 2007; Rau & Fanselow, 2005) have confirmed that because the evolved process is linked with survival the conditioned response is durable after one event and easily re-stimulated by the associated contextual factors. Fear learning is permanent and cannot be extinguished. Some researchers (Ekblad & Jaransen, 2004; Silove, 1999, 2004; Summerfield, 1999) who take an ecosocial perspective argue that this durable learning through a single event, especially in relation to mortal threats, makes evolutionary sense. Neurodevelopmental researcher Perry (2006) writes elegantly about the ramifications of this process in adult educational settings.

In connecting learning through the body with trauma, this study examined examples of fear learning particularly as an aspect of nursing education and nursing practice. In order to consider the connection between learning and trauma due to contextual, structural factors, examples of ‘trauma learning’ were also examined. *Trauma Learning*, as it is defined for this study, is distinguished from Janik’s traumatic learning concept for purposes of clarity and to use a concept that is purposefully derived from the same theoretical model as fear learning. Traumatic learning is the terminology used by Janik (2005), now an educator, in his description of a kind of transformative learning. Janik defines trauma as “any unwanted violation of one’s body, mind, and/or spirit” (p. xviii).

In contrast the concept of *trauma learning* is being constructed from the summative writings, derived from the neurobiological fear conditioning model of trauma, of leading PTSD researchers van der Kolk, McFarlane, and Weisaeth (1996). *Trauma learning*, in this study,
referred to any learning that occurs in a situation in which the person *feels they have no control* so there is the possibility of being overwhelmed beyond capacity to cope. There might be the possibility of humiliation and fear learning might be present. This definition remains in accord with van der Kolk et al’s (1996) emphasis on individual perception of being overwhelmed. It also allows for extending the evolved fear learning connection with mortal threat to include the type of being overwhelmed that occurs interpersonally, such as forms of abuse, which the field of traumatic stress studies now labels ‘complex trauma’ (Felitti et al, 1998; van der Kolk, 2003; van der Kolk et al, 2005).

Both fear learning and trauma learning are subsumed under survival learning, so named by Silove (1999) in his ecosocial model of trauma which accepts the evolutionary fear conditioning model and transposes it to a different systems level, the level of societies. Silove has studied countries beset by systemic violence and persecution to develop his model of adaptive systems (1999, 2004, 2007). He argues that just as individuals have evolved to react defensively in response to threats to their own safety (Bolles, 1970; Bolles & Fanselow, 1980), at the collective level, societies act defensively to preserve threatened institutions when they subserve the functions of safety and security, interpersonal and communal bonding, justice, maintenance of roles and identities, and preservation of social coherence and existential meaning. Collective groups do this in a self-organizing fashion, drawing upon their specific material resources and culture-specific knowledge. As the communal group engages in this process, threats to these domains can trigger fear learning and conditioned physiologic responses in individuals, especially around safety, security and bonding.
All of these systems levels, individual, interpersonal, and communal and all three types of learning, fear learning, trauma learning, and survival learning are at play and examined in this study. The next section discusses their significance for adult education and in this case, nurses.

Defining the Problem:

Trauma, Learning, and Adult Education

Adult education has shown a growing interest in the contributions of neuroscience and embodied learning. Authors such as Caine & Caine (2006) and Taylor (2006) have urged adult educators to engage more fully with neuroscience in developing new pedagogies. Neuroscience findings have been used to explain and support a mentoring approach in the classroom (Johnson, 2006) and to explain practices that aim to engage the brain in a process of serially making connections with the intention of strengthening that process and thereby changing the brain (Zull, 2006). But most discussion remains at the level of the brain. Discussions of cognition via neurobiology and the brain’s connection to consciousness as pertains to learning (Hill, 2001; Mulvihill, 2003; Taylor, 2001) are largely exploratory, but pave the way for research yet to come. When Dirkx (2007) elaborates on the construct of self and emphasizes emotion and imagination both to connect with one’s own ‘self’ and the broader social world, we sense embodiment; and his most recent writing about emotion and learning (Dirkx, 2008; Clark and Dirkx, 2008) specifies embodied learning as an important category, even mentioning neuroscience. However Dirkx does not connect with complexity science at all. Neuroscience writing that does draw from complexity provides authors such as Damasio (1999), and Siegel (2001) whose work could be useful to adult educators. Both of these neuroscientist physicians argue that the embodied self emerges through co-creation with environment or context, and that
emotion and imagination are mirrors of the neural process but expressed at a higher systems level.

The language of complexity science within the field of adult education would allow fuller expression of the connection to neuroscience and broadening of the theoretical understanding of embodiment. Tammy Freiler’s (2007, 2008) recent work helps to makes this point. Freiler’s research was grounded in the philosophical and linguistic writing of Lakoff and Johnson (1999), scholars in the field of Embodied Cognition which has been influenced by neuroscience and complexity science. Freiler (2007) conducted an action research study to understand the mind/body connection through embodied practices in the classroom. As will be discussed in chapter 2, her study revealed the depth of engagement and self-knowledge that can result from an embodied perspective. Interestingly the same argument is advanced in traumatic stress studies grounded in complexity via Embodied Cognitive Science as evidenced in recent work connecting trauma, development, and movement. (Ogden, Minton & Paine, 2006; Schore, 2005; Siegel, 2001; and van der Kolk, 2006).

It is clear that the adult education field would like to step beyond the ‘brain only’ understanding; Merriam, Caffarella, and Baumgartner (2007) acknowledge that the nervous system extends throughout the body, noting the writings of Pert (1997) about possible peptide mediation of memory in a psychosomatic network throughout the body. A notion of body memory is also put forth in trauma literature and remains contentious (Kirmayer, 2007; Brewin, 2003; van der Kolk, 1994; van der Kolk, McFarlane, & Weisaeth, 1996). But learning at the neuronal synapse and in distribution of connectedness through neural networks is something that has been researched, published in scientific journals, and interpreted for scientifically literate general audiences (Damasio, 1994, 1999, 2003; Edelman, 1989, 1992, 2006; LeDoux, 2002).
Adult education is just beginning to engage this literature. Consequently, there has been difficulty connecting from neuroscience literature to an understanding of embodied learning. This study proposes to use complexity science as the linking framework to make that connection, between embodied learning, learning at the synapse and through networks of neural connections.

Attention to trauma and its relationship to learning in the adult education setting is also just beginning to emerge. Kerka (2002) was the first to engage the topic in U.S. adult education circles. She recognized that personal trauma histories were undoubtedly present but unexpressed in adult learning settings and suggested that intentional discussions of personal traumas might sometimes be an appropriate way of giving them voice. She believed this might positively impact learning. Trauma is a fact of life for many people around the world who never present to psychiatry or develop traumatic stress disorders (Silove, 2007) and trauma is inextricably present in some professional settings such as health care. It is unknown how many people, without post traumatic stress disorder but with trauma impacted bodies avoid educational settings or experience learning in ways never imagined by most faculty. While a few physicians have begun to pay attention to classroom generated fear learning (Janik, 2004, 2005; Perry, 2006) the primary emphasis is on children, the impact of adverse events in childhood on learning, and negative classroom experiences in childhood. How this exists and occurs for adult students is unstudied with the exception of Simonelli’s (2000) study of educational wounding.

As more adult educators realize the essential involvement of emotion in all learning (Damasio, 1999; LeDoux, 2002), and begin to expand pedagogical practices to incorporate ways of knowing beyond the rational, it is imperative that we develop an accurate understanding of the presence of trauma’s presence in adult learning and of students’ experiences of alternative
pedagogies, particularly in relation to trauma. RN students are a group for whom this concern seems particularly important.

**Purpose of the Study and Research Questions**

There is a gap in the adult education literature in that the application of neuroscience knowledge to learning processes outside the brain is not addressed; neither is trauma, manifested through the body, as it appears in the adult education setting. What these topics hold in common is embeddedness in the body, and therefore a direct link to embodied learning and embodied cognitive science. This gap is pertinent to nursing education with experienced RNs who are in an RN to BS program that deals with clinical practice. Nurses practice their art in a pragmatic world that routinely presents them with challenges requiring quick response. These challenges often involve the traumatic experiences of other people; a situation which, over time, can create its own trauma (Figley, 1995; Stamm, 1999). In most cases, for patients and nurses alike, the result is not a psychiatrically diagnosable disorder. Rather it is the natural transformation of the neurobiological body which occurs as we interact with threats over a lifetime (Silove, 2007).

So these transformed bodies are what and who registered nurses bring to class, to the bedside, and to their work of interacting with and reading other people’s bodies. These nurses are my students. And yet most nurse educators don’t teach nurses in a way that recognizes this fact. We typically teach conceptual understanding of body systems, such as the respiratory and neurologic systems, and we teach physiologic processes, later matched with algorithms of signs and symptoms and protocols for response. We do this despite a long and more distant history of healing the body by first reading it (DeGowin & DeGowin, 1965). Furthermore, nursing education does not attempt to advance nurses’ awareness of their own bodies. This approach can
limit their ability to promote healing in their patients. It also limits their ability to sustain themselves throughout a career that guarantees opportunities for secondary traumatization through exposure to other people’s trauma.

Nurses can certainly be educated differently about body awareness. The much enlarged understanding of what constitutes learning ascertained by the findings in neuroscience discussed above provide insight about building connections through the nervous system throughout the body, and how this is connected with trauma. Knowing that it was possible to teach nurses differently, and given that there was a lack of data based research studies about learning grounded in a complexity science perspective in both adult education or nursing education, a couple of years ago, I began developing many new ways of teaching nurses by drawing on body stories and complexity science, in two different classes: a health assessment class and a complex problems in health care class. In so doing I’m continually trying to help these nurses to form connections about bodies in ways that more accurately reflect bodies’ realities. I was interested in how this process of forming new patterns of connections unfolded over time, and what students reported from engagement in learning this way.

Grounded in a complexity science theoretical framework, the purpose of this study was to explore how RN-BS clinical students learned through their bodies, how they formed new patterns of connection, and how these patterns related to trauma. In particular, the study first sought to understand how RN-BS clinical students who were in my nursing classes formed patterns of connections when experiencing embodied learning as they learned to assess the body and care for complex patient problems, and how these patterns related to trauma. Then, it attempted to understand the natural presence of fear and trauma learning in the clinical nursing
environment and how the students made patterns of connection between this learning, their embodied learning in class, and the context of clinical practice.

With this purpose in mind, the research questions that guide this study include:

1. How do RN-BS students learning health and physical assessment of the human body ‘map’, or make patterned connections about clinical learning when they are taught a neurobiologic mind/body model and their own bodies are actively involved through experiential anatomy?

2. How are students’ unique patterns of trauma involved in mapping their learning about physical assessment and complex clinical problems when experiential anatomy and self-assessment are included in the curriculum?

3. How do students map, or make connections, between a neurobiology based experiential curriculum and both their personal lives and professional nursing practice?

Theoretical Framework and Philosophy

Complexity science is the study of complexity theory, a form of systems thinking (Capra, 1996). It is a composite of theoretical concepts from multiple sciences and mathematics, a science of change. It describes how organisms (including people) as living systems interact with their environments and adapt to stay alive, consonant with ideas about trauma and adaptation; how they are impacted by forces within and outside themselves which create both chaos and order; how they have the internal capacity to self-organize in new ways according to their own internal principles; and how sometimes they undergo complete structural transformations to become something different. These processes of change are continuous, nonlinear and unpredictable so a living organism’s properties are continually emerging. Fluctuations and stress are constant threats to stability, overcome by forms of communication and connection, but
sometimes embraced as precipitants of a new pattern of behavior and relations (Capra, 1996; Karpiak, 2006; Siegel, 2001; Thelen & Smith; 1994).

Systems thinking began with consideration of the organism, or a living system such as a human being, which it contextualized so living system was always understood as existing through relationships within the greater whole. Organismic biology says that the patterns of relationship within the physical structures of living systems are what make them whole. This pattern of relationship has been refined to the concept of self-organization in which systems consist of complex networks that communicate, self-replicate, and recreate themselves in new forms (Capra, 1996). The foundational example of a self-organizing network related to the body is the neural network created by patterns of synaptic connection, when neurons, the primary cells of brain and central nervous system, connect through electrical firing across the synapses or spaces that separate them. This network is also the basis for learning (Kelso, 1995; Siegel, 2001). Self organization is perhaps the most central concept of systems thinking. “The pattern of life … is a network pattern capable of self-organization” (Capra, 1996, p. 83). LIFE is an emergent collective behavior, the self-organized creative product of complex chemical networks (Kauffman, 2000). So, complexity assumes that people are organisms, living systems that are the product of evolution, and they continue to evolve across a lifetime in interaction with the environment. They are integrated holistic systems with innate capabilities to transform themselves in fundamental ways.

Incorporating insights particularly from chemistry and physics, change and transformation are explained through principles of non-linearity, emergent properties, multiple causality, and sensitivity to initial conditions, contributing an understanding of dynamic systems (which do not have to be living systems, but all living systems are dynamic) where change and
stability co-exist paradoxically (as in a classroom or other learning situation). These self-organizing systems, far from equilibrium, reach a critical point of chaos at which they spontaneously shift into a new pattern. Energy and matter flow through dynamic systems creating instabilities which can evolve by transforming themselves into structures with greater complexity. The theory assumes all complex systems have structural and behavioral commonalities and can be modeled mathematically. Therefore a neural networks scientist might theorize productively with an evolutionary biologist, an economist, a business manager, and an adult educator (Capra, 1996; Thelen & Smith, 1994; Wheatley, 2006). When this science is translated into the learning literature, learning consists of simultaneous biological and behavioral (therefore structural) transformations in the learner. Structure in this biological sense is paradoxical, encompassing cause and accident, completion and process concurrently. Learning occurs due to the learner’s unique biological/experiential structure and is a highly individual recursive and elaborative process, activated through disturbances or irritations. Teaching can stimulate learning through intentional disturbances. The structure of a living system is unique and embodies its history. Many of its traits can never be known or replicated. So a learner is a complex unity capable of adapting to new situations presented in a dynamic environment. ‘Learner’ is no longer just the individual being, but can be represented at many systems levels, even many at one time, so that cells may be learners at the same time that a group of community members are learners, and they can be learning as individual systems or part of a complex interacting system (Davis & Sumara, 2006; Doll, et al., 2005). Here the theory assumes that people are always capable of learning at some systems level although the changes resulting from learning might not be easily observed or measured.
In this research study trauma was considered to be a possible initial condition, a product of an individual’s unique evolution in interaction with the environment. From a complexity perspective, teaching in a surprising way using movement and reflection on body experiences was expected to create disturbances or irritations, although what these might be was unknown. In a similar way, teaching directed at rational knowing intends to create cognitive dissonance between old assumptions and new perspectives and the structural, emotional and behavioral effects on learners are unpredictable and often unknown. Learning as formation of patterned connections was expected to occur in unique and unpredictable ways for each individual, some perhaps replicating and strengthening their initial condition, others changing in a variety of ways, structural and behavioral.

The actual pedagogy that I used in teaching the courses will be described in chapter 3 to set the context for the study. The study itself examined retrospectively the unfolding process of learning through the body, understood as an emergent property of neural systems, personal, and interpersonal patterns of connection as they are impacted by trauma. Thus complexity theory was a most appropriate theoretical framework.

Overview of Research Design

For the most part, a qualitative research approach was the most appropriate for this study for several reasons. The research was occurring retrospectively to understand what had happened across nursing education and practice settings. Complexity science was the desired lens for viewing and analyzing what happened. Finally, the study sought to understand both self-organization as a process across the period of learning and the emergent outcomes of that process. So in a sense the study was an evaluation of a series of learning events. According to Patton (2002) all of these purposes are answered by the three following characteristics of
qualitative research. Qualitative designs are naturalistic, taking place in real world settings. Complexity theory and non-linear dynamics is one of the theoretical traditions within qualitative inquiry, seeking to answer the foundational question, “What is the underlying order, if any, of disorderly phenomena?” (p. 123). And as evaluation research qualitative methodology supports both summative and process evaluations. Because qualitative research doesn’t seek to control or manipulate there is emergent design flexibility. This is harmonious with complexity theory and allowed for combining multiple forms of data generated and gathered at different times according to what was possible in the naturalistic setting.

This was a retrospective study about students’ learning in my own classes approximately six months after the final class was over. Using complexity theory within the qualitative paradigm attends to the potential problems created by the fact that I was researching adults who had been students in my classes. To some extent then I have had both an instructor / researcher role. Patton (2002) contrasts the challenges of human systems research with the tenets of complexity science, identifying that entry of the researcher into a setting can create problems of validity because the researcher’s presence changes the setting. Complexity science recognizes that learning happens in a co-created space and small events can make critical differences. This was the intention in teaching through embodiment, to make something happen. So it’s appropriate to look back afterward and analyze if and how that happened. Qualitative research does not seek generalizeability, but rather deep understanding; and for evaluation of healing and transformative programs “the best source and form of information are client stories” (Patton, 2002, p.151). All of these characteristics were a pragmatic fit for the research questions and the available data.
Clearly there was an ‘action’ element at play in offering nursing students a very different pedagogy in a purposeful way, intending to stimulate behavioral and experiential change that is part of the backdrop of the study. For ethical reasons, action research was not selected as methodology. But the guidelines and recommendations made for clinical action research were considered during development of the embodied learning content and during creation of the courses themselves, which is nearly always the case in teaching my classes. I labeled the resulting form of pedagogy ‘clinical action learning.’ While this will be discussed more in Chapter 3 as related to this study, in all of my clinical courses, alone and together students study themselves. They complete various self-assessments that are often quantitative measures of stress through specific instruments, they discuss these with each other, practice research skills by analyzing their aggregate data for these assessments, and keep reflective learning journals.

Participants were selected with purposeful sampling; they had to have completed the health assessment class and preferably also the complex problems class in order to participate in the study. As practicing RN’s they all had particular knowledge related to the issues being studied, which would be a selection criterion under purposive sampling (Creswell, 2002).

The kinds of data that were collected will be outlined more thoroughly in Chapter 3. But there were three main sources of data. One of the most primary sources of data were in-depth interviews with 14 students to find out in greater detail how they had integrated their learning into their personal and professional lives. Students had written journals throughout both of my courses in response to the course content as well as about their responses to the exercises provided in one of the texts BodyStories (Olsen & McHose, 2004). Participants gave me permission to use these journals as a second source of data. Finally, a number of quantitative self-assessment tools were used in the classes. Students also allowed me to use their results on
these quantitative measures. Analysis of qualitative data was interpreted using categories generated from the data, the fear and trauma learning model, and a complexity inspired template to assess patterns of connections based on Siegel’s interpersonal neurobiology of the developing mind. Quantitative data was assessed using SPSS for descriptive statistics and correlations.

Significance of Research

The primary arenas of significance for this research are Adult Education, Nursing Practice and Nursing Education. Currently popular adult education theories are grounded in social constructivism (Merriam, Caffarella, & Baumgarther, 2007) and expressed through a psychological and/or sociological lens, making direct accessing and application of recent neuroscience findings difficult. This study’s use of a complexity science framework and a model derived from neuroscience can serve to expand adult education theory. In particular, the Interpersonal Neurobiology model (Siegel, 2001) is derived from the neuroscience of learning in interaction with one’s environment, which includes learning through fear, and embraces a conception of learning through the entire nervous system (not just the brain), therefore whole body learning. This model and the bodies of research with which it is connected have great potential to contribute to adult education’s understanding of somatic learning, embodiment, and holistic learning, all of which are recent interests in the field and as such remain relatively unresearched. Since the Interpersonal Neurobiology model (Siegel, 2001) posits that learning through fear is an essential part of every organism’s learning in interaction with its environment, this research can contribute to an understanding of how fear develops in learning situations, is carried into learning situations, and how it is manifested there. This research also can contribute to the development of pedagogies that lead to more inclusive learning environments through understanding these dynamics. Some initial interest in this topic appears in the adult education
literature (Perry, 2006; Zull, 2006) but there is no empirical work in education, so this study can help to fill this gap.

In health care professions it is expected that practitioners will be exposed to physical and psychological trauma in the course of their work, and these situations will be potential arenas for learning through fear, with all the consequent physiologic changes it entails Therefore it seems prudent to plan for this reality in the educational preparation of these practitioners, teaching them to recognize their own bodies’ mapping of fear learning and trauma, to understand the science underlying these changes, and to know methods of ameliorating these changes as a form of preventive medicine. This knowledge can then be shared with other health care professionals and with patients. In turn this could contribute to a reconceptualization of learning as a whole body process, not merely rational, with results unique to every individual. Such understanding could necessitate a qualitative change in our efforts to improve health literacy. This research initiates a beginning understanding of these processes and can provide a basis for other research on pedagogical practices to advance this goal.

Assumptions and Limitations

As in any study, this study is based on specific assumptions, and also has limitations as well as strengths.

Assumptions

Certain assumptions must be made in relation to the selected theoretical framework and the conduct of this specific study. These are:

1) Consistent with organismic biology, this study assumes that all living systems (including human beings) are made whole through self-organization, a pattern of relationships
consisting of complex networks that communicate, self-replicate, and recreate themselves in new forms.

2) Consistent with complexity science, this study assumes an expanded form of systems thinking: that all complex systems, not just living systems, have structural and behavioral commonalities.

3) Similar to organismic biology, systems thinking underlies contemporary neuroscience.

4) Learners are themselves complex adaptive systems capable of adapting to new situations presented in a dynamic environment.

5) Learning consists of formation of patterned connections, usually as self-organization, through simultaneous biological and behavioral (therefore structural) transformations in the learner.

6) Practicing Registered Nurses as students had experienced structural transformations or trauma through fear learning/survival learning before arriving in the higher education classroom.

7) Practicing Registered Nurse students would be honest in their self-appraisals and reflections on learning as manifested in their bodies and would be willing to share and examine this information in a clinical lab class setting.

Limitations and Strengths

There are three primary limitations to this qualitative study using mixed methods of data collection. First is the small sample size (N=16) which limits the statistical tests which can be used for quantitative data analysis and generalizeability of those findings. Only descriptive statistics and measures of correlation are possible. No measures of difference. Since this study uses mixed methodology this limitation is of less concern than in a purely quantitative study
which would seek generalizeability. Second, the qualitative findings are by definition unique to this group and not generalizeable, but because systems thinking tells us that what appears to be highly unique individual pattern within a local group is actually being replicated many, many times over a large scale (Camazine et al., 2001), the findings can be instructive to those that work in similar settings. Third, my positionality as a middle-class, Euro-American female faculty member, with a history of diagnosed post-traumatic depression and psychiatric consultation practice, could both limit and enhance my ability to analyze the data and understand multiple perspectives from my students. These limitations are reflections of the complex nature of the problem and are addressed through design and methodology. Nevertheless, in spite of these limitations the study offers particular strengths in that it will initiate a research based link between adult education theory and neuroscience based applied research in other fields, building the theory base for future research on embodied learning and other holistic pedagogies. It also demonstrates the utility of complexity as a research lens in adult education, opening the way for creative interdisciplinary linkages with other ideas from science, and any discipline that communicates through the complexity metaphor.

Organization of the Study

This study opened by specifying the background of the research problem, the purpose of the study and guiding research questions in Chapter One. It also included a description of the theoretical framework, overview of research methodology and design, the study’s significance, assumptions, limitations, and defining terminology. Chapter Two will provide a review of the literature while Chapter Three details the methodology and procedures that were executed in the research process to collect and interpret the data. Chapters 4 thru 6 present integrated qualitative and quantitative data analyses around themes. The focus in Chapter 4 is fear and
trauma learning as they occur in nursing’s natural environment. This establishes the context for the study and identifies participants’ intrinsic dynamics around workplace stress. Chapter 5 focuses on the key processes of embodied learning, beginning with participants’ intrinsic dynamics around body memories and stressful life experiencing; then exploring their self-organization in response to the disturbance of a new form of learning and in connection with the patterns of stress mediated neurobiological change being expressed through their bodies; and finally identifying their patterns of integration around body memories through embodied learning. Chapter 6 attends to learning outcomes, expressed as personal outcomes involving interoception, preferred learning style outcomes, and outcomes related to professional clinical practice. Due to the complex nature of the questions and data analyses these chapters intersperse theoretical discussion and some interpretation. Chapter 7 concludes with reconnection to theory, broad interpretation of patterns in the data, and discussion of implications.

Definitions of Terms

Certain working definitions will be useful in applying this different way of understanding learning and meaning making. Following the lists of terms, Chart 1 (p. 37) provides a categorized list of neuroscience and complexity authors referenced in this study. For clarity, the terms are separated into two groups, but the groups are interconnected between the two lists.

**Terms Related to Trauma and Embodiment**

*Embodied Mind* - The personal neurobiology that supports this dynamic learning is heavily influenced by the brain (its structures, chemistry, and electricity), which is considered a dynamic systems in its own right, operating according to principles of complex systems. These structures and processes give rise to the mind, which is an embodied mind, meaning the mind
actually arises throughout a lifetime of neurobiologic development, a recursive process that requires interpersonal interaction and emotion to create coherence (Kelso, 1995; Siegel, 2001).

*Extinction Learning* – Conditioned learning linking positive stimuli to the triggers previous conditioned to evoke a fear response. These provide an alternative pathway that can be co-triggered with the fear response under highly specific contextual conditions (Quirk, Milad, Santini & Lebron, 2007).

*Fear Learning* – (fear conditioning) our adaptive fear response, evolved as the predatory imminence continuum, excessively activated with mild stress following pre-exposure to intense stress in a related context; A permanent conditioned association poorly reduced by content dependent extinction (Bouton & Waddell, 2007; Rau & Fanselow, 2007).

*Survival Learning* – A characterization of traumatic stress responses as a normative survival overdrive state, rooted in the archaic, durable single-event learning (fear learning) that occurs in relation to perceived novel threats to life (Silove, 2007).

*Trauma* - Overwhelming life experience which affects both body and mind creating suffering. One’s biology, conception of the world, personality are all intertwined with all experience. The organization of experience and assignment of meaning occurs over time. All people can be stressed beyond endurance, overwhelming their capacity to cope (van der Kolk, et al, 1996).


*Trauma learning* - Learning that occurs in a situation in which the person perceives themselves to have little or no control. The potential exists of being overwhelmed beyond
endurance or their capacity to cope. There may be the possibility of humiliation and fear
learning may be present.

Traumatic stress disorder - The core issue is inability to integrate the reality of a
particular experience with other events. There is no coherence. Disorder is present when people
begin to organize their lives around the trauma and what began as an experience within society
comes to have secondary biological consequences which are entrenched (van der Kolk, et al,
1996).

Terms Related to Complexity and Neuroscience

Coherence – Coherence characterizes emergent structures in self-organizing systems.
Coherence is meaning that incorporates past, present, and future, not in a necessarily linear way,
and not through verifiable truth, but in a connected way that ‘feels’ whole and complete to the
person. The patterns of connection that form the coherence are expected to change over time,
because each person is a dynamic system. Coherence is often understood as a kind of narrative
of the life of each embodied mind. Unlike most uses of ‘narrative,’ the concept of coherence
exists across time and space and is non-linear. It encompasses future, past, and present, but
doesn’t require a chronological beginning, middle, and end. Coherence is sense-making that is
non-linear (Goldstein, 2008; Siegel, 2001).

Complexity - a flow of states of activation between extremes of sameness and variation,
order and chaos; attained within a system’s changing states by combining differentiation with
integration. Systems moving toward complexity are most stable, flexible, and capable of a wide
range of self-organizing processes (Siegel, 2001)

Complexity Science – expands systems thinking derived from organismic biology to
non-living systems because they too are dynamic systems and adaptive accomplished by adding
knowledge from chemistry, physics and mathematics. The theory assumes that all complex systems have some structural and behavioral features in common and can be modeled mathematically (Capra, 1996; Thelen & Smith, 1994).

**Complex Adaptive Systems** – complex, non-linear, interactive system that has the ability to adapt to a changing environment; characterized by emergent phenomena, continuous and discontinuous change, and unpredictable outcomes. Examples include living organisms, the nervous and immune systems, and society (Goldstein, 2008).

**Development** - Movement toward ever more complex states of processing over the lifespan. These complex states are not necessarily more busy or intricate. They are often quite elegant in their simplicity of rules.

**Differentiation** – component parts of a system being distinct and well-developed in their own uniqueness (Siegel, 2001).

**Dynamical Systems** – complex, interactive systems that evolve over time, through multiple modes of behavior, following certain rules and showing increasing complexity. This evolutionary process can show transformations of behavior. These changes in organization and behavior are called bifurcations. The systems are deterministic but influenced by random events (Goldstein, 2008). The human dynamic system is always on the move, its activity dependent on the here and now, the just-previous activity, and the history of the system as a whole (Thelen & Smith, 1994).

**Integration** - Clustering of distinct, differentiated components into a functional whole. This process allows the movement to higher states of complexity. So moving to higher states of complexity is not drawing lines to connect all the visible dots. Higher complexity is rearranging the component parts, clustering and chunking them so they fit together in a new way that allows
them to function as a whole. The components do not have to lose their differentiation, but they become more useful through connection. Sometimes the satisfaction of functioning with the whole makes differentiation no longer desirable or necessary. But at some point there will always be new differentiation (Siegel, 2001).

*Intelligence* - the ability to adapt by fitting behavior and cognition to the changing context. Smart systems shift behavior slightly to fit contextual nuances or radically jump to an all-new state when necessary (Thelen & Smith, 1994).

*Intelligent Dynamic System* - one that is always on the move and living in a state far from equilibrium, responding to multiple sets of underlying rules for multiple contexts. This is the place where change happens, and these systems can move in and out of almost-stable states of dramatically different kinds with small amounts of energy (Kelso, Scholz, & Schoner, 1986).

*Interpersonal Neurobiology* – an integrative theory of mind as developing at the interface between human relationships and the unfolding structure and function of the brain (Siegel, 2001).

*Interoception* – a neurophysiologic term referring to the vague feelings, sensations, muscular sense that exists at the edge of consciousness (Sherrington, 1906).

*Knowledge* – From a dynamic systems, view all knowledge is context dependent, having developed out of the specifics of the here and now. It is always connected with both the present and past because it is a trajectory of activity that depends on both the past and the current. Knowledge emerges in the act of perceiving and what is known at any time depends on the history of experiences contained in acts of perceiving and activating. The understanding of possibility is contained in the specifics of how that knowledge was obtained (Thelen & Smith, 1994).
**Learning** – emergence and stabilization of spatiotemporal patterns (Kelso, 1995) as an organism evolves to greater complexity through connectivity, the source of internal coherence at every systems level, and an example of co-creation. (Stanley, 2006). More than strengthening of memory trace or synaptic connections, it changes the whole system which passes from one organized state to another rather than from disorder to order (Kelso, 1995).

**Meaning-Making** - Making meaning then is understood not as bringing order out of chaos, but as working across both chaotic and ordered states to form new patterns by connecting things that have not been connected in that way previously. Meaning-making would be a product of self-organization.

**Neurons** - these basic cells of the nervous system function by the flow of electrical activity through one neuron and across a synapse (space) to functionally connect with other neurons when the sum of inputs exceeds a threshold, creating a spider-like web of neural connections throughout the body. The strength of these couplings is proportional to activity on both sides of the synapse (Hebb’s rule) and can be changed by learning (Kelso, 1995; Siegel, 2001).

**Pattern Formation** - is the process of connection by which a system changes in response to environmental or contextual demands. Multiple connections made among constituent parts create patterns which increase system complexity and can result in structural change (Kelso, 1995) Pattern formation is also learning, of all kinds; making connections (between experiences, sensory awareness, memories, states of consciousness, ideas, images, emotions, stories, other people, etc.). There are 5 ways that patterns are formed, or learning is accomplished: Following a recipe for simple problems; using a template to create what appears to be an exact replica; following a blueprint to achieve a complicated but specific and consistent
end product; following a charismatic leader; or self-organization (Camazine, et al, 2001). Because it is a natural inherent capacity, self-organization is economical and therefore usually preferred by nature. It is also probably most consistent with the ideals of adult education.

**Self-Organization** – Intrinsic organizational processes generate spontaneous pattern formation through connectivity in systems far from equilibrium; the governing process of all human behavior, from neuron to mind; the basis of learning (Kelso, 1995). The natural process underlying autonomous learning in interaction with the environment. So this is learning through experience. It is a natural capacity inherent to every person, happening through a dynamic process mostly outside conscious awareness, made possible by the neurobiologic processes that constitute embodied cognition. What is being organized through the self-organization is meaning.

This process is a constant flow, in and out of chaotic and ordered states, using the formation of new patterns of connection to make this happen. One specific example is the appraisal of meaning and valuing of stimuli, later elaborated into a differentiated emotional state, that happens through the limbic region of the brain. This region also carries out social cognition, helping us recognize faces and feel a sense of affiliation. These abilities are there long before we have language. We don’t think about these things. They just happen, and they remain a part of our organization of meaning (Kelso, 1995; Siegel, 2001).

**Systems Thinking** – discourses in multiple disciplines based on general systems theory which arose in biochemistry. Systems included living organisms and social systems, integrated wholes whose properties are determined by the patterns of relationships among their parts and within their physical structures. (Capra, 1996).
chart 1. Neuroscience (Neurobiology) in Connection to Embodiment and Trauma

Embodied Cognitive Science: Interdisciplinary field of research (cognitive science, psychology, neuroscience, AI); Draws heavily from Embodied Cognition
Two Primary Strands: Gerald Edelman (Darwin III robots / connectionism) and J.A. Scott Kelso (Dynamic systems approach; holistic modeling of psychological and biological systems and their self-organizing processes, assuming mind/body single entity)


Neuroendocrinology: Study of the role of glucocorticoids, stress hormones and sex hormones in stress and neuronal degeneration. Builds on work of endocrinologist Hans Selye; Bruce McEwen; Robert Sapolsky: Stress, neurodegeneration and individual differences.

Intersections with Philosophy

Neurophilosophy: Philosophical ideas connected to neuroscience research results. Analytic philosopher of science Patricia Churchland through her connection with the labs of neurologist researcher Antonio Damasio; Also husband Paul Churchland, another analytic philosopher of science, with interest in consciousness.

Neurophenomenology: Pragmatic (William James) research program to study consciousness. Combines neuroscience and phenomenology. Studies experience, mind, and consciousness, emphasizing the embodied condition of the human mind. Believes both 1st and 3rd person methods are necessary for full understanding. Alexander Luria, Russian neuropsychologist; Francesco Varela; Antonio Damasio; Oliver Sacks, neurologist. Links to neuro-anthropology, transpersonal psychology, process philosophy.

Intersections with Social Science

Neuroscience and emotion: Damasio’s work on the neural basis of emotion; Joseph LeDoux’s work on the neurobiological basis of emotion, memory, and fear utilizes Michael Fanselau’s body of research on Fear Conditioning and the predatory imminence continuum to understand the development of pathological anxiety in people. This work is extended by Mark Bouton’s lab’s study of fear extinction as a context dependent process. Sapolsky connects here too.

Neuropsychology and consciousness studies (3rd person): Gerald Edelman uses computational and mathematical models such a neural group selection & neural degeneracy to understand emergent categorization. Vilayanur S. Ramachandran, behavioral neurologist, studies neurologic disorders (phantom limb, synesthesia, visual perception disturbances, autism) to understand the processes underlying mental function. Mirror neurons have been a particular focus.

Neuropsychology and development: The Embodiment Hypothesis (Esther Thelen) argues that intelligence is both made in and realized through physical actions in the world. The resultant Dynamical Systems Theory of Human Development states that humans exhibit repetitive, rhythmic, patterned movements. Shifts in the variability of these behaviors, from highly variable and disorganized to organized, mark developmental transitions. Truly skilled action is stable AND flexible, so not overly controlled or repetitive.

Intersections with Clinical Psychiatry

Neurodevelopment: Building on the Embodiment Hypothesis: Schore (attachment theory, affect regulation & trauma) and Siegel (Mind from experience)

Neurophysiology and Neurobiology of Traumatic Events: Bruce Perry, Martin Teicher; both with applications to learning; Derrick Silove: Survival Learning

Neurobiology of Post-Traumatic Stress Disorders and their treatment: Bruce Perry, psychiatric disorders in high risk youth; Yehuda on transgenerational transmission of PTSD; Shalev, Ursano, & Brewin, & van der Kolk on neurobiology of PTSD; Bremner & Vermettin on plasticity of the brain in PTSD
CHAPTER 2

REVIEW OF THE LITERATURE

We conclude here that as all mental activity is emergent, situated, historical, and embodied, there is in principle no difference between the processes engendering walking, reaching, and looking for hidden objects and those resulting in mathematics and poetry. (Thelen & Smith, 1994, p. xxiii)

The purpose of this chapter is to review conceptual and research literature pertinent to this qualitative research study which uses a complexity lens and neuroscience knowledge to explore connections between learning through the body and trauma. Complexity, the science that studies complex adaptive or dynamic systems, such as people, states that a primary characteristic of these systems is the ability to self-organize (Capra, 1996; Kelso, 1995). This is how a complex system learns and changes, by making connections and creating new patterns. The process by which this happens is non-linear and unpredictable. It is full of surprises. Now the reader’s mind is probably waiting for an ordered progression through the concepts of self-organization, learning through the body, and trauma. These are, after all, the concepts of interest as presented in Chapter 1. Our education has trained us to produce clarity with straight lines. But even a cursory examination of the research questions shows that multiple straight lines would be necessary to connect the concepts of interest, and then these must be considered within a context, meaning more straight lines, until it becomes clear that we have a surprising pattern of some sort. If we were to give up the assumption of any straight lines, perhaps what we would discover would be concentric circles or spirals. Therefore, because the problem under study is a complex problem, not a simple or complicated one, and the framework for researching the problem is complexity, the organization of the literature review might not feel intuitive.
Because self-organization, what this study aims to understand, is all about making connections, the patterning or organization of this literature review will demonstrate the connections, or lack of, between the concepts necessary to study of the research questions, within the context of current professional literature. It will do this using three interconnected discussions. Since trauma is a metaphor, its metaphorical presence will be identified within each discussion. The first discussion presents complexity science as a means to reconnect adult education with science and informs as to the theoretical framework grounding this investigation. Because self-organization is central to complexity, exploration of that concept in the literature will be embedded in this discussion which will also explain the link from complexity to selected aspects of neuroscience appearing in education and trauma literature. This closing shift to neuroscience is a foreshadowing of the essential connectivity role that neuroscience will ultimately be seen to play among all of these discourses.

The second discussion makes connections to adult education as it intersects with the research question. This is an emergent discourse so many connections are changeable and weak links at present. Complexity in adult education and the broader education literature is often found to be linked with a specific theoretical perspective of cognition, the Enactivist and an alternative perspective on evolution. Adult education makes weak links from this Santiago model of Cognition to embodiment and neuroscience, where the enactivist perspective is actually grounded. Enactivism is actually one of two neuroscience based theories of cognition related to embodiment. Interestingly there is a strong but primarily implicit trauma presence in adult education. Embodiment is developed in adult education as a social constructivist concept with recognition of a role played by the nervous system, but without direct connection to neuroscience literature. The concepts of holism and health are present but undeveloped in relation to a
complexity lens. Trauma appears through a weak link to feminist theory in education. The focus of neuroscience connections in adult education literature has been the brain, limiting its ability to connect with embodiment. Occasionally weak links through citations to the enactivist cognitive model will hint at complexity. Trauma appears in connection with an evolutionary model of fear responses in connection with the classroom. It becomes clear that there is no way to draw straight lines to connect these dots. The mind wishes for a blueprint. The researcher must choose one of these perspectives, or find a way to illuminate unseen connections by integration. The nervous system can serve as the strong integrative factor because it has been used to study all of these differentiated aspects of the larger adult education discourse.

The third and final discussion of a dynamic systems model and connections through neuroscience helps to situate, within a dynamic systems approach, an empirically derived set of models grounded in a neurobiological perspective which are driving research under a new evolutionary metaphor of trauma. These interlocking bodies of interdisciplinary research grounded in complexity science recognize people and brains as self-organizing systems, constantly changing through experiences, to include trauma. Embodiment is considered inherent to mind. Embodied Cognitive Science, the second theory of cognition related to embodiment is associated with this body of research. (See Chart 2, p.41 ) The conclusion considers how this integrative dynamic systems perspective might cycle back, for example through this research, to activate and strengthen connections among complexity, embodiment, neuroscience and trauma within the adult education discourse and how complexity science and neuroscience can inform ways of knowing in adult education, by interacting with the lively new curiosity about neuroscience and then by supporting the growing interest in post-Cartesian perspectives in learning and teaching, such as embodied learning, spirituality, and narrative.
Chart 2. Evolution of Theories of Cognition in Relation to Embodiment/ Cognitive Science and Human Experience

* Cartesian Dualism (Early Modern Philosophical Idealism)
  Mental function as rule-bound manipulation of symbols

* Cognitivism: Cybernetics, Symbol Processing, Representations
  Mental function as rule-bound manipulation of symbols

* Connectionism (or Emergence) and Computationalism
  Sub-symbolic; mind emerges from brain processes which are interconnected networks of simple units (i.e. neural networks models, providing a link to biological realism); some evolving toward continuous, non-linear dynamic systems modeling. (Edelman’s robots: plasticity of the neural network in response to the environment)

* Alternatives to Connectionism
  All are anti-Cartesian

Influenced by Edelman: neuronal group selection and neural degeneracy

**Embodied Cognition**
(Neurobiology, cognitive science, philosophy, cognitive linguistics, neuropsychology, AI, robotics)
Human mind largely determined by form of the body; cognition shaped by aspects of body. (Bottom-up approach)
Kant, Merleau-Ponty, and others

Gregory Lakoff & Mark Johnson: (embodiment, schema, aesthetic experience) Johnson/Dewey: all abstract thought comes out of the aesthetic aspects of all experience.
Tim Rohrer: How neural embodiment develops and influences acquisition of abstract thinking and language use; relationship of these to perception of physical risk.

**Enactivism**
(Evolutionary biology, Neurobiology, Neurophysiology, Cybernetics, Philosophy, Social Science)
Organisms/human mind organize themselves by interacting with their environments.
Embodiment and action are central to cognition.
Santiago Theory of Cognition (Maturano & Varela)
Embodied Mind (Varela)
Gregory Bateson, Humberto Maturano, Francesco Varela

**Situated Cognition**
(Educational Psychology: Context bound theory of cognition)
Human learning is complex and occurs by developing schemas when interacting with living world.

Greene; Lave & Wenger

**Embodied Cognitive Science**
Interdisciplinary Field of Research to explain mechanisms underlying intelligent behavior. Draws heavily from Embodied Cognition. Two strands:
1) **Edelman** (Biologist): Theory of mind based on plasticity of neural networks in response to the environment; autonomous agent design
2) **Kelso** (Neuroscientist): Creation & evolution of patterned behavior at all levels, neuron to mind, governed by Self-Organization

Esther Thelen: The Embodiment Hypothesis: Intelligence affects and is affected by the physical world; Thelen & Smith: Dynamic Systems Model of Development.
Allan Schore: Connects Embodiment Hypothesis to Attachment Theory, Regulation of Affect, Trauma Theory
Daniel J. Siegel: Builds on Schore: Developing Mind: Neurobiology of Interpersonal Experience
Theoretical Framework

Complexity science is an appealing choice of framework to examine a complex question with many constituent parts, such as the problem and questions posed for this research. But the choice of complexity as grounding theory is significant beyond this particular study because it highlights a problem faced with any adult research question that intersects with natural science. Where does it fit, theoretically? This literature review takes the opportunity to explain complexity science broadly and make the argument that it answers the science gap and is necessary for furthering research on education perspectives that assume mind/body connection.

Why Complexity? A Theoretical Gap in Adult Education

The past few years have seen a surge of interest in ‘the body’, adult education being a reflection of the larger academic community and our society’s interest in the topic. This interest exists within the context of a society that has also been inundated with the theme of trauma. The sense that an objectified body has supplanted our subjective bodies is one driving force behind this curiosity (Brandt, 2007; Kaplan, 2005). Adult education is hampered in advancing this study of the body in learning by its lack of connection with science, forcing an over-reliance on phenomenology, a function of mind, to explain awareness of self. Only natural science looks inside the body and tries to explain the body and mind empirically, offering complementary knowledge rather than a competing paradigm. This review proposes an answer to the science gap in the adult education literature and demonstrates that an embrace of the ‘new science’ (Wheatley, 2006) of complexity which explains holism might actually be necessary for research into other ways of knowing.

This study will be framed through the lens of complexity quite simply because complexity is a science of change. The inclusion of embodiment in nursing clinical courses that was the subject of this study was done purposefully with the hope of promoting change in students and in nursing education.
This new science of complexity incorporates insights from biology, chemistry, physics and mathematics which arose from general systems theory. Complexity principles stress wholeness, self-organization, non-linearity, emergent properties, multiple causality, and sensitivity to original conditions. Since these principles are being studied and applied, concretely and metaphorically across multiple disciplines outside their disciplines of origin, this is an obvious choice as framework in a study that seeks to understand what can’t be easily observed or described: knowing and learning through the body, making use of science knowledge about the unobservable: neuroscience, to notice emergent properties of learning in that which can be observed and known through interaction: the student.

Progressivism had a tremendous impact on early adult education (Elias & Merriam, 2005). Grounded in pragmatism, a distinctively American philosophy rooted in the writings of contemporaries Charles Peirce (logical validity approach) and William James (metaphysical personal approach) who embraced Darwin’s theories in the late 19th century, progressives identified human beings as naturally evolving in concert with their evolving world (Kuklick, 2001). They accepted the scientific method as useful for solving real world problems; acknowledged that worldviews are both relativistic and pluralistic; centered human experience as the legitimate source of knowledge; emphasized social reform; saw truth as changing and created in real life events; identified the human mind as a product of the environment through an accumulation of sensory data. These ideas came to their fullest flowering in education through John Dewey (humanistic approach) and vestiges of these ideas are still evident in social constructivism and radical educational philosophies. Dewey is the source of critical and reflective thinking and service education. But today, there is more skepticism about science. Much has been written about the failures of democratic education, post world war disillusionment, and the changes wrought by loss on philosophical thinking, and by extension, to education and the popular
culture (Homans, 2000; Kaplan, 2005; Kuklick, 2001; Mintz, 2001; Novick, 1999). The progressive movement receded and American pragmatism evolved into the philosophy of science. It is to this now unpopular and uncomfortable space, this existing theoretical gap, that we must return for an educational philosophical foundation for complexity science (Doll, Fleener, Trueit, & St. Julien, 2005; Elias & Merriam, 2005; Kuklick, 2001).

For any educator who practices in a science based discipline such as the health care professions, it is necessary to have an appreciation of natural sciences. This includes the beliefs that natural sciences make valuable contributions to our understanding of the world we live in and that the application of scientific findings can improve people’s lives. To science accustomed eyes, the world of adult education philosophy appears hostile, since the most prevalent current philosophies do not embrace natural science or they explicitly reject it.

As neuroscience makes its way into education theorizing, it will be useful to have a philosophy that allows direct connection with natural science. Neurophilosophy exists at this interface (Churchland, 2002). Churchland now proposes that since philosophy integrates theory across domains it belongs on a continuum with science, involving a pragmatist re-describing of metaphysics as that which addresses questions in their pre-scientific phase. She notes this is consistent with the ideas of Charles Sanders Peirce and W.V.O. Quine and is a view antithetical to a priori philosophy, which believes that pure reason and reflection can resolve questions without scientific exploration.

\textit{Self-Organization Revealed in an Overview of Complexity Science}

Complexity science is the study of complexity theory, a form of systems thinking. Arising in biochemistry the theory described systems as living organisms and social systems, integrated wholes whose properties were determined by the relationships among their parts. Systems thinking meant contextualizing so that an organism was always understood as existing through relationships within the
greater whole (Capra, 1996, p.27). This holistic, organismic perspective which contrasts with older mechanistic models of science emerged simultaneously in all sciences and other disciplines in the 20th century. This is not vitalism, which also asserts holism but requires that a non-physical entity, or force must exist to understand life. Organismic biology says that the patterns of relationship within the physical structures of living systems are what make them whole. This pattern of relationship has been refined to the concept of self-organization in which systems consist of complex networks that communicate, self-replicate, and recreate themselves in new forms. The essential properties of an organism are properties of the whole, not possessed by the parts, so life cannot be studied through reductive methods. The theory assumes all complex systems have structural and behavioral commonalities and can be modeled mathematically, for example as fractals (Capra, 1996). Therefore a neural networks scientist might theorize productively with an evolutionary biologist, an economist, a business manager, and an adult educator.

**Disciplinary Contributions From Natural Science**

Complexity science enfolds intersecting knowledge from the natural sciences and mathematics. Each discipline has made its own individual contributions to knowledge development which are now shared across disciplines. A brief genealogy of complexity science knowledge is given here identifying each discipline’s major contributions.

**Biology basics.** Both physical and biological systems (sand grains, chemical reactants, cells in tissues, schools of fish) are self-organized through complex patterns. These self-organizing systems obtain their order and structure through something inherent to themselves, interactions based on some mutual understanding by parts that results in patterns, without the need for external directing influences. Systems that lack self-organization or the capability to self-organize can have it imposed (Camazine, Deneubourg, Franks, Sneyd, Theraulaz, & Bonabeau, 2001). Self organization is perhaps
the most central concept of systems thinking. “The pattern of life … is a network pattern capable of self-organization” (Capra, 1996, p. 83). So living systems are self-ordering, but not all self-ordering systems are living.

Camazine et al (2001) provide an essential definition:

Self-organization is a process in which pattern at the global level of a system emerges solely from numerous interactions among the lower-level components of the system. Moreover, the rules specifying interactions among the system’s components are executed using only local information, without reference to the global pattern. …

Pattern is a particular, organized arrangement of objects in space or time. … in some cases the building blocks are living units and in others they are inanimate objects such as bits of dirt. (p.8)

*Physics and chemistry basics.* Systems thinking emerged in physics as quantum physics with the realization that matter reduces to waves of probabilities at the subatomic level. Heisenberg’s uncertainty principle expressed that subatomic particles cannot be understood in isolation and require understanding of their interrelations. These probabilities are determined by the dynamics of the whole system (Prigogine, 1996), an idea later extended to the concepts of perception in psychology and communities in ecology.

Some of the most sophisticated understanding of self-organization has come through Prigogines’ (1996) work in physics on dissipative structures where change and stability co-exist, paradoxically. These structures exist far from equilibrium states, in high degrees of chaos. Living systems are dissipative systems, but not all dissipative systems are living. Prigogine saw the connection with non-linearity and used non-linear equations to describe his observations. Through this work we now understand that self-organizing systems create novel structures and new forms of behavior in the processes of development, learning, and evolution. These open systems require a constant flow of energy and matter through them, and the newness occurs only when they are far from equilibrium. System components are connected in non-linear patterns which create feedback loops,
describable by nonlinear equations. What Prigogine discovered is that self-organizing systems, far from equilibrium, reach a critical point of chaos at which they spontaneously self-organize into a new, ordered pattern. When the energy and matter flow increases through these dissipative structures, far from equilibrium, new instabilities can be created, and they can evolve by transforming themselves into new structures with greater complexity (Prigogine & Stengers, 1984).

For example, heat, of some sort, continually flowing through a system can induce restructuring into interlocking honeycomb cells, which Prigogine named ‘Benard cells’. Chemical clocks are another widely occurring phenomenon associated with far from equilibrium chemical reactions. Under some conditions these clocks organize to produce periodic oscillations from one observable trait (like color) to another. Under other conditions they may produce waves of activity with the appearance of interlocking spirals. These phenomena occur throughout nature at different systems levels. A key finding for Prigogine was that dissipative structures receive their increased energy from outside. Fluctuations amplified by feedback loops are what create the instabilities and jumps. Therefore, the amplification of runaway feedback, rather than being destructive, turns out to be a new source of order and complexity. At least this is true for dissipative structures, structures far from equilibrium in which structure and order are paradoxically close to dissipation (Prigogine, 1980).

**Mathematics basics.** The mathematical theory which explains the non-linear network connectedness of self-organizing systems described by complexity theory is most often called dynamic systems theory, two important branches of which are chaos theory and theory of fractals. It is a qualitative mathematics of relationships and patterns. Moving beyond Descartes’ analytic geometry and the calculus (equations of motion) of Newton and Leibniz, Maxwell’s discovery of statistical analysis as the explanation for thermodynamics gave an explanation for complex systems and made it possible to reveal the patterns of order underlying the seeming chaos of non-linear systems. Because
prediction of non-linear equations is often impossible, qualitative analysis has come to be preferred over quantitative in these cases. Non-linear systems consist of self-reinforcing feedback loops which amplify the effects of change, so that small changes can result in large effect sizes. This creates the instability that leads to sudden emergence of new forms in transformative self-organization. What happens mathematically is that a feedback loop functions as an iteration, or repetition, a non-linear process operating repeatedly on itself through repeated multiplications. Each step of this process is recognized as a mapping, some of which produces tremendous complexity. This unpredictable process of increasing complexity is known technically as chaos (Capra, 1996; Schroeder, 1991).

Movement within a non-linear system’s feedback loops occurs along a trajectory, an inward spiral, called by the metaphorical name attractor because the fixed point at the center of a coordinate system appears to ‘attract’ the trajectory. The many attractors, or trajectories of movement, within a non-linear system, can be either chaotic (also referred to as strange) or non-chaotic. Mathematical analysis consists of identifying the movement patterns of these slowly changing attractors (the phase portrait). Attractors can suddenly appear or disappear or change into each other, so these systems are structurally unstable with critical points of instability called bifurcation points because here the system evolves by suddenly branching in a new direction with a new form of order which alters the phase portrait. The complexity of such irregular shapes which occur in the natural world is described by the Mandelbrot’s mathematics of fractal geometry which, through computer modeling, has allowed us to see that the self-similarity of pattern within pattern exists throughout nature. These complex structures are ordered by a few simple rules give rise to complex shapes (Capra, 1996; Schroeder, 1991).

Becoming Transdisciplinary

With the discovery of new mathematics and more powerful computers (Gleick, 1987), intricate patterns of intertwined webs could be analyzed and theorizing exploded as scholars from all
disciplines, biology to economics, communicating through mathematics and metaphor at places like the Santa Fe Institute (SFI), strove to apply an evolving understanding of how life is organized (Waldrop, 1992). Through integration of all the strains of research that have just been described, then testing and application transdisciplinarily at private think tanks and government research centers, systems thinking is now pervasive in our world. As a result, this new science which identifies common principles in the behavior of chemical reactions, weather, markets, and brains is labeled variously as the study of dynamic, synergetic, dissipative, nonlinear, self-organizing, or chaotic systems (Thelen & Smith, 1994).

A useful example of transdisciplinary concept sharing is that of ‘weak links’ (Csermely, 2006). Several disciplines observed that weak links stabilize complex adaptive systems. They are the glue that holds systems together, much as glial cells do in the brain. The biochemist Csermely synthesizes this work raising questions about weak links at all systems levels. His curiosity was piqued thinking about morphologic (tissues shape) diversity which occurs with inhibition of proteins, a process that is buffered by chaperones, a sort of altruistic protein that helps out wherever it can. Stress also induces morphologic diversity through damaged proteins at the molecular level. The ‘diversity’ is revealed in the damage. Chaperones become occupied trying to fix them, resulting in a different form of inhibition. Interestingly stress induces multiple forms of diversity at all other systems levels, where the identity and behavior of ‘chaperones’ is less well understood. Chaperones are sticky hubs within networks, but they stabilize networks with their generalized affinity. They have weak links to a multitude of network components/partners and through dynamic, changing linkages they help the partners change. These links, explained in conjunction with self-organized criticality, can be used to understand aging and disease, partnerships, why its good to relax, and how women might be
Positioning himself at the biology, chemistry, physics interface and communicating with economics in true transdisciplinary fashion, evolutionary biologist Kauffman (1993, 1995) teaches that natural selection alone can not explain evolution. Self-organization is required. He explains order/chaos tension in living systems through a mathematical model of binary networks. Network nodes have variable input and connectivity to other nodes, increased connectivity leading to greater chaos. The behavior of these networks is either ordered with frozen components which cannot be impacted by the lone pockets of chaos (extreme hegemony?); chaotic with no frozen components (anarchy?); or fluctuating in the boundary region between chaos and order where frozen components can only begin to melt. Living systems exist in this boundary region. Kauffman (2000) now concludes that life is an emergent collective behavior, the creative product of complex chemical networks. Autonomous agents are those that are adept at natural games, which have evolved along with them, and they use these to act on their own behalf to make a living in the environment. A biosphere then is co-evolutionary construction between the autonomous agents and the natural games. Those well searched by genetic mutations and recombinations proliferate. Those that cannot provide niches for developing slight variations of the game will not survive. Clearly, we are operating here in a new space.

To understand all of this unfolding complexity of co-evolution, the conditions of which can not be pre-stated, we need stories … We can nevertheless tell the stories as it unfolds. Biospheres demand their Shakespeares as well as their Newtons. We will have to rethink what science is itself. And C.P. Snow’s two cultures, the humanities and science, may find an unexpected inevitable union. (Kauffman, 2000, p.22).

Before starting the section linking to adult education through philosophy, Chart 3 (p. 51) provides an overview that will help to make connections visually.
### Chart 3. Outline of Theoretical Sources and Their Interconnections

**Philosophical Intersections with Science, Neuroscience and The Body**

#### Early Modern:

**Concerned with Relations Between Experience & Reality; Nature of Mind**

- **Descartes (Dualism)** ……...…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..…..….

**Kant** (Reconcile Newtonian Physics & Metaphysics)

#### 19th Century:

**Rejection of Idealism**

- **Peirce & James Initiate Pragmatism**
  - (Anti-Cartesian, Naturalism, Darwinism; 3rd Person; Bring philosophy in line with scientific method; Practical consequences vital to meaning & truth; truth emerges from the intelligent organism’s successful struggle with the environment)

- **[Husserl Initiates Phenomenology**
  - (Method of inquiry of everyday experience; 1st person, Perception, Intuition, Lived-Body, Empathy, Life-World; Ego transcends world)

#### 20th Century:

**Schools of Contemporary Western Philosophy**

**Analytic**

- (Integrate Philosophy with Scientific results; Quine, Wittgenstein)

**Pragmatism**

- **Dewey** – Theory & Practice Inseparable
  - Theorizing integral to intelligent practice
  - Quine, Wittgenstein

**Continental**

- **Rejection of Scientism**
  - Bachelard – Philosopher of Science
  - Historical / Contextual approach to Science; ontology of relations, Likeness to ‘process philosophy’; Intuition is built from complex Interactions.

- **Existential Phenomenology**
  - **Merleau-Ponty**
  - Heavily influenced by Bachelard

**Phenomenology of Embodiment**

- **Mark Johnson: Embodied Philosophy**
- **Timothy Rohrer (Johnson’s former student)**
- **Philosopher of Cognitive Science**

**Neurophenomenology: Scientific Research Program**

- addressing ‘hard problem’ of consciousness in Pragmatic way; experience, mind, and consciousness; Embodied condition of human mind.
Complexity Connects With Education Through Philosophy

“One’s educational philosophy is imbedded both in what one believes about teaching and learning and what one actually does in their practice” (Tisdell & Taylor, 1999).

Just as personal understanding begins in acknowledging beliefs, theoretical understanding requires knowing philosophical antecedents. Complexity, as science can not be slipped simply into education’s primarily social constructivist philosophies, so some searching is required to uncover complexity’s philosophical family tree and connect it with education.

Philosophical Genealogy of Complexity

In true liberalist fashion, one group of education complexivists (Doll et al., 2005) looks back to the Enlightenment for their roots and finds a dissident, a bifurcation from intellectual history. Giambattista Vico wrote a philosophy of history from an evolutionary viewpoint and predicted a New Science which warned against the tendencies of Enlightenment thought, turning the movement’s criticism upon itself, and using scientific methods to show the dangers of scientific method. An anti-Cartesian, he argued that truth and history are cognitively constructed. His history was cyclical representing interactions of cultural activity and consciousness with movement through three stages driven by class struggle. Cultures run their course and continue to degenerate until they recover the spontaneity of the primal mind. He saw rationality as poisonous to cultures because it disrupts their coherence (Bergin & Fisch, 1968). A few centuries later Charles Peirce picked up on this rejection of Cartesian rationalism and initiated philosophical pragmatism. He believed that all learning is prefaced by the desire to learn, making method inconsequential, and requiring education to bring forth the struggles of one’s own imaginative process using reflection. With pragmatism, the value of an idea lies in the consequences occurring when the person acts on the idea. Action and doing, consequences
and purposes are reiterated in the process of personal evolution. Dewey drew heavily on Peirce in developing his ideas about praxis and his conception of logic as a matrix of inquiry, with forms and standards emerging rather than being imposed from outside (not unlike a neural network). Pedagogy is performative process and curriculum is emergent. Fluid habits in dynamic interaction between learner and educator create new knowledge and new forms (Doll et al, 2005; Davis & Sumara, 2006).

The other philosophical influence comes from post-perspectives. Post-structural critiques resonate with complexivist notions of self-organization, self-maintenance, mutual specification of agents, adaptation, and nested organization which fit well when the system of interest is culture, body politic, and bodies of knowledge (Davis & Sumara, 2006; Wells, 2004). The other strain is constructive postmodernism, which rejects concepts of an essential human nature and of reason as an a priori human capacity. It denies that social progress can be achieved by applying social science theories to institutions and distrusts meta-narratives. Postmodernism endorses heterogeneity, difference, fragmentation, and indeterminacy. Notably these are qualities possessed by living systems as defined by complexity science. As postmodern inquiry, complexity science is a perspective on meaning, not a collection of techniques. Science (and complexity by extension) is redefined as meaning system, in close alignment with spirituality, relationship, and interdependence. The logic of relationship and experience take precedence over logic as abstract form. Here there is intersection with Wittgenstein’s theory of meaning, seen as an extension of Dewey’s pragmatism (Davis & Sumara, 2006; Doll, et al, 2005; Karpiak, 2000; Wells, 2004). Chart 4 (p. 54) shows the intersection of philosophical approaches to neuroscience research.
Chart 4. Two Approaches to Studying Embodiment Through Neuroscience

**Embodied Cognitive Science**
- Study of ‘intelligent behaviors’
- 3rd Person, Bottom-up, Holistic methodology
- Grounded in philosophical Pragmatism; uses other philosophy eclectically
- Robotics Branch
- Brain as Dynamic System Branch
- ‘Embodiment Hypothesis’
- Movement Central to Survival
- Psychoanalysis Human Development PTSD
- Sensorimotor / Somatic Therapies
- Across paradigms and around emotion, development, and trauma

**Neurophenomenology**
- Study of Embodied Condition of Mind
- 3rd Person and 1st Person Methodologies
- Pragmatic approach to research;
- Grounded in phenomenology
- Links emerging neuroscience understanding to personal experience to enhance understanding of both
- Development of 1st Person methods

**Neurodynamics / Neural Field Theory**
- Non-linear dynamics, Complexity Theory,
  Statistical Physics
- Spatio-temporal dynamics of self-organizing behavior
- Influenced Both
  Hebb, Sherrington, Varela, Merleau-Ponty
- Autopoiesis and Interior awareness
- Development of 1st Person methods

**Neuroendocrinology**
- Stress
- Neurodevelopment Understood as Context by Both

**Neuroanthropology**
- Brain and Culture

**Philosophy**
- Watch and make connections to neuroscience results: Analytic
- Inform the conversation during research: Merleau-Ponty Philosophy of the Body / Existential Phenomenology
- Integration into evolution of interdisciplinary research program: Pragmatism: Philosophy of Cognitive Science
Neurophilosophy as Complex Pragmatism

The emerging integrative perspective, Neurophilosophy, exists at the interface of philosophy and science (Churchland, 1986, 2002; Bechtel, et al, 2001). Philosophically pragmatic, it views philosophy and science on one continuum that is more iterative cycle than it is linear or hierarchical. On this continuum, metaphysics addresses questions in their pre-scientific phase. As science finds answers to these questions it simultaneously uncovers new questions which metaphysics explores until they are fleshed out well enough for science to study them. Both metaphysics and science have their own internal, iterative cycles of self-questioning in response to new understandings. Both are necessary and function best in connection with each other (Churchland, 1986, 2002; Edelman, 2006).

Both Churchland (2002) and Bechtel (1993, Bechtel et al,2001) write harmoniously with complexity science. Churchland grounds her work in the systems-level neuroscience approach of her tutors, Antonio and Hannah Damasio. She describes the brain as a complex dynamical system and calls on this model to explain how brains represent and their qualitatively different functioning (2002, p. 78,205,218,274). Free will is described with the metaphor of dynamical systems (Churchland, 2002, p.205, 230) and she calls to quantum mechanics as she argues that “causality and unpredictability are entirely consistent” (p. 206). Holons appear in her discussion of research into the holistic characteristics of face recognition (Churchland, 2002, p. 298).

Bechtel et al. (2001, p.7), in marrying philosophy to cognitive neuroscience, resonate with complexity through “naturalized philosophy” which sees mind and brain in natural world (not miraculous or supernatural) and recognizes that biological, evolutionary, and environmental pressures have helped shape them. They address challenges such as whether the computational model of brain processing whose cognition requires a “language of thought” (Bechtel, 2001, p.
or language-like representations will be replaced by a neural networking model or connectionism which characterize cognition as based on patterns of activation, or distributed representations, and if dynamical systems theory is the best explanation of such holistic, emergent features in these systems. An overview of the intersecting philosophies that appear in discussions of complexity, neuroscience and especially embodied cognitive science was given in graphic form in Chart 4 (p. 54).

Specific Critiques of Complexity Science

Unfortunately, complexity thinking is often presented in ways that suggest a metadiscourse. This is challenged as misconception by arguing that complexity science is not an explanatory system. Part of its appeal has been the enhanced recognition of similarities across disparate phenomena, suggesting answers to questions that rely on analogy and metaphor. It is transphenomenal, transdisciplinary, and interdiscursive. It has to be all of these because it studies phenomena at the level of emergence. Its great value lies in its connective power making conversation possible between disparate perspectives often leading to unimagined developments. To attain the status of metadiscourse would freeze other discursive activity and decrease connectivity, which from a complex adaptive systems perspective would suggest a dying system (Davis & Phelps, 2005; Davis & Sumara, 2006).

A second strain of criticism is posed indirectly by feminist debates about science in general and evolutionary biology in particular. Decades of feminist critiques of Darwinism have not been concluded, but some of the arguments are defused by new biological findings requiring modifications to Darwin’s original theses (Kauffman, 1993 & 2000, on self-organization). Other lines of argument have been challenged as logical fallacy in that theory about organic life cannot be invalidated by arguments noting its congruence with aspects of capitalism.
Likewise, to equate Darwinian theory with social Darwinism is a fallacy of logic. There is general agreement on all sides about the data regarding female behavior in sexual choice. The debates arise around the meaning of this behavior. Since meaning can only be interpreted and not empirically demonstrated with animal behavior, any interpretation might be on equal footing with Darwin’s and all theorizing is welcomed. The theorizing can not invalidate evolutionary theory (Vandermassen, 2004). Conflation of evolutionary biology and evolutionary psychology also muddies this water (Kaplan, 2006). More interesting are the discussions about a feminist science. While acknowledging the presence of misogyny in science, Longino (2005) declares that calls for a women’s values inspired interactionist science will not be taken seriously because holistic and interactionist research programs (complexity science) already exist, albeit mostly in the hands of men, since men predominate in science. She notes that claims to a feminist science characterized by complexity, interaction and holism, are branded as weak and non-mathematical, presumably because this ‘science’ is sourced in a feminist perspective rather than in science and mathematics (as is the comparable complexity science). Longino expresses support for a feminist congruent model, chosen deliberately based on political considerations. This is Edelman’s neurobiology model, which replaces a linear brain model with a much more complex and interactive one of a self-organizing and self-modifying unit. Desirable because it allows for agency and validates subjective experience, it is praised elsewhere for producing research which confounds the often assumed immutability of sex and sexual difference presented in some cultural theories (Hird, 2004).

*Complexity Implicit In Adult Education Theory*

Complexity science concepts are implicit in adult education, just as they flow through popular culture. They should be made explicit because 1) the transdiscursive nature of
complexity science could promote transformative theoretical developments in adult education and 2) by identifying a continually evolving source of this knowledge in science, adult learners and adult education academics are empowered to access and interpret this knowledge for themselves.

Assuming that learning is about evolving to greater complexity via pattern formation, then ultimately integrating into new patterns of organization, it is essential to understand the ways organisms achieve pattern formation. Camazine et al (2001) explain that in nature, self-organization is often preferred over the other four methods found in nature. Self-organization requires few resources or rules. Especially in large groups, the other four alternatives are extremely difficult to use. The first, leadership by central authority, requires personal abilities and resources that are rarely available. The second, blueprints, are in short supply and require instructions, so demands for native cognitive ability are high. The third, recipes, only work for individual projects and impede cooperative effort. And finally the fourth, templates, are rare so we need to accept that only through engagement with our environment and other people can we ‘see’ the forms to which we must respond and know what our contribution is to be. It is no wonder that natural selection prefers self-organization. Control is embedded within situations, arising naturally and in complex forms out of simple interactions that make up life. This control is lively, dynamic, highly variable and we help to create it through out interactions (Wells, 2004, referencing Doll, p.202).

Expanding on traditional understanding of radical and critical adult education, Tisdell & Taylor (1999) present the five most prevalent adult education philosophies as overlapping transdiscursive categories weaving various threads of critical tradition with each other and with humanism, building on the earlier traditions of liberalism and progressivism. Complexity
science builds on the same earlier traditions. Since living systems evolve toward greater complexity and thrive on connectedness, complexivist education would not seek to develop autonomy, making it consistent with the feminist inspired relationally-driven philosophies. The complexivist focus is neither purely individual or social-cultural, but rather the points of interaction where individual and context meet. It resonates with writing about spirituality in adult education (English, Fenwick & Parsons, 2003; Palmer, 2004; Tisdell, 2003).

The pedagogy of creating disturbances and the ‘post’ perspective thread in complexity are consistent with post structural feminist and feminist emancipatory pedagogies. The post-structural (Tisdell, 1998) has several well-developed points of overlap with complexity. Both concern themselves with structures in their dynamic state, interested in the paradoxical tensions that keep them changing and therefore alive. The complexivist approach, in promoting pattern formation, disrupts hierarchies in favor of self-organization. Fostering greater complexity as life giving it prefers strategies that increase diversity. Its understanding of co-creation/co-evolution of learner and environment makes transformation inevitable. Trajectory, time course, and outcome remain unpredictable. The educator intending to effect social change, informed by understanding of pattern formation and self-organization, knows that creating disturbance will result in some kind of learning as the learner self-organizes, but how and in whom and with what result will be unknown.

At every level of organization (human body, learner ‘self’, classroom, community, workplace) connectivity is required for internal coherence and to sustain life. We are connected to ourselves, self-reflexively, and to the world, in a sense as co-creators. My mindset can disconnect me from the world, because my conceptualizations about others determine my connections with them. It is impossible to self-regulate when disconnected from the world
because there is no feedback, which is necessary over time and space. My connectivity at multiple system levels creates its own patterns, which help shape other patterns, and the changing creates a rhythm. So there is nothing static about health or teaching. The essence of life in our natural world is movement arising from connections. Making invisible connections manifest can increase health, and adaptation happens within some midrange of connectivity. Sometimes the demands for connectivity for health at a higher system level, like a workplace organization, create an unhealthy degree of connection at the personal and even body level. These effects can be mitigated when leadership in a living system is shared, distributed and circulated (Stanley, 2006). By using one’s own connectivity with students, revealing connections to self, the adult educator helps them understand this web of life and explore the perceptions that tell us how to navigate it.

A transformational model of engagements and interactions that are not time dependent is preferable, because they recognize the need for variety, creativity, the life-giving interactivity, and the need for unstructured play (Doll, 2005). Learning is about dynamic spacing and when it emerges through language it will be language in use (Fleener, 2005), bringing to mind the ‘natural games’ that Kauffman (2000) tells us are the basis of our ecological co-evolution. In current curriculum models, play space exists in the liminal spaces between formal knowledge and disciplinary structures (Doll, 2005). So learn to find the liminal spaces and take students there to play (Tyler, 2006). The complexity inspired epistemology calls for a pedagogy of invention. Since our knowledge/significations change our reality, they will always place us in a new and different present, even from moment to moment. So we can use these constantly changing significations to create new ways of being. Always grounded in our present
experience, they create new worlds in the moment, which brings forth new experience opening more new worlds, in a chain of self creation. That is emergence (Osberg & Biesta, 2004).

**Transition Through Complexity’s Connection with Neuroscience**

The previous section suggested that with increasing presence of neuroscience in education, complexity science would prove to be a useful theoretical framework. But besides the word ‘science’, what do the two have in common, what makes this so, and what is the connection to this particular study and literature review? A brief discussion will attempt clarification of this connection. A chart (Chart 4, p.54) clarifies the interconnection between two neuroscience research approaches to embodiment, embodied cognitive science and neurophenomenology.

As stated earlier and summarized by Babloyantz (1991), systems thinking had its origin in biology in the 1950’s (with traces much earlier) and the overarching field of complexity science evolved after related concepts were uncovered through research in chemistry, physics, and mathematics. So the physics and math intensive study labeled complexity science grew during the 1970’s and 1980’s when complexity concepts such as self-organization were being researched in many separate disciplines with growing pockets of interdisciplinarity. Self-organization was understood as the ability of systems comprising many units and subject to constraints, to organize themselves in various activities, across time and space. It was assumed that these emerging properties patterns of organization would be pertinent to the system as a whole, and not seen within the comprising units. After two decades of study, there was growing international interest, encouraged by NATO, in how these separate bodies of research on self-organization, emerging properties and learning capabilities of interconnected multi-unit systems might inform each other (Babloyantz, 1991). From the disciplines of physics, physiology and neural networks emerged discussions of self-organization, network dynamics of interacting
elements, neuronal network activity modeling, and theorizing about dynamical attractors in
cognition and learning. Two factors from this cross-pollination are of import for this review.
Gerald Edelman, a neurobiologist (1987) had been writing for a few years about Neural
Darwinism or the Theory of Neuronal Group Selection (TNGS) (to be described later), and this
theory was now presented as successor to the classical algorithmic understanding of how animals
perceive and classify. Second, a group of researchers at the NIH sponsored Program in Complex
Systems and Brain Sciences (Kelso, DeGuzman & Holroyd, 1991) had been uncovering the
principles to explain how individual components in a complex biological system cooperate and
coordinate to form recognizable functions. Kelso went on to research self-organization of the
brain as a dynamic system (1995), a body of work that accepts Edelman’s TNGS. Kelso
mentored neurodevelopmentalist Thelen (Thelen & Smith, 1994) whose research underscores the
applied research on trauma, development and learning which will comprise the final major
discussion of this review (Beebe & Lachman, 1994; Schore, 2002; Siegel, 2001).

In a very general way, Edelman’s TNGS followed 40 years behind introduction of the
concept of ‘learning at the synapse’ between two nerve cells (Hebb, 1949) and after momentous
discoveries in the 70’s and 80’s revealing the chemical neurotransmitters operational at the
synapse. Hebbian learning is an expression of Hebb’s rules which explain how neurons connect
with each other across the spaces that separate them, the synapse. The rule describes an
associational process by which neurons, which are repeatedly involved in stimulating each
other’s firing, will undergo lasting cellular change, a form of growth process, that then
contributes to both of their efficiency. Neurons, nerve cells, that repeatedly assist in each others’
firing connect with each others’ soma. These functionally associated neurons form groups, or
neural networks. The development of brain imaging technology has made it possible to observe
patterns of activation of brain regions and from these to interpolate to theorizing about neural networks. But these networks themselves would be extremely difficult to study in human beings. They are researched through neural modeling, so that ‘neural network’ can refer to both biological neural networks and artificial neural networks used in artificial intelligence. The Hebbian perspective from neural modeling states that what we “know” exists in the synaptic connections between neurons, the central nervous system cells, then extends this to patterns of neural network firing throughout the body’s entire nervous system. Hebbian connections across synapses which separate neurons are those that increase in strength when the connected neurons are coactive and are considered a possible basis for self-organizing parallel-distributed neural networks … nerve nets with a life of their own (Tucker, 2007,).

Describing his Theory of Neuronal Group Selection simply, for general readers, beginning with the neuron, Edelman (2006) tells us the key property of synapses, the space between neurons, is their plasticity. Activities and chemicals can change their strength, influencing decisions about which pathways are selected for transmission of signals, these patterns of transmission setting up the basis for memory. These anatomical connections and pathways in the brain are selected for a species during evolution and during development, leading to the tremendous variety of specialized brain areas and nuclei clusters. Various life experiences leave imprints on these currents so that no two brains are alike, because neurons that fire together wire together. Also brains do not operate like a computer. Brains do not operate by logical rules, as the computer does, and they receive a chaotic array of ambiguous and uncoded input. Edelman declares that the brain is embodied and the body embedded. All of the neural networking through synapses, just described, occurs through interactive communication between the brain and body regarding its sensations and movement, all fundamental functions and
emotions. The signaling about all of these events has electrochemical and genetic aspects. This communicating network is also embedded in a particular environment, which is different from culture. The critical interacting triad is always the brain, the body and the econiche which bring forth the embodied brain and embedded body.

So these are the basics for Edelman. He is careful to note (Edelman, 2006) how his theory is different from both evolutionary epistemology and evolutionary psychology. He recommends a naturalizing of epistemology, away from philosophy, to be based on evolution since all brain mechanisms arise through evolution, an implication being that brains are not designed for knowledge. The brain is a selectional system, not an instructional one, as explained through the process of selection of neural networks. Reentrant connectivity evolved as the property allowing the brain to connect with and coordinate with itself, among its own specializing parts, giving it the capacity to organize to acquire knowledge. Once language evolved in evolution, development of knowledge and the evolutionary path became dependent upon culture. For Edelman consciousness is construed as a process of integration involving reentrant dynamics, parts of the brain connecting with and interacting with each other. As modes of thought arise from these processes they are originally highly unique pattern formations that are metaphorical, and even after application of logic can remain very much so, forming the basis of imaginative constructions.

Elements of Edelman’s “brain-based” epistemology (1989; 2006) are echoed for educators in biologist Zull’s (2002) guidance on teaching to change the brain. His interpretation of the selectional brain evolution vs. instructional brain is to explain that learning is about changing neural networks, and that simply providing specific steps and instructions for learning cannot change networks. Direction and instruction in learning should be replaced with
incentives and support in using what already exists in the brain, learning consisting of selecting the optimum neural network from those already present. Only new experience and exposure to newness can cause a new network to fire and connect, with later chance at being reinforced by continuing selection.

Edelman’s Neural Darwinism is now referenced in any of the popular neuroscience books, usually written by physician researchers, that educators are likely to read. But the acceptance of this new way of thinking about the power of neural networks has evolved slowly and is not complete. Oliver Sacks, a neurologist who writes poetically about neurological mysteries presented Edelman’s “radical” (Sacks, 1990, p.116) suggestion of neuronal maps which allow animal adaptation to new perceptual challenges as a possible way to understand learning by a deaf child. But in his notes Sacks revealed the challenge of having to evolve his own thinking, stating his emotional attraction to a Cartesian, or Platonic idealism, a notion of language capacity and perceptual powers being innate, and in a most general sense to the notion of Design, but observation has led him to “move around somewhat between a ‘nativist (Chomskian) and an ‘evolutionist’ (Edelmanian) viewpoint” (p. 117) still hoping that the two points of view might be compatible. Damasio (1994, 1999, 2003) who writes extensively about neural pathways and neural mapping, and acknowledges Edelman as a fellow researcher interested in consciousness, does not use the language of neural networks. A hint at their differences comes through in this reference, “… our brains receive signals from deep in the living flesh and thus provide local as well as global maps of the intimate anatomy and intimate functional state of that living flesh… so impressive in any complex living organism, is positively astounding in humans. I do not wish to diminish in any way the value of the interesting artificial creatures being created in the laboratories of Gerald Edelman ….. [which] deepen our
understanding of certain brain processes” noting that these animated creatures are not living and
do not feel in the way that a human being does. He suggests that the qualities of perceptions and
feelings probably depend on the qualities of the neurons themselves, the cells from which they
arise (Damasio, 2003, p. 128-129).

Nowhere is rejection more clearly expressed than from mainstream psychiatry.
Psychiatry, the discipline dominating trauma discourse, has continued to view brain and mind
(body/mind) as discontinuous and to use neuroscience information to circumvent this
medical school psychiatric faculty, present the following summary of the psychiatric perspective.
The domain of psychiatry is given as study of the mind, a natural biosystem equivalent to
personal consciousness which is the point of contact where psychiatrist meets patient. In
contrast, diagnosis and treatment are explained through the brain as computer metaphor, with
disorder resulting from broken parts or maladaptive instructions. The natural biosystem mind’s
interactive elements of thought, mood and perception are expressed in consciousness as thoughts,
moods and decisions. All of these elements are only experiences, produced by the physical
structure of the brain through the actions of neurons and synapses and in no other way. Current
neuroscience is considered incapable of explaining this process by following its current
trajectories. So until there is a revolution in the understanding of neural systems and their ability
to bring forth properties, the mind and body will be considered discontinuous and therefore
psychiatry not reducible to neurology. This broad discussion hopes to make understandable the
resistance van der Kolk (2007) reports is expressed by the psychiatric community to the
neuroscience grounded trauma research and perspectives that will be developed later in this
review.
Connections Embedded Within Adult Education

This section will link the research question to adult education literature. Then, since this study seeks to understand patterns of self-organization created while learning through the body, it is important to understand how complexity science is being expressed in adult education, whether self-organization is being researched in relation to learning, and how learning through the body is characterized and studied. Since neuroscience provides a salient link between the theoretical framework of complexity, the body, and learning, the presence of neuroscience in adult education literature will follow. The metaphors of trauma will weave through these three bodies of literature, both distinguishing between them and forming connections among them.

Research Literature

The research studies included in this review were selected for their relevance to the theoretical framework as it has been employed in adult education and to the research question. The primary focus was on complexity science in research because there are so few explicit references to these concepts in adult education conceptual literature. The review sought to uncover an overview and chronology of use of frameworks related to complexity science. Since Freiler (2007) wrote an extensive review of embodiment and somatic learning, this review looks at research relating embodiment to nursing education and teaching health assessment. The literature on taking a dynamic systems approach to trauma is all empirically grounded and will be described in detail in the final discussion where trauma is related to learning. Therefore this research review sought to identify a connection between trauma literature and adult education.
Complexity and Adult Education

There were three databases used through a computerized search to locate appropriate studies: Dissertation Abstracts, Education Abstracts Full Text (Wilson), and ERIC. The search strategy used complexity, complex systems, dynamic systems, chaos theory, systems thinking, enactivist, and Varela as terms in citation and abstract crossed with adult education as subject for dissertations or appearing anywhere in the other two databases. Systems thinking was eliminated as a term because the results showed no clear relationship to complexity science. All others were successful at returning dissertations using a form of complexity framework. There were no research studies found outside of dissertations. The results netted 16 studies meeting the criteria of adult education research using some aspect of complexity science in the theoretical framework. Chronologically, these studies were conducted in 1987, 1989, 1990, 1994 [2 studies], 1996, 1998, [2 studies] 1999 [2 studies], 2001 [2 studies], 2003 [2 studies], 2004, 2007 [2 studies]. This is interesting because it demonstrates that despite the lack of explicit attention to this framework in the conceptual literature, there has been a steady and increasing use in research over the past two decades. Other patterns are evident within this group of studies. Five studies specifically used Maturana and Varela’s Santiago model of human systems (Beutel, 1989; Harper, 1987; Kerr-Edwards, 1994; Kirley, 1999) or the related more general enactivist perspective of cognition (Mouton, 2001), perhaps suggesting a move away from Maturana & Varela’s work as more theory has become accessible to educators. Two works employ metaphor, either a biological metaphor of aging (Harper, 1987) or a chaos metaphor (Feigenbaum, 1998) in conducting qualitative interpretive studies. Eight qualitative studies address learning in organizations (Daniel, 1994; Hite, 1998; Karakekes, 2003; Kirley, 1999; Munaker, 1996; Olscheske, 1999; Kerr-Edwards, 1994; Beutel, 1989); not surprising because
systems thinking was embraced by management studies and HRD. But there is also a focus on non-formal individual learning processes (Eckert, 2003; Feigenbaum, 1998; Mouton, 2001) and academic group learning processes (Keyes, 2001; Ortegano, 2004). With the exception of Keyes (2001) all are qualitative studies. Developmental process and life transition (mid-life, aging, and experience of immigrant students) was yet another focus (Harper, 1987; Karpiak, 1990; Kung, 2007). An unexpected but not surprising finding was that five studies spoke of transformation (Eckert, 2003; Keyes, 2001; Kung, 2007; Mouton, 2001; Munaker, 1996) ranging across individual non-formal learning, formal academic, and organizational learning. Only Kung (2007) incorporated transformative learning theory in her framework, but increased use of the terminology indicates the influence of transformative learning and its intersection with complexity science concepts. The methodologies used were quite diverse and included general qualitative interpretive research, case study, interpretive phenomenology, critical hermeneutics, ethnography, and participant action research.

Not all of this research has direct applicability to the research question, but a few do. In a philosophical examination of the cross-cultural meanings of work Kerr-Edwards (1994) demonstrated that work is not separate from life, and our worldviews are affected by our created meanings of self and work. These meanings and worldview are critical to our understanding of our own roles in the future. This has bearing on action research that hopes to create changes for students in relation to their professional work. It supports the importance of education for deeper meaning making that is personal and connected to work as opposed to collections of new facts about topics related to the workplace. Students are often frustrated that they are required by their employers to attain this further educational degree and yet there is often poor support from the workplace for doing so. They are consistent in this way with workers in other high-tech
organizations who saw that possession of knowledge was unrewarded while the perception of being knowledgeable was highly valued (Beutel, 1989).

At the individual level, the one piece of research to specifically examine self-organization (Eckert, 2003) was a qualitative study of successful small farmers (organic, sustainable). Their development of proficiency in the face of overbearing high-tech corporate farming came about through a spiraling, iterative process of successive proficiency building. Proficiency consists of knowledge specific to farming, tacit knowledge, and metacognitive skills which are uniquely self-organized using mental models which they construct through implicit and explicit learning. It is the self-organization of these factors that promotes knowledge and skill transfer and brings greater proficiency. The types of learning used by successfully self-organizing farmers were discovery learning, problem solving, and working within and helping to construct ecologies that were supportive of their own and other farmers learning. Another problem solving pedagogy found useful with groups was concept mapping (Ortegano, 2004). This exploratory descriptive study used concept mapping to facilitate group learning online in a course that also introduced complexity science. The mapping facilitated the group process of problem solving and this visualizing of complexity led to better understanding. There could be direct correlation between these studies and nurses who also wish to practice holistic and sustainable nursing in a contrary environment. This action research can strive to support them by constructing a supportive classroom ecology which they can then model at work. The embodied learning activities will constitute discovery learning as will their choice of learning focus around clinical problems from their own experience. Besides embodied learning the primary in class activity will be collaborative problem solving which will incorporate concept mapping. So this research (Eckert,
2003; Ortegano, 2004) informs the design of learning activities for an action research using learning through the body with nurses.

It is understood that the hoped for attainment of higher levels of integrative complexity will be significantly influenced by the individual learning style composition of the group and also their shared perceptions, with learning styles determining the initial integrative attainment, and successive jumps in complexity influenced by the emerging shared group perceptions (Keyes, 2001). This quantitative examination of group learning in a formal setting used Kolb’s learning styles and King & Kitchener’s experiential learning as a framework, connected with the concept of integrative complexity which echoes a neuroscience model. It found that 46% of the variance in attainment of integrative complexity could be attributed to the factors of style and group perception. For the proposed study of RN’s using embodied learning, it is notable that previous groups of students in the same program measured very strongly as active and concrete learners according to Kolb’s survey. So learning using the body and movement and connecting reflection with body experience in the active work environment is very consistent with the expected learning style. Using various types of learning, fostering body awareness will itself be integrating. Then adding reflective writing as well as discussion to bring this awareness to greater consciousness should be integrating at another level. Part of what the analysis will examine will be the emerging individual and shared group perceptions which could be integral to the patterns of self-organization.

Bodies, Learning and Trauma

For this portion of the research literature review the purpose was to identify research in adult education regarding the body as site of learning or knowledge and related pedagogical principles that could inform the proposed action research. The distinction between embodiment
and somatic learning has already been addressed in a broad review of social science and education literature (Freiler, 2007; 2008) so this review was more specific to adult education. There is additional research on embodiment in the general education and social science literature, but definitions and use of terms becomes muddied as they are passed through different lenses. Being less pertinent to this study these sources were eliminated. Because this action research study will be conducted with RN’s in a nursing higher education clinical course setting, the nursing literature was also reviewed. Finally, because trauma is an intersecting concept of interest, the trauma literature database was included. The search strategies used were as follows:

Round One included Dissertation Abstracts, Education Abstracts Full Text (Wilson), and ERIC. Search terms were embodiment, embodied learning, somatic learning and somatic pedagogy in citation/abstract; each crossed with adult education, or nursing, or nursing education in the dissertation subject field or anywhere in the other databases. In ERIC, physiology or kinesthetic were also crossed with pedagogy, learning or education. Somatic pedagogy gave poor returns that overlapped with somatic learning. Embodied learning drew on different sources than embodiment so it was a useful term to include. Nursing and nursing education yielded nothing.

Round Two looked specifically for nursing in Dissertation Abstracts and CINAHL, using embodiment, embodied learning, somatic learning and somatic pedagogy in citation/abstract crossed with nursing education or research. Embodiment was the only term to yield results, but all 25 studies dealt with patients. As early as 1999 (Wilde) there has been a call for theory development on embodiment using Merleau-Ponty’s phenomenological definition. But nurses’ bodies are not addressed in the literature, and embodiment in the classroom is not being discussed. The closest connection was a call by Diekelman (2002), the most outspoken
proponent of alternative pedagogies in nursing education, for faculty to develop skills in timing and reading non-verbal cues from students to know if they are connecting with their listeners. Neither has the academic interest in patients’ embodiment extended into public health discourse, where its exclusion could have potential damaging effects (Brown, 2001). When health assessment and physical examination were substituted as citation/abstract terms they yielded pertinent results.

Round Three was a very narrow search for intersections with trauma as they are emerging for adult education. The original ERIC search produced a few conceptual articles through the physiology term, all identifying that stress and trauma are expressed in the body in ways that can interfere with classroom learning (Kerka, 2002; Kosbab, 1989; Stone, 1995), and the changes associated with aging are additionally stressful (Verner & Davison, 1971). But there were no research studies. In PILOTS (Published International Literature on Traumatic Stress) the search term Adult Education anywhere yielded a few studies. It was interesting to note that a consistent thread in this small body of work is a desire to naturalize rather than medicalize the experiences of trauma and adult education theory employed in psychoeducational processes is viewed as a means to that end. Some conceptual literature (Burstow, 2003, 2005) problematizes the PTSD diagnosis and calls for a fundamental break with psychiatry, with all trauma work moving toward radical adult education. The research literature is less bold in its expression of intent, although in line with Burstow there is clear declaration that socio-political contexts create trauma and public education should intend to bring this reality to consciousness (Beathe, 2005).

The three search rounds offered 23 studies which met the criteria for inclusion. All types of research were represented, over half being qualitative. These studies fell into two broad categories: 11 attended to the body as site of learning or knowing (Ahn, 2006; DiRubbo, 1995;

Only two studies (Beate, 2005; Wainright, Williams & Turner, 2005) did not fit into these two categories. Both viewed body as *vulnerable object*, not subject or source of knowing and learning. Notably both were also medical writing. Wainright, et al (2005) reviewed ethnographies from a bio-psycho-social perspective and used their work to argue for a middle ground between a purely biomedical perspective of the body and what they identified as the radical social constructivist view. They recommend Bourdieu’s schema (which is employed in the health professions’ vulnerability theory) as theoretical framework for understanding the body embedded in culture, noting the significant influence of economics in sculpting our views of body. Beate (2005) writes from a public health perspective about trauma, arguing for broad public health education on trauma that identifies the state’s pivotal role in creating trauma. A critical piece of evidence used for her argument is the assumption that all war veterans are survivors of trauma and this constitutes a public health problem. The implication is that all bodies are damaged (not simply changed) by experiencing an extraordinary event and violence and this damage itself constitutes medical/psychiatric disorder without consideration of function. This is a well-intentioned but medicalized view that does not make room for the body’s subjective voice.
Analysis of Parts

In the overview of complexity science it was identified that open systems are characterized by holism: the whole is greater than the sum of the parts. Each part is a whole system at a different level, with its own properties. So the character of the parts will be different from the character of the larger whole they form when integrated with each other. If this concept is applied to analysis of the reviewed literature, we see that a complex interwoven whole of ‘bodies, learning, and trauma’ is comprised of the parts, education, nursing and trauma. We expect that analysis of the parts will reveal one set of information, while examination of the recurrent themes within the total group will reveal something different. In this section, analysis of parts, the literature is reviewed separately according to its database source: education, nursing, or trauma. This breakdown will be followed by an analysis of the same literature but considered as an integrated whole.

Education. This group was composed of 8 studies, 3 addressing primarily the body as site of knowing and learning; 3 focusing on pedagogy, and two engaging the interconnections of both. Theoretical research from 1998 (Simon) informs most of this work. Interestingly, Simon’s work is connected to complexity through Gregory Bateson’s (1979) ecological systems perspective. This lens allows for the re-embedding of subject within the body, which lies within culture and natural environment. Simon (1998) argues that subjectivity is ecological and all learning is embodied, but our culture has objectified bodies and because of this learners aren’t aware that they are experiencing bodies which have inherent wisdom as a way of knowing. This thinking should call to the reader’s mind a connection with self-organization as a natural process for which each living organism has inherent understanding without being instructed. The
implications identified for education are that it must be participative and embodied, interactive with the entire system’s intelligence, with purposeful efforts to cultivate mindful attention to experience. This approach is expected to promote sustainability and interdependence.

It is clear that both Ahn (2006) and Freiler (2007) have taken Simon’s message to heart. Both conducted case study/action research in classes of health care professionals. Ahn used mindfulness based stress reduction as content, teaching with authentic presence (so a transformative element) to enhance body, mind and spirit (so a holistic conception of person). Mindfulness was revealed to be a useful alternative meaning-making system which could work either as adjunct to reflective education or as a stand alone transformative vehicle. The fact that this teaching intervention could serve in both ways provides some indirect evidence of learning that is occurring through the body, before and without the addition of reflection for meaning-making. In a first attempt to understand the mind/body connection through embodied practices in the classroom (Freiler, 2007) revealed the depth of engagement and self knowledge that can result. This work was grounded in the philosophical writing of Lakoff & Johnson (1999), intellectual descendents of Merleau-Ponty in the school of phenomenology, and the primary source of philosophy of the body. Freiler’s (2007) research nevertheless was an action study, so she went beyond capturing another’s experience. Her extensive review of the literature on embodidment (2008) reveals a concept more holistic than somatic learning, a tie to social constructivism and a feminist perspective, and research on classroom actions that lead students to challenge their current assumptions by engaging them in activity coupled with reflection. In her research students moved through progressive experiences from body awareness to movement, connection with past memories and finally creative expression. Her approach was unique in also using an embodiment exercise to experience and learn about power in understanding cultural
differences. Students were highly engaged in the process, some taking actions that demonstrated increased ownership of their bodies, others using the heightened awareness of self to make major changes in their lives (Freiler, 2007).

Three very different venues explored different aspects of pedagogy, and all found support for including the body in learning. In an experimental study (Richardson & Birge, 1995) that compared passive and active methods for teaching physiology, learning outcomes were the same no matter which approaches were used. But students preferred learning with a combined approach over passive only education. Dance students (Green, 1998) specifically valued the somatic authority outcome of their pedagogy, being able to affirm how their body should look and behave, because this authority carried with it a personal engagement with and ownership of their bodies. Even though this pedagogy uses an external, objectified view of the body, with students working to achieve a look and proper technique while they are being observed and corrected by faculty, the subjective awareness and ownership are the result. This teaching method is not unlike yoga instruction in which a wide variety of individual variations of posture are acceptable, but specific poses act as templates and the instructor makes adjustments of students’ bodies. Both of these findings are directly applicable to understanding of a nursing health assessment classroom in which students learn to perform physical skills while practicing under a guiding eye. An unusual organizational setting provided the backdrop for Horst’s (2007) work with women managers. This action research used yoga as action and demonstrated that through the dialogue engendered by the yoga practice, participants were able to explore and make new connections about how gender and body were present in the work place in multiple ways. They made connections between new self-management abilities gained through yoga and professional situations in which these skills could be put to use. The research provided support
for Horst’s model of somatic pedagogy which includes kinesthetic, sensory, affective and spiritual learning (Amann, 2003).

Two qualitative studies examined the experience of embodied learning while attempting to understand the pedagogies that help embodied learning emerge (DiRubbo, 1995; Powis, 2005). Using a specifically feminist framework for education and the research, Di Rubbo assumed that gendered bodies are the locus of learning and found that when ‘fleshy’ experiences are incorporated into the content, process and environment of learning, her all female students experienced changes in body perception and gender took on greater relevance. DiRubbo described how this embodied pedagogy tapped into sensory, sensual and sexual experiences which then translated into perceptions of external structures, such as sexual harassment policies. She emphasized the importance of designing open and aesthetic spaces if embodied pedagogy is to be used effectively. Powis (2005) describes another unique approach, using organic inquiry with body as worldview for theoretical framework which she explains as being embedded in transformative learning. Her methodology was collaborative telling of the inner subjective stories of body knowing, shared in a sacred context, for the specific purposes of bringing the storytellers in touch with their somatic wisdom and creating an embodied learning experience for the reader. Powis believes that story sharing promotes interconnectivity with all of life and a healing of the Cartesian split. It is becoming clear that there are many possible ways and contexts for bringing embodiment to education. These approaches are well received, at least within these groups of primarily female students. Even in a physiology classroom with more men present, action was preferred to passivity. Learning outcomes may (Freiler, 2007) or may not (Richard & Birge, 1995) be enhanced, perhaps dependent upon the method of evaluating
outcomes. A greater awareness of body and subjectivity seem to be consistent results, expressed in different forms depending on the pedagogy used and the driving philosophy of the educator.

Nursing. The over-riding message one takes from the review of these 10 studies is that here there is a tremendous gap in research. Half of this research is removed from practice, being either descriptive quantitative study (Greer, 2007) or theoretical (Lickteig, 2003; Ridley, 2007); or ethnography in which the researcher is somewhat removed from the subject (Ellingson, 2006; Wainright & Turner, 2003). The intrinsic condition they describe is one in which nursing trails behind even medicine in implementing the interactive and alternative pedagogies which the National League for Nursing has encouraged for almost two decades (Diekelman, 2002; Greer, 2007; Kohtz, 2006). There is no conception of body that makes sense to medicine while still allowing a move beyond a biomedical view (Brown, 2001; Wainright & Turner, 2003), and even in the growing body of qualitative research, the researchers’ own bodies remain obscured, distorting findings (Ellingson, 2006). Whatever might be realized by developing theories of embodiment in nursing (Wilde, 1999) or creating an embodied writing in the research literature (Ellingson, 2006) remains in the imagination. The vast majority of nursing faculty use conventional pedagogy (Greer, 2007, Kohtz, 2006; Ridley, 2007), expressing multiple concerns with alternatives, but particularly a concern with losing control of the classroom and almost a sense of disrespect for students who are viewed as immature, self-absorbed, and needing to be controlled in the face of the complexity of nursing. Above all, it is the faculty’s teacher-centered, content-driven beliefs that inhibit change (Kohtz, 2006). In a thorough concept analysis of interactive teaching, providing a basis for research, Ridley (2007) notes multiple positive results for students. Disadvantages for students were related to group dynamics, such as unequal participation and the possibility of loafing. It is unclear how this is different from a
conventional classroom where these possibilities also exist. Students also might experience anxiety about advance preparation. But apparently students like interactive teaching, since an advantage for educators is positive student evaluations and relationships with students, and increased intuition and personal creativity. The disadvantages again are related to control: loss of control, possible loss of credibility with students who expected an imparting of grand knowledge, concerns about outcomes and mandates and large class size (Ridley, 2007). One reads this list and wonders who wouldn’t want to experience these positives, and then notices that the educator disadvantages are primarily determined by the education system. Perhaps nursing educators have lost control of the class long before they are confronted with living students. Which returns us to Greer’s (2007) question: how is meaning valued in nursing?

Spirituality is offered as hopeful answer to this question when a theoretical existential inquiry concludes that connected pedagogy would meet the philosophical challenge of addressing the meaning of experiences in nursing (Lickteig, 2003). Bodies aren’t mentioned, but increased awareness as spiritual awareness would be an outcome, with the possibility of making connections to life and work that could be transformative. Writing and reflecting on readings are the methods to be used for making connections.

Only two studies connected directly with students. Because self-awareness is valued as a necessary nursing attribute, a naturalistic inquiry (Eckroth-Bucher, 2004) sought to understand how nursing students develop self-awareness in the context of nursing education. It seems that self-awareness arises through a dynamic process of intrapersonal and interpersonal steps that are taken by the student, involving the components of catalysts, dissonance, and specific mental activities. Internal influences include religion/spirituality and personality and development issues. External factors are foremost relationships, both social and academic, then the pedagogy
that is used and particularly facilitative actions, and finally transformative events. This sounds a lot like transformative learning and self-organization (Karpiak, 2000, 2003; Mezirow, 1991). In the only true trial of alternative teaching, a case study (Prowse, 1998) describes the use of a single integrated course to introduce new BSN students to their first clinical practice experiences. Students and instructor co-constructed a ‘lived curriculum’ using reflective and situated pedagogy. The experiment was deemed a success. Students gained new knowledge, demonstrated critical thinking skills, provided competent and caring nursing care at the appropriate level. Significantly, the faculty member felt she recreated herself in the teaching. It would seem that this project demonstrates all the advantages of interactive teaching identified by Ridley (2007), a group of students who did not succumb to the disadvantages, and a faculty member who had the freedom to be creative, valued meaning-making and relationship, and did not need to be in control. These last two studies alone provide a clear big-picture for the nurse educator planning an action research that hopes to foster increased self-awareness through interactive/alternative methods.

As a segue to the trauma literature, two studies of mixed groups of health care personnel link workplace trauma with experiencing through the body and the process of making meaning. One (Raingruber & Kent, 2003) is a qualitative study of hospital based nurses, physicians, nursing students using phenomenology and Merleau-Ponty’s philosophy of the body to understand how the body’s strong physical sensations can help clinicians understand what is most meaningful in a situation, and whether attentive awareness of these sensations might facilitate reflection on a traumatic event. It was hoped that such personal practice might serve to prevent secondary traumatic stress. Results showed that strong physical sensations did occur in the clinical setting and did not interfere with either work or education. The body became
recognized for participants as center of meaning-making, and this catalyzed reflection on several factors: the traumatic event itself, the significance of the event for patients and family, how the clinician would feel if they were the patient, how the traumatic event had shaped their view of the profession, and the generally unpredictable nature of everyday life. It was quite interesting that psychiatrists in the group, who were all male, did not mention strong physical sensations, but male nursing students did. The study concluded that self-aware, mindful attention to body sensations was a useful health practice for health practitioners and organizations should encourage reflection on these experiences to help staff members grow and learn.

This was an interesting counterpoint to results of a mixed method study conducted with burn center professional personnel two months after a training accident mass casualty (MASCAL) when 22 out of an original 42 patients still remained in their care (Swartz, 1995). Based on a stress and coping model, this research combined a quantitative assessment of post-trauma experiencing with both a likert scale survey and open-ended question survey to assess meaning-making. All professional staff (N=83, RN’s, MD’s, PT’s,OT’s, Social Worker and Chaplains) completed the surveys. As with Raingruber and Kent’s (2003) participants, there was broad experiencing of physical sensations (hyperarousal, intrusive imagery) as well as avoidance behaviors as measured by the Impact of Events Scale (Horowitz, 1976), but these did not interfere with performance of duties. There were major differences across professions and according to years of experience with trauma. Notably, physicians, who were all plastic surgeons, reported relatively little hyperarousal or intrusive imagery. Their elevated scores were in forms of avoidance, for example avoiding thinking about aspects of the event or reminders of the event. Physical therapists and chaplains experienced the most intrusive imagery. Nurses and chaplains were the most bothered by waves of feeling. In the analysis, it was noted that the
The chaplain group was almost entirely trainees who were new to trauma and the PT’s were relatively new. Nurses and chaplains spent the most time with families. Nurses also got the least sleep.

There was a clear developmental path for the body experiencing. Staff members in their first year of burn work had heightened scores in every form of post-trauma responding which decreased some during their second year. Those in their third and fourth years were significantly less bothered by intrusive imagery and demonstrated a consistent pattern of moderate hyperarousal and avoidance. After four years, continuing through 13 years of experience, the highest expressed for that group, the pattern of responding was primarily avoidance/numbing. In terms of meaning making, all professional groups were consistently positive about their own and the team’s performance during the MASCAL, and felt it was a transforming experience for them personally and for the staff as a group. There was frustration with politics and influences from outside the center, but much increased appreciation of each others strengths and dedication and a greater appreciation for life and their own families. At that point MD’s considered the incident finished and a success, based on the 100% survival rate. Other personnel, especially the RN’s, expressed reflecting on other topics mentioned by Raingruber and Kent (2003) such as the impact on patients and their families. For those who were most involved with families, the MASCAL was not over, and their thoughts and feelings were now in response to concerns for the future. What would this mean for their patients and families lives in the times to come? The participation rate was extraordinary, and not enforced. It was very clear at the time that the survey provided and opportunity to reflect and share stories in a setting that did not permit formal/official group discussion of events. Both of these studies serve to confirm that body experiencing is an integral aspect of clinical nursing experience, and involved in making
meaning of traumatic events. So integrating body awareness into a clinical nursing course makes good clinical and pedagogical sense.

*Trauma: Impact on Mind/Body.* Four very different studies (King, 2003; Motley-Abbott, 2007; Simonelli, 2000; Zimmerman & Weber, 2000) reflect the both the infancy of trauma work’s intersection with adult education and the rich opportunity for diverse applications to promote healing through learning and change. One might expect an increased concern with trauma after the events of 9/11/01, but this research shows that the connecting had already begun, and the driving force appears to be a shared interest in helping people change their lives and make meaning through a paradigm that is non-medical and non-pathologizing. Motley-Abbott’s (2007) work with women in the psycho-educational aspect of addictions treatment suggests itself as evidence based support for the approach, which in this case was based on transformative learning (Mezirow, 1991) and women’s ways of knowing (Belenky, Clinchy, Goldberger & Tarule, 1986). Women made better progress in recovery if they were able to view learning as an active, engaged process of changing oneself rather than a passive process of gaining information. If evidence-based success is determined by participants attempting to reproduce a program locally, then the Canadian Military’s program for chaplains has been a success (Zimmerman & Weber, 2000). The program is adamant about not using a psychological debriefing model or a diagnostic environment with chaplains returning from high intensity deployments. An adult education model was chosen to promote dialogue by focusing on the attribution of meaning to the chaplains experience over the course of 4 days of small group instruction in various topics related to trauma and coping. There is a strong spiritual component, expressed through a ceremony centering on grief and loss. As with most of the research covered
in this review, this program aimed to increase self-awareness and did so. Body experiencing was not a focus.

Another program using a grief framework in conjunction with transformative learning is a collaborative inquiry carried out by adult educators studying in NYC in September 2001 (King, 2003). Through two phases of research, they met with each other, reflected and talked, examined their own experiencing and process of coping with the aftermath of a terrorist attack on the city in which they were living. It was an international group, and they found again and again that diversity emerged as a strength in their process of making meaning because they were able to hear and compare differing perspectives emerging from connections made to differing past life experiences. The other critical factor was the repeating cycles of reflection which led to dialogue. It was the talking and sharing of the stories they told chronologically and built over time that helped them cope with memories and finally achieve new understandings. The study used narrative and dialogue, and these educators were very rational in expressions of their self awareness. The body experiencing that did come through in some reports of memories is almost entirely visual, and always linked with the questions being generated mentally. The analysis is positive about the concurrent use of transformative learning and grief theory because these frameworks allowed for both cognitive and emotion based progression during their peer debriefings. Connections of any kind between participants are not examined. One wonders if connection might not have been as meaningful to their transformation around traumatic experience as the reflection and dialogue, but the frameworks used to not provide for that kind of analysis.
Finally, Simonelli (2000) makes an extremely valuable contribution with a heuristic study, guided by holistic integrative learning, which examines memories and lasting impacts of experiences of educational wounding as trauma in adults with and without learning disabilities. Only one piece of research mentioned neurology, the brain, or fear circuitry, and it was this study that explored adults’ stories of lasting damage from ‘educational wounding’ that occurred in childhood. Her construct of educational wounding has aspects in common with the traumatic learning described in conceptual literature by Janik (2005). Other than the physiologic trauma literature, this qualitative study may be the first supportive research evidence of learning imposed trauma impacting adults.

Themes which occurred in the stories of both groups of participants were use of humiliation, judgment, control, abuse, and shaming to get students to conform to a narrow idea of success. Other identified aspects were presence of some post trauma symptoms, breaking of spiritual connection perceived as negative disruption, and healing through their own authority. Simonelli (2000) resonates with the proposed study in many ways, and her work serves to integrate multiple aspects of this literature review. Her findings lead her to characterize our traditional educational system as an impoverishment experience which wounds at the level of the soul, an experience that is stored in the body and the spirit. This direct experience that she labels educational wounding includes constriction of the body. Her description is consistent with the evolutionary perspective of trauma being assumed for this research study which is not surprising since she describes the role of neurologic fear circuitry and makes links to brain processing through theories of multiple intelligences.

Calls for education that attends to the imaginative and artistic, physical and spiritual selves (Simonelli, 2000) remind us of the somatic pedagogy model (Horst, 2007).
Acknowledging and telling stories to heal and remember wholeness resonates with several other pieces (Horst, 2007; King, 2003; Powis, 2005; Raingruber & Kent, 2003). It seems that the body is site of knowing and learning for Simonelli’s participants although that is not the language she uses. The fact that they heal through reclaiming their own authority reminds us of the dance students who experience the somatic authority of knowing and owning their bodies (Green, 1998). When she tells us that educators are products of the same impoverished system, and that it is their unexamined beliefs that lead them to wound unintentionally in school and personal life (Simonelli, 2000), we think of the nurse educators whose teacher centered beliefs lead them to fear loss of control and system demands at the expense of personal intuition and creativity and relationships with students (Greer, 2007; Kohtz, 2006; Ridley, 2007).

Analysis of Integrated Whole

Despite coming from disparate sources these 23 research studies converged around several significant themes which will serve as structure for this section of the review. The overarching themes, each addressed by 10 or 11 studies, were an increase in some form of subjective awareness, often of the body; the presence of a process of transformation; the positive attribute of heightened student engagement; and the power of the educator as catalyst. Both educator and learner must agree to co-create these situations for learning if they are to occur.

Outcomes were identified consistently by eight or nine studies as various forms of increased connectedness, including transfer of learning through connections to other personal and professional contexts. Eight studies specifically noted the critical role played by either reflective writing or dialogue. Of interest is the fact that nine studies also expressed concepts or metaphors that harmonized with complexity thinking.
Less frequent but still notable were the intersections with improved health, spirituality, and meaning-making. There was overlap among the studies representing these factors. Of the 11 research reports fitting this picture all but two pertained to health care workers and/or trauma.

*Conceptual Literature*

Perhaps it seems that the body of reviewable research is somewhat sparse, and while it is interesting, it is not dense enough to provide for full understanding of this complex web of concepts. The conceptual literature is a little more fully developed, and the two sets of writing serve to fill each other’s gaps. This review of conceptual literature follows a cyclic arrangement. It begins with the outermost context, complexity science, and examines where these science ideas are present in adult education, and within each of those pockets where ideas about the body or embodiment are being expressed. Next, body is the starting point, following with examination of body as its learning is described through neuroscience. Finally, taking neuroscience as the starting point, there is a cycling back from the center to the exterior as neuroscience is linked to adult education and its appearances there are identified.

*Complexity Science in Adult Education and Ties to Embodiment*

There are presently two primary strains of complexity science in adult education thinking: one is the enactivist perspective on cognition (Fenwick, 2000, 2003), the other an application of complexity to transformative learning (2000, 2006). When Fenwick (2000) wrote about experiential learning in light of contemporary perspectives on cognition, her co-emergence/enactivist perspective was grounded in Maturana and Varela (1992). Her educational foundation for complexity thinking came from Davis and Sumara (1997, 2006) who choose this term over complexity science due to “a pervasive suspicion of the physical sciences among educators” (p. 17). Fenwick (2000) introduces complexity by way of enactivism, within the
context of a larger argument concerning the experiential nature of all learning, and her attempt to present alternatives to what she views as the colonizing influence of an experiential learning/managerial discourse. She quotes Michelson’s (1999) work to declare all experience as “embodied, communal, and fruitfully incoherent” (p.244) and redefines experiential learning as a process of human cognition. Her last identified contemporary perspective on cognition is a systems perspective which Fenwick (2000) labels as “co-emergence, the enactivist perspective” (p.261). For this perspective cognition requires experience through a sensorimotor body that is embedded in a biological, psychological, cultural context. Change occurs as adaptation as learner and environment interact dynamically with each other, according to the structural dynamics of complex systems. Learning can only be understood as co-emergence, all individual knowledge entwined and co-emergent with collective knowledge. Educators help learners name the nuances unfolding around and within them, track interactions by making a story, and interpret all the emerging patterns of interaction and connection as well as their involvement in the patterns. In Fenwick’s opinion the enactivist perspective, like other systems views, require individual interests and identities to be surrendered to the greater community, making them vulnerable to the powerful manipulations of a few (2000, p.265). She does not distinguish systems thinking from complexity science, so she is not distinguishing between closed system and open system perspectives. She accurately links the enactivist perspective of cognition to the cognitive theory of Maturana and Varela (1992) and its interpretation for educators by Davis & Sumara (1997). But her critique is perhaps influenced by other applications of the theory beyond cognition. Maturana and Varlea’s (1992) definition of organism is a closed system, self-referential structure that exists to keep itself alive, hence the emphasis on autonomy and closure to outside influences. Their worked inspired Luhmann’s theory of social dynamics.
Maturana and Varela (1980) were biologists who offered an alternative biology-based explanation of organism self-sustainment processes, the ‘enactivist’ theory of cognition which challenges the underlying assumption of most epistemologies that cognition is a representation of an independently existing world. They are noted by complexity thinkers (Capra, 1996, 2002; Lovelock, 1991) for their pioneering work in cognition. Damasio (2003) cites support for Varela’s overall conception of the biophysical organism (p. 308) as resistant to emotional upheaval and tending toward control of these perturbations. He also accords respect to Varela’s studies on brain dynamics (Lutz, Lachaux, Martinerie, & Varela, 2002), consciousness and the mind/body problem (Varela, 1996, Varela & Shear, 1999) (Damasio, 2003, p. 308, 112 & 322), and study of methodologies for researching interior experiencing. But the writing by Maturana and Varela that is most frequently cited by education authors is their book *The Tree of Knowledge: The Biological Roots of Human Understanding* (1987, 1992). The authors acknowledge that this book was a deliberate attempt to present their anti-representationist perspective in a naïve format, in hopes of reaching a broad popular audience. That goal was achieved as the book is still being published. They also became aware of its limitations as a book with no citations, and lamented in the recent edition (1992) that the format does not allow for the ideas to be developed beyond the original.

Maturana and Varela (1980, 1992) give us an atypical view, the enactivist theory of cognition, which is not representationist, a perspective they resist as reductionistic stating it assumes a pre-given world and precludes autonomous meaning creation. They find the principle of autonomy present at the cellular level in the process of autopoesis whereby organisms at every level are organized as closed systems to produce themselves and this is their only product. Self-production is their means of survival Maturana & Varela, 1992, p. 60). This is a non-empirically
derived but unique, science based perspective that draws on complexity science (organismic biology), tackles embodiment by invoking Merleau – Ponty’s philosophy of the body, and explores mindfulness through an East-West philosophical discussion (Varela et al., 1991).

Although Varela (1991) has been critiqued (Basu, 2004) for providing educators with only a collection of abstractions and unusable esoterica, the enactivist theory of cognition is the model of choice for many education scholars currently writing about complexity (Davis & Sumara, 2006). Proulx (2004) explains that for Maturana and Varela (1992) “knowledge is behavior” (p. 115), a concept resting on the assumption (“conviction”, p. 115) that physical and mental processes are one, so knowledge equals “adequate action in the world” (p. 115). Environmental stimuli are only potentially transformative through learning to the degree that they are perceived through registration with the sensory system (Proulx, 2004).

This alternative perspective of cognition must be noted well because it already appears among the citations in education literature related to complexity (Doll, 2005; Davis & Sumara, 2006; Fenwick, 2000, 2003; Fleener, 2005; Hill & Johnston, 2003; Karpiak, 2000; Mgombelo, 2003; Namukasa, 2004, 2006; O'Sullivan, 1999, 2004). There are three other major anti-Cartesian alternatives to the more traditional cognitivism (symbol processing) and connectionism (the earlier neuroscience based approach based on neural networks). The first of these is situated cognition (Lave, 1988; Lave & Wenger, 1991) that binds cognition to the living world through schemas and is not derived from complexity science but is represented in adult education literature. The other two alternative perspectives are both inspired by Edelman’s theory of neuronal group selection, so in contrast with enactivism they are more specifically derived from neuroscience research. The first of these two related perspectives is embodied cognition which is an interdisciplinary approach to embodiment exemplified by the work of the cognitive linguist
Lakoff and cognitive philosopher Johnson, “Philosophy in the Flesh” (Lakoff & Johnson, 1999). Embodied cognition appeared in the theoretical framework of Freiler’s (2007) adult education study of embodied learning. The third alternative, embodied cognitive science, is explicitly grounded in complexity science. Also interdisciplinary it is a field of research to explain the mechanisms underlying intelligent behavior (Kelso, 1995; Thelen & Smith, 1994). This empirically based theory of cognition does not appear in adult education literature and it is the theory on which this current study of nurses embodied learning and trauma was based.

Interestingly these complexity derived alternative theories of embodied cognition are not appearing in the education literature on complexity science. Nor has this literature made a strong connection the neuroscience research (despite Varela’s work on consciousness and connection with neurophenomenology). Even the natural science sources of complexity are cited infrequently. The results of this approach which approaches complexity but distances from science, as several education scholars note (Elbaz-Luwisch, 2004; Hill, 2001; Jarvis, 2006; Wexler, 2002) are readers who struggle with the concepts and ultimately interpret through their entrenched frames of mind. The worst result is creation of the impression that there is only one complexity friendly model of cognition (the enactivist). Reasons for this non-empirical orientation are the inaccessibility of science literature leading to reliance on the popular press for translation of ideas, the lingering resistance to science, and adult education’s growing interest in embodiment (Amann, 2003; Brockman, 2001; Clark, 2001; Heck, 2004; hooks, 2003, Michelson, 1998; Mullis, 2006; O’Farrell, 2000; Shusterman, 2006; Yorks & Kasl, 2000).

Because Maturana & Varela (1992) explicitly declared theirs to be a model of embodied mind, arising from their research on the perception of color, cognition discussions of embodied perception begin with them (Gibb, 2006). In one case (Anderson & Woodill, 2004) this focus
has been extended to teaching in a discussion about the importance of information visualization as supporting learning about complexity and also as a good fit with younger students’ preferred modes of learning. Neuroscience is at the heart of this paper which incorporates global workspace theory and cognitive load theory. But adult education tends to rely on psychology to interpret neuroscience for them, so such papers are still rare.

A few notable exceptions are Stanley’s (2003) well referenced paper that begins in a dynamical systems view of heart physiology (Goldberger 1997; Goldberger et al. 1990, 2002) and level jumps metaphorically, to surmise the appearance of a healthy education system. Gilstrap (2005) does difficult transdiscursive work in attempting to explain the process of Freire’s dialogic in a group using dissipative structure theory. Finally Karpiak (2000, 2003) provides the most expert synthesis of natural science, philosophy, and transformation theorists from a variety of disciplines to create a picture, with heart, of a complexity derived transformative teaching practice. These writings are inspiring and give hope for what might lie in the future.

As has already been suggested, the enactivist perspective has been linked in education writing with a somewhat science averse view, despite its origins in biology (Fenwick, 2000; Davis & Sumara, 2006). A different emerging complexity strain in education comes from Karpiak (2000, 2003) and Doll, et al (2005) who embrace the organismic metaphor but ground their complexity thinking in the new ideas from math, physics and chemistry. Maturana and Varela (1992) are not their sources, rather Prigogine and Stengers (1984). Karpiak (2000) explicitly links her use of complexity to a non-Darwinian, unifying theory of evolution (Jantsch, 1981 in Karpiak, 2000) that focuses on sudden occurrences of innovative changes rather than gradual adaptation. Such changes are examples of transformation, and transformative learning is
her other explicit link. Jantsch was an astrophysicist who wrote about evolution of the universe, and the method that has evolved from his work involves observing natural systems and using their properties to understand and solve human problems in ways that are sustainable. Where the enactivist theory discusses closed systems recreating themselves through autopoesis, the Jantsch expression of complexity discusses open systems at different levels from cell to society responding through interaction with their environments, self-modifying through self-organization. These are very different, but related expressions. Note that embodied cognition and embodied cognitive science are linked with new elaborations to Darwinism coming from the Santa Fe Institute and complexity biologists such as Kauffman (1993).

Karpiak never examines how Jantschian evolution related to neural Darwinism and neuroscience. But she does connect with neuroscience through Damasio (Karpiak, 2003) in exploring attunement in teaching. Here she also makes her connection to body, noting the importance of being attuned to our feelings because they come first. First we feel what happens, later we make sense of it through reflection. When she describes connection with students through a ‘listening heart’ and mirroring to develop and authentic self, a practice she attributes to Parker Palmer, she is making metaphorical connections with body that are also verging on the spiritual. She implicitly acknowledges body knowing when she quotes Levin, “… human beings, sharing in the flesh, the anonymous intercorporeal subjectivity, of the world” (Karpiak, 2003, p.78). Furthermore, Karpiak’s adherence to Jantsch’s theory of evolution does not seem to reflect a total rejection of the neo-Darwinian. In expanding on transformation (2000), she explains her view that learning and development are evolutionary equivalents, and transformation can be both sudden and gradual. She then makes an explicit connection to “trauma and chaos” (2000, p. 37) giving us a new complexity science metaphor for trauma.
What Karpiak is presenting is a complex integration of many adult education and complexity perspectives, and this is fertile ground for further theory development if the scientific bases are clearly delineated.

Another alternative but connected perspective from theoretical physics is Bohm’s (1980) idea of implicate order which posits a non-local hidden variable in quantum theory. His ideas about physics were influenced by eastern philosophy and expressed to neuropsychology in his holonomic theory of brain function, brought into flowering by Pibram (1987). More direct connections with systems thinking are Bohm’s (1992) proposal that thought is a pervasive system of mutually interdependent thoughts, feelings, body states, connecting throughout society over the course of time and Pibram’s work on brains and learning as self-organization (1994, 1996). Latching on to the Bohm (1980) idea of a ‘non-local variable’ Sheldrake (1981), a biologist, reintroduced vitalism with his theory of formative causation. This is a compelling theory for imaginative meandering but it exists way outside the boundaries of current neuroscience research literature.

Linking to Body Learning Through Neuroscience in Adult Education

Finding neuroscience in education literature requires a bit of effort, since connection to the brain is often through a layer of psychological concept. When it does appear it has been in literature about cognitive development, cognition, and learning. Developmental concerns about capability/IQ and identity development have changed under neuroscience influence, with psychometric interpretation and new test development incorporating neuropsychology, perhaps as defensive reaction to the charges against testing as racist and sexist. However the enduring questions remain the same: How should deficits/decline/giftedness be identified and accommodated and how are the sexes different? (Bigler, 1992; O’Boyle & Gill, 1998;
Most general education literature which explicitly attempts to incorporate neuroscience remains within this category such as brain-based education and the layered curriculum, and reading and math remediation, memory enhancement, brain changing self help books, most of which seek practical application of neuroscience without empirical testing. There is ongoing criticism of some educators’ tendency to make direct application to the classroom, assuming that research about neuron learning constitutes ‘evidence-based’ research on how best to teach. The addition of neuroscientists and practitioners to the authors list is raising the standard (Bruer, 1999; Geake, 2004; Lovrich, 2007; Willis, 2007a, b, Zull, 2002, 2004).

A few writers have specifically attempted to incorporate neuroscience and complexity principles into proscriptions for K-12 (Caine & Caine, 1997; Mangers, 2007). An interesting offshoot is literature which calls upon neuroscience research to support calls for arts education (Jensen, 2001) and the transformational possibilities of science education as aesthetic experience (Wickman, 2006).

The creation of transdisciplinary initiatives such as Harvard’s Mind, Brain and Education program, which aims to create a new science and practice of learning and development, is generating a new scholarly discourse. The questions are changing from how school districts should measure disability to whether psychology is capable of generating a science of the mind, why teaching for representational change is more effective for learning mathematics, and if there are separate neural systems for spelling (Dahaene, 2007; Norton, Kovelman, & Petitto, 2007; Singer, 2007). The theories of multiple intelligences (Gardner, 1999) and emotional intelligence (Goleman, 1996) are examples of non-empirically derived theory that has arisen in academic research settings and is inspired by but not explicitly connected to neuroscience findings demonstrating that we require experiences and emotion to learn. Gardner is involved with the
Harvard initiative where affective and social neuroscience are topics of interest (Blake & Gardner, 2007; Immordino-Yang & Damasio, 2007).

The complexity and education literature tells us The Santa Fe Institute is engaged in a massive initiative aimed at increasing human potential (Goldberg, 2003) in line with futurist predictions about the possibilities for brain/mind enhancement (Holmes, 2007). The SFI study uses cutting edge non-invasive structural imaging in prospective longitudinal research of cognitive, behavioral and physiological milestones in babies and adolescents. After mapping the brain through its normal development, the study will relate developmental milestones with brain changes to address mind/brain questions. The findings will be used to test interventions at times of optimal learning and plasticity. This will lead to development of teaching strategies designed to take full advantage of the process.

Adult education has taken a less intense but broader perspective on incorporating neuroscience. Cognition literature, in expanding its purview beyond rational thinking, makes room for neuroscience to connect with consciousness studies and various other ways of knowing. Both Caldarelli & Taylor (2001) in suggesting an evolutionary psychology (brain as product of evolution) approach to situated cognition and Hill (2001) in describing consciousness through neuroscience and network connectivity (mind and consciousness as emergent properties of the brain) are using systems/complexity thinking, although neither acknowledges this. By emphasizing the interdependence of emotion and rationality in learning as supported by research on other ways of knowing and whole person knowing, a direct association is made between neuroscience and the change that occurs through transformative learning (Taylor, 2001). This direct challenge to Merzirow’s (2000) rational transformative learning suggests emotion as a
system integral to learning which occurs through interconnections, again evoking complexity thinking but not acknowledging it.

Concurrently, there’s been some neuroscience inspired renewed interest in Gestalt psychology in support of holistic/whole person learning (Gray, 2006; Janik, 2004; Marks, 1998). This complexity perspective of brain function posits an organizing principle leading the brain to actively search for changing patterns of interpretation. From a complexivist perspective, visualization is recommended as a heuristic device particularly useful for younger adults under age 35 whose exposure to electronic media and decreased reading experience have created learners who use different neural pathways and require active inquiry modes of learning rather than the traditional conversion of knowledge to static information (Anderson & Woodill, 2004). Another fascinating tangent has been the interest in aesthetic education arising from understanding of the neuroscience of visual processes, extending to other modes of perceiving that are somatic (Blakemore, 2003; Jensen, 2001; Ramachandran, 2003a, 2003b; Shusterman, 2006). Actor network theory, situated cognition and communities of practice also clearly reflect conceptual overlap with neural network research and connectivity within complex adaptive systems, but since neuroscience is not appearing explicitly in those categories of adult education literature they will not be addressed here.

From a learning perspective, theoretically, it seems that systems thinking has eclipsed the older behaviorist and cognitivist orientations. Through the combined advances of evolutionary biology and neuroscience (where evolutionary biology, chemistry and physics are meeting in an integrative systems perspective) a picture of learning is developing that begins with a unique human being, continuously evolving in co-creation with its environment, changing and continuing to regenerate over an entire lifetime. The brain and nervous system, particularly the
neural synapses, are the site of learning, and the basis for all learning is connections at all systems levels, whether it be the dual channel neuron firing, connection of new network circuits across brain regions or connections with other human beings as attunement to include an educational mentor.

Stress and trauma can impact this process at all systems levels, but the brain self-repairs through neural reorganizing under positive conditions, which educators can help to create (Caine & Caine, 2006; Cozolino & Sprokay, 2006; Janik, 2004; Johnson, 2006; Perry, 2006; Ross, 2006; Sheckley & Bell, 2006; Taylor, 2006; Wolfe, 2006; Zull, 2006). Perry (2006) and Janik (2004, 2005) make the direct connection between trauma and learning, Perry through a neurobiologic understanding of fear and learning and Janik as an educator taking a mentoring posture in the classroom to apply neurobiology through linguistics to language learning. Janik (2004) cites the classic trauma therapy literature of Judith Herman (1997) and Bessel van der Kolk (1987), although not explaining how these relate to his mentoring model. As an ESL (English as a second language) educator, Janik (2004, 2005) also injects a cross-cultural piece into this discourse. He also includes spirituality, suggesting some relationship to somatic experiencing as dealt with therapeutically by Levine (Levine & Frederick, 1997). The basic science supporting this theoretical framework is difficult to replicate in human beings, but epidemiologic evidence exists showing that the negative neurobiologic consequences of many forms of adverse childhood events (ACE) exist into adulthood (Anda, Felitti, Bremner, Walker, Whitfield, Perry, Dube, & Giles, 2006).

The next research step will be linking to adult education theory and the educational setting. The current group of neuroscience inspired education authors represent a social constructivist framework (Taylor, 2006) that connects the brain’s learning processes with Kolb’s
(1984) learning cycle which is a quantifiable measure of experiential learning (Zull, 2006). The framework envisions this cycle occurring within a “constructive – developmental” transformative learning paradigm as explicated by Kegan (2000) which fosters qualitatively more complex ways of understanding and knowing and has been tested as a higher education assessment framework. The implied pedagogical approach is mentoring as conceived by Daloz (1999). Such an approach, they suggest, will lead to both greater epistemological (and individual neurological) complexity and a clear vision of the few simple rules or basic truths which order learning’s chaos. These truths would be wisdom (Zull, 2006). Considerable effort has been made to create a comprehensive neurobiologically based approach to adult education that can be researched using already validated quantitative tools. Incorporating the research criteria from the ACE studies would provide the necessary link to trauma. This is research we should expect to read about in the near future and it is clearly compatible with complexity science.

Complexity in Trauma Literature and Connections with Learning Through Neuroscience

After establishing in the previous section that bodies are embedded in and explained as complex systems whose learning is explained through neuroscience, this section moves on to show that this body learning is affected by trauma, and this process is also explained by models grounded in complexity principles. This trauma and learning discussion is then critiqued from an adult education perspective with final consideration given to intersections with trauma in the nursing classroom.

Trauma and Learning at Three Systems Levels

Beginning at the level of the neurobiological body, trauma’s effects can be seen and explained by complexity at the level of individual experiencing and interpersonal interactions, at the level of the individual classroom or other learning situation, and at the level of community.
The source of this discussion of trauma is the research literature linked with the fear-conditioning model of trauma. This is an ethological, neurobiologic perspective that is empirically based in bottom up research. It defines trauma as based in the perception of an individual as being overwhelmed by life events. These situations are characterized by having no control, perhaps being subject to humiliation, and the presence of fear conditioning. Interdisciplinary traumatic stress research that takes a complex systems perspective and builds on neuroscience will be used to discuss trauma and learning at three different systems levels: individual, classroom, and larger community.

*Individual Level: Pre-conscious Knowing and Security*

Here is a place that both neuroscience authors (Edelman, 1992; Varela, Thompson & Rosch, 1991) and philosophers of the body and embodied cognition (Lakoff & Johnson, 1999, 1946) are in agreement. Both express that most knowing and understanding is preconscious and arrived at through our bodies. Sensory, motor and central (or brain) systems work together as interconnected dynamic systems, over time and space. This occurs spontaneously and long before our conscious mind has been kicked into action by the activation of our cerebral cortex, our higher brain center. These parts all communicate with each other materially using electricity and chemicals, hormones and neurotransmitters.

One such system that is most basic to survival is the stress response system that makes us move into action when we perceive a threat (Selye, 1984; Sapolsky, 2004a, 2004b). Our cherished ability to abstract is not available to us without a first pass of electrical charges and neurochemicals through the emotional valence determiner deep in the brain, the amygdala (Damasio, 1999; LeDoux, 1996). The neuroendocrine stress response is mediated by the hypothalamic-pituitary-adrenal (HPA) axis. The amygdala is essential for influencing this axis
because it acts as a key processor and integrator of environmental threat data (Fanselow & Gale, 2003; Fanselow & LeDoux, 1999). Unless the amygdala provides us with ‘calm’, we might achieve focus, but abstraction will elude us (Perry, 2006; Perry, et al., 1995). Why? Because theorizing does not help one to move, to act, in response to imminent danger. Movement and action, in response to fear, have kept the species alive (Bolles, 1970; Bouton, Mineka, & Barlow, 2001; Charney, 2004; Christopher, 2004; Fanselow, 1994; Le-Doux, 1995). Clearly, this can account for why terrified students can’t learn theory or abstract concepts.

There is a codified, species-specific series of events which is occurring continuously as an organism lives in, evaluates, interacts with and responds to its environment. As active co-partners, the organism and the environment impact each other, in effect constantly recreating the world in which they live. Many neuroscientists who study emotion and stress (Bouton, 2005; Damasio, 1999; LeDoux, 2000; Panskepp, 1982; Sapolsky, 2005b) agree that the dynamic functioning of this process is grounded in preconscious interior experience. Siegel (2001) calls this a “primary emotional process” (p.81) that includes initial orientation, appraisal, and arousal. Once these initial responses are elaborated on, sadness, joy, anger or fear might emerge.

This review focuses on fear because the learning through fear circuitry is particularly linked to trauma (Bouton, Mineka & Barlow, 2001). “From a functional behavioral systems perspective this fear evolved as a set of anti-predator strategies designed to evaluate and respond to threat. The rapid learning of fear is a component of this system” (Rau & Fanselow, 2007, p.27). This fear is defined as “a loosely coordinated set of physiological, behavioral, and cognitive responses that are designed to get the organism ready for a future aversive event” (Bouton & Waddell, 2007, p. 41). Because Fear evolved to dominate behavior in the face of threat, there exists the potential for multiple negative consequences when the system is not
functioning optimally (Rosen & Schulkin, 1998). Just like the animal species, people experience
the qualitatively different states of worry, fear and panic along a continuum, (Craske, 1999),
similar to the predatory imminence continuum identified for animals (Bouton, et al, 2001). In
the face of imminent threat, people show fear, but below this threshold there is a continuum of
experienced responses that varies according to the temporal, physical and psychological
proximity of the threat.

In summarizing the body of research on this phenomenon, Rau and Fanselow (2007)
explain that when no threat exists, people, like animals, engage in their preferred activity pattern.
This is a pattern that is unique to them, having been self-organized in interaction with their
environments over time, and having features in common with the preferred activity patterns of
other species members, other people. There are strong elements of security and control.
Animals enjoying their preferred, secure activities go about searching for food and eating it,
exploring, mating with other animals, and attending to their nests (Bolles, 1970; Fanselow &
Lester, 1988). The reader will note that people choose to spend their time in similar ways. In this
relaxed, secure state, the full cortex of the brain, neo-cortex and sub-cortex can be involved, and
our inner state of calm allows us to enjoy reveling in abstract thought (Perry et al, 1995). As
dynamic systems, these are the stable forms of behavior and action that we achieve after self-
organizing to give form to disorder during developmental spurts (Thelen, 1989; Thelen &
Smith, 1994; Smith & Thelen, 2003).

The following restatement of Kauffman (1993, 2000) explains the elements of biological
process that are being applied here to understand trauma learning. When living systems are
disrupted from a state of equilibrium novel situations are constantly emerging. For the system
this is a function of its fundamental creativity. But creation also engenders some destruction. So
from this process novel situations emerge and present themselves. Agents must adapt and find new ways to respond, which they accomplish through self-organization. From a human perspective this novelty, a paradoxical blend of creativity and destruction, is often perceived as incongruous or even grotesque horror as it threatens wholeness. Adapting over time involves agents cooperating with each other and their environment to expand possibilities.

This body of research is central to evolving models of interpersonal neurobiology (Siegel, 2001) which underlie trauma research on somatic therapies. Attachment processes begin with activation of mirror neurons shortly after birth. From these interactions and other interpersonal communication the developing mind creates neural maps, representations of its own and other minds, which allow holistic perception of thoughts, feelings, perceptions, beliefs, attitudes, intentions, memories, leading to creation of a personal narrative. The integrity of this process and the constructed narrative determine our ability to be and feel connected with the world, making flexible self-regulation possible. Elements of caring that foster secure attachment during this process are collaboration, reflective dialogue, repair when attunement is disrupted, coherent narratives connecting past, present and future, and emotional communication (Siegel, 2001).

Mothers altered by trauma bring those changes of disconnection, aggression, attunement failures into the most minute level of interpersonal interaction with their infants, who respond as would be predicted by neurobiology with fear, defensiveness, freezing, disconnection, learning by mirroring to display these same expressions. It all happens below the level of conscious awareness of the mother, but is observable on digital video recordings (Beebe & Lachman, 1994). Availability of functional MRI technology has lead to new understanding of mechanisms underlying post traumatic stress disorder (PTSD). It is now being conceptualized as dysregulation of this self-system, so that the dissociative states that are observed with trauma
recall could be aligned with the defensive behavioral immobilization seen in animals faced with inescapable predation (Frewen & Lanius, 2006). These dissociative and hyperarousal states associated with PTSD also form the expression of traumatic attachments. These are imprinted into the developing limbic and autonomic nervous systems of the right brain, a structural deficit that endures and leads to inefficient stress response mechanisms at the core of PTSD in all age groups. At the interpersonal level victims of traumatic attachment (early abuse or neglect) respond to relational stress with incoherent strategies. Since the right brain is dominant for attachment, affect regulation and stress modulation, a template is set for deficient mind and body coping (Schore, 2002).

It is notable that complexity science is being used to explain the linking among interpersonal communication, personal narratives, and self-regulation. Human relationships that simultaneously support individual difference (differentiation) and interpersonal collaboration (integration) are thought to nurture the most complex states, presumably developing a person with greater adaptive flexibility and wide ranging self-organizing processes. So self-organizing capacity, self-regulation is a gift through secure attachment in a caring relationship (Siegel, 2001).

While the preceding emphasis has been on early life trauma and its lasting effects, most traumas at all ages occur in the context of interpersonal relationships, involving boundary violations, loss of autonomous action, and loss of self-regulation. They are all vulnerable to continue becoming physiologically dysregulated, entering states of extreme hypo- and hyperarousal, along with physical immobilization. This can become habitual. The empirically based treatment recommendations arising from the neuroscience research are contrary to traditional talk therapies which can activate memories and the entire symptom complex. Instead,
acknowledging what is now known about self-representations and body maps, effective treatment needs to involve increasing interoceptive capacity so that feelings and sensations are better tolerated, learning to modulate arousal, and knowing that the best response to experiences of physical helplessness is taking effective action. New approaches attempt to reprogram these automatic physical responses by addressing internal sensations and physical action patterns. Dialectical Behavior Therapy incorporates some aspects of mindfulness. Some traditional non-Western healing traditions claim to do this by activating physical movement and breath (tai chi, Qi gong, yoga). Pilot studies have shown yoga to be effective at reducing intrusions and arousal symptoms and improving body image. Other techniques work with sensation and movement, including the Alexander Technique for body work, Feldenkrais, Rolfing, focusing, somatic experiencing, Pesso-Boyden therapy, Hakomi, Rubenfeld synergy, and there are many more. Absence of clinical research leaves them misunderstood (Van Der Kolk, 2006).

Classroom Level and Learning to Fear

Not all trauma learning is sensory. Some becomes associated with conscious memories, both visual and languaged. This linguistic learning is explained by a different brain learning process and illuminated by another body of neuroscience research. A physician/linguist/educator (Janik, 2005) has written about a mentoring pedagogy to promote transformative learning, but with the express recognition of the lasting power of traumatic learning (fear learning activated in socially constructed situations), widespread experience of its effects in the general population, and the role that formal schooling has played in perpetrating some of this trauma. He identifies ritualized trauma as any traumatic learning that involves an element of ceremony and over which the victim feels they have no control. This category includes socially sanctioned and distributed substances, services, and activities (alcohol, tobacco, guns, prostitution, war, circumcision,
corporal punishment, professional sports, recreational hunting and fishing) and some individuals’
experience of school. The fact that this does occur in schools and with lasting consequences for
adult learners has been supported by research on learners with and without learning disabilities
(Simonelli, 2000). In a similar vein Perry (2006) has written about fear and learning, for
children and adults, noting that physiologic changes persist over time and are manifested in the
classroom. Fear, once learned, is reactivated whenever the associated memories are activated. If
a student learned to fear around formal learning, every new learning situation will revive the
memories and associated states, generating the physiologic stress response. Perry provides a
staged model to explain changes in levels of awareness and emotional reactivity as levels of fear
increase. Neuroscience research explains the model through fear conditioning and damage to the
hippocampus and neural networks.

Fear conditioning is also ultimately a function of plasticity at the synapse. A region of
the brain, the amygdala, is assigned to rate incoming stimuli on a noxious scale (Lamprecht &
LeDoux, 2004). It all begins with cue recognition. From an evolutionary view, fear protects us
from danger, which is why some researchers who study fear learning as a global phenomenon
choose to label it ‘survival learning’ (Silove, 2007). Behavior is automatically reorganized for
defense as threat level changes. Fear is no longer adaptive when activated excessively, which
can occur with traumatic exposure or prolonged and excessive activation of the stress response
system, and contributes to the symptoms of stress disorders (Rau, DeCola, & Fanselow, 2005).

Anxiety is a complicator that can interfere with fear extinction, and childhood trauma or
abuse may predispose to this through a different form of neural reorganization. This fear
reversal process is of particular interest in current research indicating that extinction represents
new learning laid down next to the old fear learning which will never be destroyed and is context
dependent. So extinction learning, while effective, works best in the context where it is learned. True extinction would require incremental learning with safety connected to wider and wider contexts. Temporal, physical and imaginary context changes operate similarly, so imagination might be used to promote extinction over time (Bouton & Waddell, 2007). Quirk, Milad, Santini, & Lebron, 2007). Functional imaging shows that post traumatic disorders are partially explained as failures of extinction characterized by lack of top-down control of the amygdala which responds heavily to triggers while the prefrontal cortex is quiet; a failure to learn, of sorts (Quirk, Milad, Santini, & Lebron, 2007). The hippocampus, essential to declarative memory, is particularly vulnerable to stress damage. Its work is disrupted by sleep disturbance. Cell death results in disrupted memory function, and stress prevents neurogenesis which this region normally can perform as a type of self-regeneration (Bremner, 2007; LeDoux, 2002).

The unfortunate story of stress is that it doesn’t just affect a few regions of the brain. Since the brain and nervous systems function as networks, stress does lasting damage to brain circuits and systems. Dysfunction of the prefrontal cortex after extreme stressors, like childhood abuse, may manifest as difficulty with correct interpretation of other peoples’ emotional expression. Functional imaging studies identify multiple ways in which people with PTSD or extensive trauma histories have alternative activation patterns during various cognitive tasks. There are clearly circuit disruptions in the processing systems for emotional and traumatic material and visuospatial processing. How these affect memory, sustained attention and visual association in cognitive function is unclear (Bremner, 2007). In youth the story is different as Teicher et al.’s (2003) longitudinal research shows that adverse childhood events are quite common, there are specific periods of vulnerability for brain regions, the brain damage differs
according to the type of abuse suffered and the identify of the perpetrator, and the effects of abuse are delayed for several years leading to concealment of true etiology and misdiagnosis. This work is the first to examine the effects of exposure to domestic violence, and there are now clear correlations with significantly lower SAT scores, IQ scores, and academic performance. What is being studied in adults for the first time is how exposure to adverse childhood events (ACE) manifests with workplace stress exposure. Police officers with just one type of ACE showed evidence of nervous systems permanently altered long before entering the force and on exposure to threat showed measurable heightened autonomic arousal, prolonged adrenaline and abnormal cortisol levels, prolonged panic and dissociation at the time of event, making them vulnerable to PTSD (Marmar, 2007).

Broken feedback mechanisms can also alter the outputs of the emotional motor system (EMS), resulting in changed responsiveness and unexplained somatic symptoms. Genetic factors, adverse early experiences and severe adult traumatic stress increase vulnerability to EMS problems and increased stress responsiveness as an adult (Mayer, 2007). New understanding of the role of distinctive bodily responses in expressing emotion (LeDoux, 1996) and the importance of afferent feedback, in other words information about the state of the body, for cognitive and emotional function (Craig, 2002, 2003; Damasio, 1994) shows that activation of the EMS in response to real and perceived system perturbations is adaptive. Differential responsiveness is environmentally contingent (Mayer, 2007).

Kerka (2002) has written about trauma and adult learners, asking for a reframing of the problem from psychiatric diagnosis for victims to an issue of increased safety for everyone. And yet what she describes are primarily examples of acute symptoms, which you would not expect to present in the classroom. She recommends holistic teaching for ‘healing’ with emphasis on
telling one’s trauma story for meaning making. Considering what is known about somatic experiencing, this may not be the best approach in a therapy situation, and education is not therapy. I would argue that it is also not the place for purposeful attempts to support meaning making of traumatic experience. Sometimes, this may occur as a secondary product of learning something new, but it should not be the aim of an educational offering. Such attempts could be re-traumatizing.

Neither Janik (2005) nor Perry (2006) suggest that past trauma experiences would be explicit course content. Their aim is improved recognition of the range of chronic stress and trauma induced physiologic change that already exists in the average classroom. Fearful learners learn differently and fear kills curiosity. They both suggest classroom level interventions to promote safety and recognition of individual differences. For Janik this includes multisensory engagement, learner self-direction with mentoring, attention to engagement with symbolism, attunement to the rhythm of learning cycles, and accommodating male/female differences. Perry (2006), citing Laurent Daloz on mentoring, recommends a creative and respectful approach in a familiar and structured environment made predictable through consistent behavior and interaction, with nurturing and sensitive attention to the learner’s state of mind.

*Community Level and the Tearing of Societal Tissue*

Kai Erikson (1995), a sociologist who studies community trauma in the wake of natural and technical disasters, if often quoted for writing “Sometimes the tissues of community can be damaged in much the same way as the tissues of mind and body” (p. 185) For him, trauma is the state, or state of mind that exists after receiving a stressful blow and his language likens the community to the human physical body. Like a systems thinker, he sees traumatized communities as clearly distinct from a collection of traumatized people. The community is an
entity, a system, unto itself. Just as brain learning occurs at the synapses, where it is also
distorted by stress and trauma, communities ‘learn’ through traumatic blows at their boundaries,
at their fault lines. Structural changes often occur that result in disconnections. The trauma
comes to supply the community’s mood and temper, imagery, and sense of self. The shared
experience links people (not usually by strengthening affiliative bonds) in a common culture of
trauma. So communal trauma damages in two ways: by ripping the tissues that keep groups
intact, and creating climates that dominate group spirit.

It is easy to notice the similarity to sensorimotor and attachment dysregulation and fear
conditioning with attendant hyper- and hypo-arousal. Just as with individual trauma, where
interpersonal trauma is the most damaging, for communities, the human manufactured
technological disasters that are therefore preventable are the worst. They cannot be blamed on
God. Traumatized people and communities experience a changed sense of self and way of
relating (again supported by neuroscience) and also a changed worldview. Some educators
would call this a transformation. Like the altered synapses that now produce different algorithms
in predicting the outcomes of incoming charges, traumatized communities calculate life’s
chances differently. Having failed to screen for peril, they become unusually vigilant and
anxious. Competence vanishes after being routed by technology. Space opens for alternative
forms of explanation. These changes should not be labeled pathological, but be recognized as a
unique form of wisdom. (Erikson, 1995).

There is an extremely powerful message here, because Erikson never suggests what
should be done to repair this situation, or to change it in anyway. Being a systems thinker, he
accepts the reordering and self-organization that come about when a system reaches the edge of
chaos. He does not place blame or seek to explain. He simply tells us, “Here is knowledge. Listen.”

The extensive ethological study of human creatures shows that fear learning is an innate, evolutionary, physiologic process which serves survival, with a continuum of species specific interoceptive experiences, mental states and behavioral responses (Rau & Fanselow, 2007). These exist in highly unique patterns as they arise from the individual self-organization occurring when disorder results from encounters with threat. Not only do the self-organization pathways and results vary, but there is variability in the intrinsic dynamics of each individual which determine the initial perception of threat and risk appraisal. For example, the experience of subordination contributes to chronically increased circulating levels of cortisol, a stress hormone (Abbott, Keverne, Bercovitch, Shively, Mendoza, Saltzman, Snowdon, Ziegler, Banjevic, Garland, & Sapolsky, 2003). Stress hormones in turn can mediate enhancement, or sensitization of fear learning. One becomes more sensitive to even less intense stressors ((Rau & Fanselow, 2005). This becomes a continuous cycling process of survival learning, through fear and extinction learning, as episodes of exposure and the resultant self-organization create new intrinsic dynamics which will be at play when the next episode of threat exposure occurs. It is an endless process of learning, through the body, in interaction with the environment, in order to survive.

Survival itself has many facets and can be described at the multiple systems levels in which individuals live their lives. Because context is integral to both fear learning and fear extinction learning (Bouton & Waddell, 2007; Quirk, et al (2007), it becomes important to identify aspects of context which promote or inhibit fear learning and fear extinction learning. Power is one aspect.
Critique from Adult Education Perspective

These three examples of learning in relation to trauma are all derived from or supported by empirical research, whether neuroscience, clinical intervention trials, or sociology. Two are intentionally grounded in neuroscience and note that trauma changes the way a neural network and a person learn, especially with changes in visual awareness. Only one specifically declares a reliance on complexity science, but systems thinking is clearly evident in two of them. All three view learning as structural change that comes through trauma, or intersection with threat, accepted as part of the natural evolutionary process. They all view these structural changes as lasting, but potentially alterable through future systems action (movement, mentored exploratory learning, community behavior from the place of new identity). None of them values a rational or linguistic response. None suggest that meaning making would be useful. All support the primacy of learning to listen: to self, interoceptively, and to each other to build and strengthen a network of connection. All recognize the significant role of emotion in every iteration of self-organization and that after helplessness there must be action and safety.

There is no recipe here for adult education. What these perspectives offer is the empirically based, comprehensive, transdisciplinary system of understanding in which they are anchored. Taken alone, each could be useful for the system level it describes. They are strongest when viewed as part of a unified whole. It is not necessary to adopt a complexivist worldview in order to use these principles as an educator, which means fewer ethical issues should be raised for educators wary of stepping beyond their accustomed territory (Ettling, 2006). They are true descriptions of learners as organic systems regardless of educational philosophy, and they offer the opportunity to achieve better understanding of our learners, without seeking to pry into their personal histories. The subject matters because of the high
incidence of interpersonal and other forms of violence in our culture and around the world and the incidence of stress syndromes beneath the threshold of PTSD (van der Kolk, Roth, Pelcovitz, Sunday, Spinazzola, 2005). Being able to recognize these effects and respond to them as individual differences in learning style rather than symptoms or problem behavior will make it possible for more people to be students and more students to learn well.

*Interacting with Trauma in the Nursing Classroom*

Experience and the literature have taught me that nurses and other health care workers are vulnerable to vicarious trauma in the work setting and this problem is receiving more attention (Ambuel, Butler, Hamburger, Lawrence, & Guse, 2003; Clark & Gioro, 1998; Hughes, Grigg, Fritsch, & Calder, 2007). Otherwise healthy RN-BS students consistently measure as sleep deprived, caffeine dependent, and exhibiting early signs of stress mediated physiologic change, the level of which is predicted by their perception of never being able to be and do enough. Compared to Marmer’s (2007) police trainee group they appear to have high levels of traumatic exposure manifested in high levels of dissociation. They do not rate high on job burnout or compassion fatigue but as many as 20% have secondary traumatic stress. This does not have to be a negative, as the physical sensation and perceptions of secondary stress can become useful in the clinical setting (Raingruber & Kent, 2003). The fact that novice nurses who use intuition often credit previous adverse experience or trauma for their intuitive gift attests to this (Ruth-Sahd & Tisdell, 2007). Students who are learning to work with disaster and trauma report their most satisfactory learning happens at the bedside, in open discussion transdisciplinary groups with expert practitioners that include some practical skills training, and with virtual simulations (Davies & Hannigan, 2007; Huber, Alsfasser, Hillmeier, Herzog, Kock, & Meeder, 2006). In effect, they want to deal with reality.
Conclusion

Complexity science or dynamic systems principles contribute to understanding learning, trauma, and the mind/body connection which is not only assumed but integral to the more holistic adult education approaches, such as embodied learning, spirituality and narrative. Complexity and neuroscience informed practice models of cognition and development (Siegel, 2001; Thelen & Smith, 1994), fear learning and survival learning (Perry, 2006; Quirk, Milad, Santini & Lebron, 2007; Rau, DeCola, & Fanselow, 2005; Silove, 2007), and sensorimotor psychotherapy (Ogden et al, 2006; van der Kolk, 2006) are contributing to the empirical foundation for linking mind/body, learning and trauma. These models can also inform research on embodiment and somatic pedagogy. Such pedagogy becomes increasingly important as adult education theory finds new application in fields such as trauma work.
CHAPTER 3

METHODOLOGY

Our guiding premise is that the questions emerging from the embodied, embedded, and mindfully lived clinical experience frame conversation and determine research design. (Miller & Crabtree, 2005, p.609)

This chapter reviews the purpose of a mixed methods study, grounded in a complexity science theoretical framework, that sought to understand how RN-BS clinical students learned through their bodies, how they formed new patterns of connection, and how these patterns related to trauma. It first provides a description of the study in context including a list of guiding questions, then an overview of mixed methods research with discussion of its appropriateness for the questions under consideration and participant selection procedures. The chapter then provides an explanation of data collection and data analysis methods, and concludes with strategies to insure trustworthiness.

The Study Purpose in Context

This study explored the process of self-organization (learning as the process of forming patterns of connections) among RN-BS clinical students learning through the body, and how these patterns relate to trauma. This is a complex phenomenon involving intersections of several aspects evolving over a period of months so mixed-method research was selected to permit delving below the surface of this complexity to understand and generate new ideas.
Complexity in Pedagogy

Because the source of my data related to the two courses I taught to RN-BS students, along with final interviews as they retrospectively made sense of their learning, it is important to explain my method of teaching and evolution of embodied activity in my courses as a background to explaining the study. The courses were attended by a primarily consistent cohort and taught using my usual complexity informed teaching style (Fenwick, 2003; Karpiak, 2000). In the classes I teach, this means that I provide a general structure and allow for lots of individual variation in carrying out assignments. In class I might incorporate art or music to illustrate principles, or just as a surprise. Students study themselves by completing surveys linked to aspects of health, stress, trauma, learning, teaching, temperament, conflict and power. We analyze group data in class to practice research skills and then they do individual analyses as they want to in learning journals. Learning journals are for the purpose of noticing how they are putting things together, what they respond to, and recording surprising ideas. They are graded on completion, not against a standard, and I allow them to evolve at any pace, as long as they are finished by the end of the semester. In some cases a clinical project evolves as a creative work, for instance when family assessments are done building scrapbooks about their own families. We use case material from my nursing experiences and their work setting to make sense of readings. Sometimes we use simulations. I watch dynamics carefully, attending to whole group and individual students to keep energy flowing, and take opportunities to connect our activities and discussion and behavior to complexity. So that is my usual pedagogy and it is how I taught in the courses that generated the data used in this study.
Clinical Action Pedagogy

At a complexity conference in 2004 I heard Benjamin Crabtree discuss some of his research in primary care. Later I was happy to find the Miller and Crabtree (2005) chapter on Clinical Research. I liked that the theoretical orientation was complexity and ecological science, emphasizing that nature thrives on improvisation. Although the chapter was about doing research, specifically a multi-method randomized control trial design, I saw possibilities for designing clinical education. Seeking to bridge dominant biomedical and other cultural worlds Miller and Crabtree (2005) write that they emphasize the metaphor of the body and its socially constructed aspects beyond its corporeality, which is the focus of biomedicine. They also suggest storytelling as a way to restore voice to the body. Body symptoms are understood as the in-folding of cultural traumas into the body. As bodies create history, these symptoms unfold into social space. In terms of research design they also advocate mixing data collection methods in order to challenge existing paradigms (Miller & Crabtree, 2005).

My teaching goals harmonized with their research goals: deepen and contextualize practical and ethical questions and understandings, and trouble the waters to seek change. Their general approach of democratizing medical knowledge by creating a space for storytelling to share knowledge sounded pedagogically appealing. Their guiding premise, which centers the embodied, embedded, mindfully lived clinical experience, fit my desire to do something more in my classes with embodiment. Using their “participatory wheel of inquiry” (Miller & Crabtree, 2005, p. 617) as a guide, I began to create what I thought of as ‘clinical action pedagogy’ which would inform the series of four clinical courses that I teach, aiming over four semesters to produce slow knowledge, consistent with the rhythms of life and sustainability (Orr, 2002, in Miller & Crabtree, 2005). The wheel balances the domains of knowledge and ways of knowing
that they believe are necessary for personalized, prioritized and integrated clinical care. The approach is more participative and subjective than traditional clinical knowledge creation, requiring involvement with oneself, and balancing materialist science knowledge with inner knowledge and meaning.

Pertinent to this study are the first two courses in that series. [Say something clarifying about this “wheel” thing that you refer to after this, so we know more of what it does in a sentence or two.] Beginning with a health assessment course, I drew from the information mastery half of their wheel, framing the course around the complementary pair of “I” as embodied clinician or patient and “It” as disease or illness. Story was incorporated in both of these courses by adding a repeating attention to the natural history of disease and the unfolding of allostatic load as a form of “It” body story of the evolutionary human body. In the “I” category I incorporated, along with the already present health and stress survey self-assessments, a book of experiential anatomy exercises called *Body Stories* (Olsen & McHose, 2004); we did some of these in class and some independently, and students kept a weekly reflective journal about these and any other aspects of the course. This was a way to incorporate ‘reflection of the clinician’ on their own body story. Changing textbooks to one that framed medical history taking as uncovering patient story helped us focus on the ‘experience of the patient’. I prepared for this by taking a semester of yoga class and having that instructor begin and end this course with a yoga trance dance. She has continued with that practice and I have continued with yoga.

The second course addressing complex problems in adults moved around the participatory wheel of inquiry so that the primary complementary pair for this course is “I” as clinician or patient and “Its” as the system, which rests in the justice half of the wheel. The course incorporates some content on family, culture, and pathophysiology (other quadrants of the
wheel), but only tangentially because they are sources of complexity. The focus is on the tension within the “I” and “Its” pair. A primary content thread is complexity science in healthcare. Embodiment was incorporated into this course by introducing self-organization with a movement activity, and then creating life size body maps in class, which helped the students who had not been in the health assessment course to ‘join’ with the embodiment thread. We used a brief progressive yoga mindfulness program developed at Bessel van der Kolk’s Justice Resource Institute in Massachusetts. This was our way to open class and after a few weeks students engaged in leading each other in the exercise. We did an in class viewing of “Wit” about a woman with ovarian cancer and her experience of hospitalization, and we used a body awareness scale to watch our body responses to the film. Finally, over two weeks at the end of the course we had a story sharing exercise to exchange clinical stories in which body experiencing had played a significant part. This began with me telling my own story. Throughout this class students also kept an unstructured learning journal in which they recorded whatever they studied, learned, noticed, and paid attention to each week. Clinical projects were self-directed. This model extended into two other courses but I will not report on those since I did not study them. Details of how these courses unfolded are summarized in Appendix K (p.384).

Research Questions

With the purpose and assumptions (as given in Chapter 1) in mind, there are three primary research questions that guided the study:

1. How do RN-BS students learning health and physical assessment of the human body ‘map’, or make patterned connections about clinical learning when they are taught a neurobiologic mind/body model and their own bodies are actively involved through experiential anatomy?
2. How are students’ unique patterns of trauma involved in mapping their learning about physical assessment and complex clinical problems when experiential anatomy, self-assessment, and body awareness are included in the curriculum?

3. How do students map, or make connections, between a neurobiology based experiential curriculum and both their personal lives and professional nursing practice?

**Mixed Methods Research to Understand Complex Phenomena**

In this section I begin with a philosophical look at why mixed methods relate to the complexity science framework. Then I provide an overview mixed methods research going on to discuss how the qualitative and quantitative paradigms relate to the research questions.

**Philosophy, Complexity Science and Mixed Methods**

As a perspective that embraces science, scientific method, and evolutionary biology, complexity science is naturally tied to philosophical pragmatism. This is the research paradigm that traditionally provides the philosophical framework for mixed-methods research. On this basis alone a mixed methods study would be appropriate for research using a complexity science framework. Pragmatism, an American philosophical tradition, was birthed by Charles Peirce and William James and later developed by John Dewey (Kuklick, 2001). The significance for this discussion is that declaring a stance on reality is not what pragmatists would do. So, their reality is essentially that which is useful and lends clarity.

A logical extension would be that there are multiple realities within every reality and an infinite number of these at any one time, all changing over time and space at variable rates and in
variable patterns according to what is necessary (for a dynamic system) at that moment in time for that particular situation within a particular context. Pragmatist research would be practical using whatever methodology the researcher decides is most useful for the question at hand as long as it achieves the stated purpose. Neo-pragmatists value mixed methods specifically as a way to temper the tension between quantitative and qualitative paradigms (Mertens, 2005). Research confirms that systems can yield unexpected new structures and events at macro levels when simple rules are followed by large numbers of components. The origins of these collective system properties are not intuitively obvious since they don’t exist at lower systems levels or in individuals (Camazine, et al, 2006, pp.88-91). Restating these last two sentences in simple language, this is a way to study self-organization which was my goal.

*Mixed Method Research: Viewing the Whole from Above*

Mixed-methods design is a cover term for mixed method and mixed model research (Tashakkori & Teddle, 2003). Mixed method research studies use qualitative and quantitative data collection and analysis techniques in either parallel or sequential phases. The mixing occurs in the methods so that both qualitative and quantitative data are collected and analyzed to answer the research questions of one study. These studies are often only marginally mixed with the questions and inferences made falling into one or the other of the two traditional paradigms. This study is a mixed method research study as just described, using quantitative data collection and analysis to complement a primarily qualitative study. The decision to use this mix relates to the general intention of the study in line with Tashakkori and Teddle’s (2003) typology of reasons one would do research. This study fits their category of wanting to understand a complex phenomenon and to understand change, in this case self-organization processes.
Among these categories of reasons for doing research (Tashakkori & Teddle, 2003) this one, to study a complex phenomenon, is often associated with understanding meaning, and self-organization can be construed as the construction of meaning in learning, and how it unfolds as a process. This intention for research can also be used to reveal story, uncover detailed descriptions of people’s lives, to contextualize, or to illuminate a particular case or issue. To extend this intention in an exploratory way by uncovering relationships and generating ideas adds a second prong in the study. This combination of general intentions is an accurate representation the study questions one and three which relate to self-organization around embodied learning. A particular strength of mixed method research is triangulation in the sense of looking at the same phenomenon in more than one way so, extra important with complexity.

The traditional approach used for understanding a complex phenomenon like self-organization would be qualitative, holistic and inductive studies. Either paradigm could be used to continue with the uncovering of relationships. Using mixed method research for a study with this multilayered purpose allows for multiple techniques, which would be done for any of three reasons (Tashakkori and Teddle (2003): to answer questions that other methodology cannot; to provide stronger inferences; and to provide the opportunity for presenting divergent views. Each of these reasons is considered in connection with the research questions. Questions one and three are written so that they can be answered with qualitative methodology. Stronger inferences and divergent views are not of particular concern. The purpose is simply to come to a deeper understanding of self-organization in learning through the body under particular conditions.

It is question two, about the connection with trauma, that presents the methodologic challenge. It is the question that recognizes the field of trauma studies is already rife with
divergent views. To address trauma and uncover relationships would benefit from adding quantitative methodology as a way to present divergent views. Those divergent views could be expressed as complementary pair of medicalized trauma vs. naturalized trauma. An additional way to approach research question two would be with exploring another dimension: adding to and strengthening the knowledge base and clarifying structural connections. The traditional approach to this dimension would be a quantitative design. Qualitative method can be added under a mixed method paradigm to aid in developing theory (Tashakkori & Teddle, 2003).

This dimension of exploration was indeed present. In light of all these considerations the final design determination yielded an exploratory study of trauma’s connection to learning that is embedded within the larger inductive study of self-organization in the presence of embodied learning. Qualitative methodology predominates with quantitative data incorporated for the reasons just describe. It fits the pragmatic parallel mixed method design category since both types of data, qualitative and quantitative, were collected independently at the same time.

Participants were recruited (Appendix A, p. 357 ) at the time of the interview approximately five months after the completion of the second course. They signed the informed consent (Appendix B, p. 358) and later provided whatever they selected from the work they produced during the two nursing courses, such as their journals documenting their insights as they unfolded throughout the course, papers, results of quantitative assessments that they took during the course, that they wished to share as part of the study.

Participant Selection

The potential participants for this purposeful sample included the students who had completed N351, the Health Assessment Course. Most of those students had also continued with
the Complex Problems course the next semester or had completed it previously. But completion of N351 was the criterion for invitation to participate. All 16 students chose to participate but ultimately two of those were not available to complete the study due to illness and a travel position. So the quantitative portion of the study is based on data from 16 participants while the primary data collection for the qualitative portion of the study was completed with 14 participants.

A purposeful sample was chosen because it provides useful manifestations and rich examples of the phenomenon of interest, but not highly unusual cases (Patton, 2002, p.40, 234). Both nursing courses are required course, the first and second of four clinical courses, and pre-requisites include licensure as an RN, therefore all students will had particular knowledge about the phenomenon under study, a selection criterion under purposive sampling (Creswell, 2002). Students’ current status as practicing registered nurses means they provide rich examples without being highly unusual cases.

Participant selection criteria included: a) willingness to participate; b) demonstrated openness and interest in developing body awareness (differentiating internal sensations and emotions; visceral experience of memory) and developing control over physiological states such as breathing, and c) a level of comfort with offering in-depth descriptions of their body awareness and indicated interest from journals and class discussion. The sample included 14 participants, so all the members of the class except the two who were sick or had moved. The participants will be introduced in alphabetical order and identified according to demographic data pertinent to this study. The demographic data is listed as they provided it in their interviews.
<table>
<thead>
<tr>
<th>Participant’s Name</th>
<th>Gender</th>
<th>Age</th>
<th>Ethnicity</th>
<th>Years in Nursing</th>
<th>Nursing Work Setting</th>
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<tr>
<td>Angela</td>
<td>F</td>
<td>23</td>
<td>Primarily Caucasian, Italian heritage</td>
<td>3.5</td>
<td>Staff Nurse / Acute Med.</td>
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<tr>
<td>Cadence</td>
<td>F</td>
<td>24</td>
<td>White; Irish and ?</td>
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<td>6 mo.</td>
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<tr>
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<td>29</td>
<td>Caucasian</td>
<td>7</td>
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<tr>
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<td>Caucasian</td>
<td>15</td>
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<td>Not too sure</td>
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<td>Staff Nurse / Oncology</td>
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<td>Frequencies</td>
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<td>36 – 45 yrs (2nd Career)</td>
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<td>44%</td>
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<tr>
<td>Married (Parents)</td>
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<td>56% (44%)</td>
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<tr>
<td>Asian American (Indian)</td>
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<td>6.2%</td>
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<tr>
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<tr>
<td>Latino</td>
<td>1</td>
<td>6.2%</td>
<td></td>
</tr>
<tr>
<td>Family or members in refugee status</td>
<td>2</td>
<td>12.4%</td>
<td></td>
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</tbody>
</table>

| Years of Nursing Experience     | Range: 0 – 23 Years   | Median: 2.5 years |            |
Data Collection

Several forms of data were collected for the study. Each one is described in this section beginning with all qualitative types followed by descriptions of the quantitative tools. Chart 5 (p. 135) gives a chronological account of data generation, collection and analysis.

Qualitative Data

Qualitative forms of data typically are interviews, artifacts such as documents, records, materials and equipment, and observations recorded in the researcher’s field notes, photographs, and audio and video recordings (Stringer & Genat, 2004). Much of the data for this study was qualitative in nature.

Students’ reflective journals. Journals are uniquely suited to the study of complexity since they model real life while removing external controls. This creates a situation that promotes disequilibrium, which promotes change. As a form of complexity pedagogy the journals capture this change in documentation of emergence and bifurcations/irreversible shifts while they allow participants to make non-linear interpretations. As individual histories are seen to interact with current and emergent states, the property of sensitivity to initial conditions is clearly demonstrated through experience, and students can observe and reflect on the holistic pictures being formed through the interplay at another level. (Phelps, 2005).

In the health assessment course, the reflective journal was built into the course requirements and was tied directly to the experiential anatomy curriculum (Olsen & McHose, 2004). Students journaled weekly in response to these experiences in the “Health Assessment” class, following guidelines from the syllabus and activity specific instructions in the book. This process provided feedback to guide the learning experience and functioned as written conversation and relationship building between the student and instructor.
Other Documents and Artifacts. A number of other documents and artifacts were generated throughout the two courses that were collected for possible data analysis. The critical incident questionnaires (CIQ’s) conducted at the end of some class sessions were an example of one of these types of documents. Throughout the Body Stories curriculum mentioned above, students supplemented their experiential movement and imagery with sketches of their unique skeleton, after exercises lead them to know its individual difference. They also created life size body maps. These were collected along with the reflective journals and reviewed to identify the unique features of organization to understand the broad range of ‘signatures’ apparent in the personal learning methods designed to meet requirements and move through material as well as changes in reactivity to the material as discerned from the writings. Marker experiences notable when identified by student as generating significant learning or surprise were recorded in a visual way to look for patterns at the group level.

Interviews. One semi-structured interview was conducted with 14 of the 16 eligible participants, five months after finishing the second course, “Complex Problems in Adults.” Prior to the interview they were given the list of interview questions and asked to review any course material they had saved, keeping in mind two primary questions: What they noticed about how they made connections and self-organized through the body learning, and what they were learning about their own body interaction with trauma.

They were asked to identify original patterns of order, intrinsic dynamics at the start of learning, extrinsic dynamics especially as they stimulated fear conditioning in the process of learning, surprises in the process, emerging patterns. The outcomes of this process of consideration were discussed in the interview, comparison of original body story (baseline pattern of organization) was compared to the body map drawn at the end of Health Assessment,
and to their current memory of early body stories. Evolution in their understanding of ways of body knowing and personal sense of embodiment were explored. The interview also addressed fear and trauma by discussing in greater depth the body stories that were written about testing situations, instances of fear learning or re-stimulation during the process of learning through the body, and connections made to fear or trauma learning in academic or work settings. Finally questions addressed the experience of yoga trance dance, process of change in body awareness, notable body sensations or body map changes, changes in workplace experience and effects on their personal lives. The interview guide is available at Appendix C (p. 361).

Quantitative Data.

Quantitative data was acquired using four published instruments. These produced scores that were compared to normative data in class for interpretation. The standardized tools were used and data collected during the “Health Assessment” course. After participants gave informed consent, the data set was retrieved from the Angel automated course management system and analyzed using SPSS. Since trauma in this study is understood as existing in the body and mind is itself embodied, the study assumed it was possible to assess trauma’s presence in the body in some measurable way. Since trauma has been medicalized, there are numerous tools for measuring trauma-related disorders. The attempts to measure trauma in this study walked a middle ground between the extremes of purely subjective experiencing at one end and psychiatric diagnostic criteria at the other.

“Am I sleep deprived?” Since sleep deprivation contributes to physiologic stress and disturbed sleep is also a manifestation of the nervous system dysregulation that occurs with trauma (van der Kolk, 2006), a measure of sleep deprivation was included (Maas, 1998). The “Am I Sleep Deprived?” tool (Appendix E, p. 370) which was developed for self-assessment by
the general public. According to Maas (2009) his tool was based on the Stanford and Epsworth Sleepiness Scales, validity of both having been measured against sleepiness. Maas combined these with overall subjective sleepiness ratings in undergraduates. His questionnaire has high construct validity but no Multiple Sleep Latency Studies have been done on this population (Maas, 2009). The Maas sleep deprivation tool asks 15 true/false questions. Three or more true answers suggest more sleep is needed.

*Adrenal Burnout Scale.* The dysregulation of traumatic stress occurs over time with chronic serious stressors being especially damaging to the hypothalamic-pituitary-adrenal axis (HPA), or stress response system (Sapolsky, 2005c). I used an Adrenal Burnout (Hanley, 2001) tool (Appendix G, p.372) that attempts to use behaviors to screen for early indications of physiologic change occurring before actual tissue change results in medical disorder. Jesse Hanley is an M.D. who used data from her clinical caseload in rehabilitation medicine to develop a screening survey to identify adrenal burnout in healthy, high-functioning adults. Her goal was to teach lifestyle change and changes in thinking about stressors through early diagnosis of the precursors of later chronic degenerative disease. The tool was published, along with a ten-step recovery plan, and marketed to a general audience as an anti-aging self-help guide. The survey instrument produces Adrenal Burnout Scores grouped in 6 categories: those whose lives are healthy, driven risk takers who thrive on adrenalin, dragging caffeine junkies with mild sleep disturbances, and the midpoint stage of Losing It. Here, there are multiple sleep, weight, energy, and pain symptoms signifying possible onset of tissue changes that will lead to disease but medical tests could not currently identify any pathology. The final two categories move through memory loss, physical and emotional symptoms to complete Burned Out stage which is crisis
mode functioning. This survey asks 59 questions either as yes/no or 5 item Likert scales. All responses have a numeric scoring value from 0 to 7.

To help answer the question related to workplace experience I turned to Stamm’s collection of tools developed to research health care professionals who work with traumatic stress. B. Hudnall Stamm (1997, 2005) is a psychologist who worked in traumatic stress research for the Veterans Administration and now is a faculty member at Idaho State University. Her Traumatic Stress Research Group produced the Stressful Life Experiences Screening (SLES) and Professional Quality of Life Scale (ProQOL, R-IV).

*Stressful Life Experiences Scale.* The Stressful Life Experiences Scale (SLES) (Stamm, 1999; 2002) was developed to support an empirical approach to contextualizing death and trauma. It is exhibited in Appendix F (p. 371). Stressful experience is viewed as an ecological, contextual issue from which positive developmental growth can occur. Traumatic stress reactions are the natural feelings and behaviors that arise when dealing with the stressor (Figley, 1985). These reactions are assumed to include an element of even-induced demand for reorganization of one’s belief system (Stamm, 1999). When coping resources don’t meet the challenge pathology results: traumatic stress disorder (Figley, 1995). Even stressful experiences are simply categorized and packed away unless they fail to meet our general expectations for a situation. When we encounter a situation that is unexpected and ‘larger than us’ destabilization can occur. When the person has resources to match the event, it is absorbed. The more massive the event the greater power it has to overwhelm and destabilize.

The SLES screens for history of exposure to events that are known from traumatic stress literature to have the power to destabilize and cause traumatic stress reaction. The screening tool asks about exposure to 20 of these experiences. It uses a 10 point Likert scale to rate the degree
to which each even equates with ones own experience; the amount of stress experienced at the
time of the event; and the amount of stress experienced in relation to that event today. In this
way, the tool provides a lifetime history of risk factors for traumatic stress disorder, a hint at
possible current disorder based on lingering stress over past events, and finally a look at coping
and adaptation by noting how stress response to events was registered initially and how it has
changed over time. The psychometric properties of this scale are being studied but have not
been established. To date it has been used primarily with dissertation studies (Stamm, 1999).

Professional Quality of Life. The ProQOL is a self-scoring tool that uses 30 statements
rated with a six item Likert scales. Combinations of these item scores produce three scores:
Compassion Satisfaction, which measures the satisfaction derived from caring for people in a
health care setting; Burnout, which is a measure of work satisfaction for health care providers
based on their sense of effectiveness in their current job; and Trauma/Compassion Fatigue which
assesses presence of traumatic stress disorder symptoms in relation to work in health care.

Psychometric testing was conducted on the original version of the ProQOL instrument
(Figley & Stamm, et al, 1996) which was designed for use with adults working in human service
fields. The theoretical orientation is labeled ‘integrative’ with roots in secondary traumatic stress
literature. Burnout items were taken from Pines (1993) and trauma items were derived from the
traumatic stress literature. Research on the ProQOL is ongoing. The psychometric properties of
the revised version are Compassion Satisfaction alpha = .87, Burnout alpha = .72 and
Compassion Fatigue alpha = .80. While these are in absolute value somewhat lower than the
original test (Compassion Satisfaction alpha = .87, Burnout alpha = .90 and Compassion Fatigue
alpha = .87), given that the scales are shortened by half in length, these scores are actually
more reliable than the longer form (see Spearman Brown formula, for example, if original
reliability was .82, a comparable reliability on the shortened scale would be .69). The measure has considerable improvement on the item-to-scale statistics, due to increased specificity and reduced collinearity. The addition of the new items should reduce the known co linearity between Compassion Fatigue and Burnout (Stamm, 2002). The PQOL is at Appendix H (p.374).

*Experiential Learning Styles.* We include self-assessment with Kolb’s Learning Styles Inventory (Kolb, 1976, 1984) along with some other tools to facilitate discussion about diversity in learning preferences and how this impacts student learning as well as patient teaching. It was selected from the course products for inclusion in the data analysis after participants noticed their styles had changed. According to the most recent technical manual for this tool (Kolb, 2005) the LSI is not a criterion referenced tool. It is a self-assessment and a tool for construct validation of Experiential Learning Theory for which it shows strong construct validity. For the original 1976 version, which was used with participants in this study, 350 research studies established validity in a number of fields, including education, management, psychology, computer science, medicine, and nursing (Hickcox, 1990; Iliff, 1994) providing empirical support for Kolb’s experiential learning theory. But psychometrically it had low internal consistency reliability and test-retest reliability. Later versions of this tool have addressed these weaknesses so in future research if this tool were used purposefully it should be the newest version (Appendix I, p.376).

Responses to the various survey instruments were collected online and through the university’s course management system. Student input was anonymous. A complete data set was available through the course management system with students identified by a computer generated number. In creating their reflective journals in health assessment, students also include scores on these various surveys which they interpret to learn about themselves, but these scores are not shared with the instructor or with the group unless the student chooses to do so.
Chart 5. *Data Management*

**Year 1**

|------|------|------|------|-----|------|------|

**PRIOR TO RESEARCH**

**QUAL Data Generation**

**Activity**
- Yoga Trance Dance 1
- Trance Dance 2
- Body Stories at home and in class: 1 – 6, 27 7 – 17 18 – 24
- Body Map ……………….Body Map “Wit”
- Self - in class
- Organization
- Yoga Mindfulness
- Exercise
- Clinical Cases to Stories

**Body Stories Journal**
- Early body memories story
- Drawing of own skeleton
- Reflections on weekly “Body Stories” book exercises done at home and in class

**Learning Journal**
- Self-organization of learning about complexity science and through the body in relation to clinical stories

**QUANT Data Generation**

- Sleep
- Learning
- Adrenal
- Stressful Life Experience
- Deprivation
- Style
- Burnout
- Profess. Quality of Life
- Dissociative Experiences

**Participant Data Analysis**

**Qualitative………………...**
- Ongoing analysis of their own data as students discuss results in class

**Quantitative………………...**
[Most participants in a new course together, with researcher, Learning about Family and Community Nursing; create a family scrapbook; no embodiment activities]

RESEARCH BEGINS

IRB
Solicit Participants
Receive their products from previous courses
Conduct Interviews

Qual and Quant Data Collection

Qual Data Analysis
Preliminary analysis after each interview; transcription; Coding Themes

Quant Data Analysis
Quant. Analysis
With SPSS

Mar. Apr. May
Integrate Quant. Data & Qual. Data from journals and interviews to Interpret around major themes

Integrate Quant. Data & Qual. Data for analysis to identify integration using a template based on Siegel’s model of emergent embodied “mind”

Integrate Quant. Data & Qual. Data, transform and Analyze for patterns of connection
Data Analysis

Data analysis with mixed methodology occurs consistent with the design, which is either sequential or concurrent depending on the researcher’s reason for using mixed methods (Creswell, Clark, Gutman & Hanson, 2003). In this particular case the design is concurrent and nested, in which quantitative and qualitative data are being collected concurrently and qualitative is the predominant guiding method. Quantitative data is being embedded in this study to indirectly access information at a different level, within the body, and to measure the presence of trauma in addition to connecting it with learning to strengthen the analysis. This data does not answer the question of how students are self-organizing, or mapping their learning. Data of the two forms can be mixed during the analysis phase (Creswell, Clark, Gutman & Hanson, 2003).

In research from a complexity perspective the appropriate unit of analysis for studying learning is the individual, because learners are recognized to have unique histories that have evolved them into unique individuals, whose change through self-organization will be sensitive to and differentiated by initial conditions (Kelso, 1995). Learning would not be expected to be understood through an averaging of several experiences. The research questions themselves will determine the balance of qualitative vs. quantitative data analysis. A general discussion of how the data will be analyzed is included and a more detailed description of the coding approach.

The first research question is How do RN-BS students learning health and physical assessment of the human body ‘map’, or make patterned connections about clinical learning when they are taught a neurobiologic mind/body model and their own bodies are actively involved through experiential anatomy? The primary data collected pertaining to this question was QUALitative and includes: a) the reflective journals addressing the mapping of clinical learning with experiential anatomy from the “Health Assessment” class b) the various CIQ’s
related to clinical learning around Complex Problems such as responses to the film *Wit*, etc.; c) learning journals from the “Complex Problems” class d) depth interviews

The second research question is *How are students’ unique patterns of trauma involved in mapping their learning about physical assessment and complex clinical problems when experiential anatomy, self-assessment, and body awareness are included in the curriculum?*

There is both QUALitative and quantitative data for this question. The quantitative data analysis was used to *describe the presence* of trauma in the group in establishing the intrinsic dynamics. Data gathered from the survey instruments identified above was analyzed with the Statistical Package for the Social Sciences (SPSS), producing descriptive statistics that yielded a group profile. Correlations were run to identify patterns of connection between specific factors within the group. Because the sample number was small, non-parametric tests were used to complete these analyses. A second qualitative review of reflective journals, action CIQ’s, and interview transcripts sorted for examples of fear learning and trauma learning, expressed explicitly in story or implied through descriptions of physiologic arousal or other body sensations or experiences. The QUAL and quant analysis happened simultaneously with a revisiting of the quant data and additional correlations performed as the interviews and journals began to reveal a high stress group. This group was identified and then examined as a subgroup to consider how they might be different.

The third research question is *How do students map, or make connections, between a neurobiology based experiential curriculum and both their personal lives and professional nursing practice?* The qualitative data is most relevant to this question and qualitative data analysis to assess connections being made between body awareness learning and personal and professional lives will be conducted on the in depth interviews. A combined QUALitative /
quantitative data review was added to make comparisons to PQOL which reflects the workplace context and to learning styles after participants in interviews described noting changes.

Throughout the data analysis the coding categories were tested and refined, culminating in a list of 13 experiences and events related to embodiment (Chart 6.)

Chart 6. *Data Coding Categories*

1. **Evolving Concept of Embodiment** (understanding, Body as object)
   1a. Distinguishing ways of knowing through the Body
   1b. Definition of Embodiment / understanding of Wholeness, interconnectedness
   1c. Noticing body expressions of stress and other experiences
   1d. Interpersonal relationship with own body

2. **Evolving Sense of Embodiment** (experience, Body as subject)
   2a. Feeling energized, invigorated
   2b. Feeling relaxed
   2c. Noticing significance of Movement

3. **Emerging Connections with Self**
   3a. Body awareness (what own body is able to do and experience)
   3b. Emotional awareness (recognizing emotions and related actions)
   3c. Self-awareness (understanding one’s own perceptions and actions)

4. **New (Emerging) Embodied Practices**
   4a. Self-care
   4b. Affect Management
   4c. Sharing embodiment in close relationships
   4d. Nurse care (Attention to each others’ bodies and health)
   4e. Identify with patient’s body / patient advocacy

5. **Integration** (Siegel)
   5a. Emotion (named)
   5b. Interpersonal Relationship (named individuals, or own body)
   5c. Coherence (Connecting across past, present, & future in trying to make sense, raise ?)

6. **Fear and Trauma**
   6a. Specify Fear
   6b. Stressful Life Experience (reporting an event from the SLES)
   6c. Fear Learning (Durable one time learning through fear, remember forever)
   6d. Trauma Learning (Little or no control, maybe fear, maybe denigration/humiliation)
   6e. Intense Novelty / Horror
All of these categories were well represented throughout the journals from both courses and within the interviews, but the patterns of presence changed over time. Chart 7 exhibits the process of data analysis over time.

**Chart 7. Process of Data Analysis**

1. Quantitative data analysis (descriptive, correlations) to identify initial state (what trauma and manifestations are present and the pattern of connections among them)

Data Coding

2. Preliminary analysis of themes in interviews as they were completed, then again as transcriptions were being completed

3. Coding of finished transcripts with development of final list of interview themes

4. Coding of Body Story 2 (Body Memories) with coding list, identifying presence of integration for each participant

5. Coding of 3 journals from each course (one each high, medium and low integrator), using the coding categories from interviews; identification of additional subcategories

6. Coding of all journals, course products using the new coding category list

Data Analysis

7. a. Identify intrinsic dynamics: look for themes in body story memories in journal; relate to skeleton drawings done concurrently; look for integration
   b. Compare to quantitative data; themes identified high stress group, confirmed using quant. data.
   c. Compare written body memories to first body memory described in interview; evaluate interview body memory for integration; compare two reports of first body memory for changes in aspects of integration

8. a. Identify LEARNING thru self-report from interview (personal learning methods and stand-out exercises); note parameters of uniqueness; compare these to CIQ; target corresponding sections of journals and look there for integration and trauma
   b. Compare to Quant. Data, note characteristics of high stress group
   c. Look for differences in high stress group
9. a. Identify FEAR and TRAUMA in body memory (journal and interview); throughout journals (including test anxiety) and CIQ; throughout interview when not specifically asking about these.
   b. Compare to quantitative data.

10. a. Code reports of fear and trauma learning; identify new themes
   b. Create fear and trauma learning diagram as confirmed by data
   c. Compare fear and trauma codings to embodiment codings and identify patterns of connection
   d. Compare to quant. data
   e. Look for characteristics of high stress group

11. Identify patterns of connections within and between personal and professional outcomes (note Emergents and Integration) and the co-occurring categories; show learning style outcomes.

12. Re-look at analyzed data for instances of differentiation, integration, emergence

13. Continue to re-analyze while writing

Verification and Trustworthiness

Mixed method research must meet the verification and trustworthiness standards of both qualitative and quantitative paradigms and in addition: define the multiple purposes and questions that justify the use of a mixed method design then match the purposes and questions to appropriate methods. These two criteria assess the overall validity of the research (Mertens & McLaughlin, 2004). These two criteria specific to mixed method research were addressed in the first portion of the chapter. This section will attend to the specific requirements for quantitative and qualitative research.

Qualitative

Verification and trustworthiness in qualitative research are typically related to that which enhances credibility, transferability, dependability, and confirmability (Patton, 2002).
Credibility

Credibility checks exist to minimize the intrusion of the researcher’s own biases. Such review enhancing the plausibility of findings since it evidences procedural rigor. Prolonged engagement was provided in the sense that the researcher used as a form of data the products of classes previously taught, so during the months that the courses were taught there were 90 hours of contact. This would meet the criterion’s purpose of spending sufficient time with participants to be able to pull forth breadth and depth from the data. One recorded and transcribed semi-structured interview of approximately 1.25 hours was conducted with fourteen participants which served to gather details which established adequacy, accuracy and appropriateness of research materials. Course structure provided for participants’ engagement with their own self-assessment which enhanced depth of inquiry.

Another means to promote credibility is triangulation which serves the purpose of helping the researcher clarify the meanings of findings by making clear the multiple ways the phenomenon under study is being perceived (Stake, 1994). In this study all students who completed the health assessment course also had the opportunity to learn using a curriculum designed to access multiple ways of knowing. The course construction as well as the research process design which included a journals and a depth interview allowed for uncovering the multiple ways participants perceived their learning as well as ways they created knowledge alone in or connection with others. The courses used multiple learning sites including traditional classroom, direct clinical experience in a nurse managed center, and observations in tertiary care settings. A variety of learning activities, some individual and some in groups generated multiple forms of documents and artifacts. All of these were reviewed with elements of individual reflection and group discussion and responses to these in class processes were reflected in the
journals and CIQ’s. Critical incident stories will draw from various clinical settings. As this study was conducted to meet dissertation requirements for a doctoral degree, the multiple perspectives of the interdisciplinary dissertation committee served as another form of triangulation. Finally, in studies such as this one which use mixed methods of data collection, the reconciling of qualitative and quantitative data is a means of triangulation (Patton, 2002).

Participant debriefing is another technique to enhance credibility because it serves several essential purposes. For the participant, debriefing allows for dealing with emotions that arise which could prevent relevant information from being shared. Debriefing can be used to review the appropriateness of research procedures (Stringer & Genat, 2004). In this case debriefing was built into the interview process and continuing contact with participants allowed for updates on the progress of the research and any other questions or issues that arose.

Diverse case analysis criteria was be met by including as participants all enrolled students who were willing to participate in the study, then including aspects of all student perspectives and clearly detailing the sampling process in the final report. Referential adequacy was met by using quotations from the participants’ responses rather than reinterpreting through the researcher’s perspective or a particular lens. This approach prevents distortion of findings and demonstrates that the outcomes have a direct relationship to the participants’ use of language and terminology (Stringer & Genat, 2004)

Transferability

Transferability refers to the legitimacy of applying research findings beyond the setting and circumstances of the original research. (Stringer & Genat, 2004). Transferability requires a thorough understanding of contextual conditions during the study, then an understanding of how conditions in a new setting differ from the original context with reflection on why this matters in
applying the new knowledge (Greenwood & Levin, 2005). This study provided for transferability by using purposeful sampling and providing heavily detailed reports of the context and participants so that an outside party can determine by reading whether their context and participants are sufficiently similar to warrant a degree of transferability.

Dependability

An inquiry audit serves this purpose by detailing the research process in clear and understandable language, from problem definition to collection and analysis of data through reporting (Stringer & Genat, 2004). This was accomplished through the Penn State University Internal Review Board process, with documentation made available to participants, and maintenance of a researcher’s journal recording all steps of the research, changes that occur, and researcher’s reflection on the process.

Confirmability

Confirmability means that once the research is complete, any observer could confirm the accuracy and adequacy of the study’s representation of findings. This was achieved by using an audit trail consisting of all recorded information collected in the process of the study (Stringer & Genat, 2004). Seeking out and analyzing negative cases and searching for data to confirm alternative explanations are both techniques to enhance confirmability (Patton, 2002). All materials generated in the course of this study will be archived and the audit inquiry will document that alternative explanations were trialed and negative cases sought.

Quantitative

Reliability and validity are the two main psychometric characteristics of measuring instruments and therefore important criteria of trustworthiness. All available reliability and validity data on the survey instruments that were used are shared earlier in this chapter.
Reliability

Reliability means consistency in relation to measurement tools. Do they measure the same thing over time and are all items consistent with each other (Punch, 2005)? Because the surveys used in this study are primarily self assessments, there isn’t published data on reliability testing for most of them. Additionally as most of them are measures of state, they would be expected to change over time, making reliability difficult to measure.

Validity

Measurement validity is the extent to which an instrument measures what it claims to measure. If it represents the full content of a conceptual definition the measure has content validity (Punch, 2005). All the tools used to generate the self-assessment data accessed in this study had content validity. Criterion validity is a measure of comparison with a strong measure of the same construct. The sleep deprivation tool has criterion validity. Construct validity describes how well a measure conforms to theory. The learning styles inventory has construct validity.

Reactivity

Reactivity concerns the extent to which collecting the data changes the data. If this occurred in the quantitative data used for this study, it occurred not during the collection for research but during class when the data was generated as part of online self-assessment. I trust that they were honest judging by the sincerity of attention and discussion shown in class, generally and during the interview. It is possible that knowledge of my experience with psychiatry could have either inhibited interaction or generated it.
**Generalizeability**

With such a small number of participants the statistical analysis was very limited and results can not be generalized beyond this group. The purpose was not to generalize but to identify a pattern of trauma’s presence in a particular group and then look for links with qualitative data.

**Summary**

This chapter has clarified the process for examining self-organization occurring in learning through the body and how this relates to trauma. After establishing the rationale for using mixed methods research it described the use of a purposeful sample, qualitative and quantitative data collection techniques and the methods used to interpret both forms of data. Finally all aspects of verification and trustworthiness were discussed as they pertain to this study. As a visual summary of this chapter and segue to the presentation of findings, Chart 8 (p.147) shows an overview of elements of data, where they arose in connection with the two nursing courses, some of the primary themes connected with those events, and how those data elements fit with the questions and findings.
Chart 8. Relationship Over Time of Nursing Course Work and Elements of the Study

**Learning Journals:** Generally few inclusions of references to the body learning experiences. Reliance on readings and connections to work experiences. No Body ‘text’ in 465; trouble seeing connections to learning

**Researcher**
- “Hippies”
- Struggle
- Unique Approaches
- Affect
- Work Traumas

**Notes/Group**
- Values re: ‘body choice’
- Shared GYN
- Broken
- Shared leading bodies
- How to?
- clinical stories
- wholes

**Learning**
- Pain & Hunger
- Circles
- Distractions
- Depression

- Following
- Confusion
- Deep Relax for a few
- Work experiences

- in body maps
- A Few Uniques

---Difficult understanding Awareness Scale--

**N351 Health Assessment**
- Trance
- Written
- Dance
- Body Story
- Self-Assessments
- “Body Stories”
- for self-awareness
- in class & alone
- Body Map
- Self-Organization
- exercise in class
- Mindfulness Exercise
- “Wit”
- --- Body Awareness Scale ---

**N465 Complex Problems in Adults**
- “Patterns of Learning”

**Student’s Past**
- “Fear Learning”
- First Body Memories
- “Trauma Learning”

**Intrinsic Dynamics**
- 1. Learning style
- 2. Hx of Exposure to Major Stresses
- 3. Expression of Stressful Experiences through Body
- 4. Sleep Deprivation
- 5. Manifestations of Stressful Experiencing at work as Burnout & Compassion Fatigue

**Connections between stories of past, intrinsic dynamics and patterns of learning**

**INTERVIEWS**

**Relationships between Intrinsic Dynamics & Learning Patterns**
CHAPTER 4

FEAR, TRAUMA AND SURVIVAL LEARNING:

NURSING’S NATURAL ENVIRONMENT

*It may even happen when I am in danger that my human situation abolishes my biological one, that my body lends itself without reserve to action ... for most of the time personal existence represses the organism without being able either to go beyond it or to renounce itself.* (Merleau-Ponty, 1945, p.97)

Grounded in a complexity science theoretical framework, the purpose of this study was to explore how RN-BS clinical students learned through their bodies, how they formed new patterns of connection, and how these patterns related to trauma. Because this is clinical education it is important to understand the environment in which clinical practice and learning occur. This chapter, the first of three in which data is presented and analyzed, establishes the hospital nursing clinical practice environment as the context for this study. In this chapter, participants’ stories interspersed with citations from the literature will illustrate experiences of fear learning, trauma learning, and survival learning, particularly within the clinical practice environment. There will also be some references to extinction learning. While these terms were defined in earlier chapters, below I will re-explain these terms in relation to this study. It will become apparent that all of these forms of learning are integral to nursing practice, that they are separate but overlapping in ways that vary for each person, and that a component of body knowing is present.

The first section of this chapter provides a discussion of these types of learning using definitions, examples and a graphical model. The second section focuses on participants’ experiences in their clinical work in relation to fear and trauma learning as given in interviews. In this section, detailed individual stories are provided. It was most important to participants
that their nursing stories be shared, so as the listener, I must honor them by maintaining story integrity. The reader is advised that these clinical reports, edited only for readability, are quite graphic. Someone who has not been exposed to healthcare and trauma may find them disturbing.

The final section links these stories to the literature on workplace related stress-disorders. Quantitative analysis of the workplace related stress disorders, burnout and compassion fatigue, gives another way of understanding the impacts of situations such as the ones described by participants. By including and contrasting quantitative and qualitative data on this phenomenon our understanding is enriched beyond the pathology paradigm that is normally used to explain these experiences.

Connection with Trauma Through Fear, Novelty and Incongruity

Before becoming immersed in the data, this section begins by providing a brief overview of concepts related to fear and learning as they are used in this chapter, and then will examine through examples how these concepts might play out.

*Definitions and A Model*

Given the complexity and the subtle distinctions among types of learning related to fear and trauma, it is helpful here to remind the reader of the definitions of terms of *survival learning, fear learning, trauma learning, and extinction learning* as they are being used in this study. A model denoting the relationships among these types of learning also appears in Figure 1.

*Survival Learning* is the broadest category of learning, and refers to the ways an organism adapts by self-organizing in becoming adept at the natural games in its environment. As discussed in Chapter 2, biologist and complexity scientist Kauffmann (1993, 1995) explains that in the natural process of evolution, agents interact with their environment and the two together create the natural games, the intentional actions, of that setting or context. He declares
that the agents that become autonomous are the ones that succeed at these natural games. Self-organization allows them to do this, therefore, according to Kauffman, self-organization must be considered as the second essential element of evolution, which natural selection alone cannot explain. In this study, this process of evolutionary co-creation of contextualized intentional actions is designated broadly as survival learning and it includes all the types of learning we do to negotiate the hurdles in our environment. The other types of learning discussed in this chapter are all subsets of survival learning.

_Fear Learning_ is the grounding concept for the fear-conditioning model of trauma. Fear circuitry neuroscientists Bouton & Wadell (2007) conclude that research currently supports fear learning as preconscious learning that occurs naturally along a species specific continuum through our physiologic fear circuitry in response to perceived threat. They write that fear learning is durable after just one experience and generalizes readily across contexts, allowing it to become connected over time to other qualities via classical conditioning. So being chased down the street by a dog sometimes translates into lasting fear of all dogs; a childhood episode of being swept under the tide can become a fear reaction years later in response to someone else’s story about a third party’s accident at the beach, and memories of one experience of school humiliation often prevent academic risk-taking through adulthood. As trauma researcher Shalev (2007) now argues, in addition to this fear conditioning, novelty in the form of horror at grotesque disruptions of wholeness is probably a co-requisite for the development of PTSD.

_Extinction learning_ also occurs in the course of natural interaction with the environment. Separate from fear learning, it is highly context dependent but unlike fear it is NOT generalized. It does, however, build positive memories in the presence of fear triggers thereby mitigating some of fear learning’s negative effects over time (Quirk, et al, 2007). If I learn to fear dogs
after a large dog chased me, I might learn to manage that fear by being exposed to a friendly dog of the same breed in a controlled setting. This is extinction learning because it provides a new neural pathway, a different pattern of understanding and responding to the source of fear. But if I encounter that same breed in another setting, the fear can be unmanageable again. Or perhaps in the controlled setting a different breed of dog is frightening until additional experiences teach me that I can feel safe. Desensitization interventions are based on this principle. But this extinction learning is never completely effective because it doesn’t affect that original fear learning in any way. Research to date shows fear learning to be permanent, and the extinction learning just provides a competing response pathway that can co-occur with the fear response, thereby lessening its impact in specific contexts (Bouton, 1988, 2002; Barad & Cain, 2007).

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Figure 3.
*Trauma Learning* is the term being used in this study for certain contextual factors of learning, specifically situations in which there is the perception of little or no control, often the likelihood of denigration or humiliation, often fear or anxiety. This description characterizes a power differential. For nurses this might describe the situations that often surround patient deaths, but the trauma aspect lies in the lack of control, not the death itself. The traumatic effect of death is usually subsumed under the category of what Shalev (2007) labels as novelty / horror/incongruity because it disrupts equilibrium and presents a challenge to adapt. It is a natural, routinely occurring response to trauma.

The Trauma label is used in this study for this category of learning because the human relational factors of abandonment, betrayal, helplessness, and submission are known to predict the development of Post Traumatic Stress Disorder (van der Kolk, 2007). Use of the term also attempts to uncover the more subtle forms of structural violence that escape notice, embedded as they are in everyday life (Farmer, 2004).

A simple way in which these types of learning co-occur in nursing is seen around patient death. All nurses, some more than others, must deal with patient death. Learning to do this is part of survival learning, and although seeing death can be traumatizing, death alone does not usually have that effect in the clinical setting. But if a death resulted when a nurse had to do emergency response alone for an extended period and the experience evoked fear, the event could trigger a lasting fear response. If the setting included structural elements such as policy which left the nurse feeling powerless, or conflict with a physician who used humiliation as a method to control, then there could also be trauma learning occurring. If a nurse was trapped in a work setting that provided this pattern of learning events on a regular basis, the nurse might also have some good experience with other physicians within the same environment. This could
provide extinction learning, despite the fact that the policy power differential still left the nurse feeling out of control. But the offensive physician, or other patients who arrested and had to be resuscitated, would still evoke a fear response. When the nurse moved on to a new job, the fear learning would carry over, while the extinction learning would probably have to be re-learned through positive experiences in the new work setting. Appendix J (p. 377) gives a detailed presentation of this fear conditioning model of trauma in connection with a story derived from the participant interviews. It demonstrates how the process played out in one nurse’s personal and professional life.

Presentation of Results: Clinical Chaos, Fear and Embodiment

This section is going to focus on how the R.N.’s who participated in the study describe the elements of fear and embodied learning in their clinical practice, both as they learned to become nurses and in their ongoing professional practice. Before discussing the learning of these nurses in clinical practice settings it’s important to reiterate acceptance of the embodiment hypothesis: that intelligence is both made in and realized through physical actions in the world. Meaning originates in action and is created in real time through activity (Thelen & Smith, 1994). This is how clinical learning occurs, through the body’s real activity with other embodied creatures.

For one to evolve into an expert clinical practitioner with the capacity for developing (essentially parenting) future practitioners, one must first survive being in the profession. This is where survival learning is at play in this study. Survival learning is accomplished by becoming expert at the natural games (Kauffman, 1993, 2000) which are the agent’s intentional actions in interaction with the environment, or practice setting, and as active partner becoming a participant
in creating these games. According to biologist and physician Kauffman (1993), this is the route an organism takes to surviving as an autonomous agent.

Clinical storytelling was one element of the course on complex clinical problems which most participants completed. These and other clinical stories were shared during the semi-structured interview conducted six months after the complex problems class ended, and almost a year after the embodied clinical learning had begun. Within the interviews, participants used stories from their own experience to illustrate how embodiment was present in their clinical practice, their experiences of fear learning, and their episodes of trauma learning. These stories were analyzed in relation to the model that was presented above and examined for emergent themes that would identify the patterns of presence of fear and trauma learning in nursing education and practice. Preliminary analysis helped to clarify the trauma learning segment of the model. The results of that analysis comprise the first two parts of this section addressing clinical chaos, fear and embodiment.

The clinical stories fell into two broad categories. There were stories related to the early period of transitioning from nursing school into being an autonomous R.N. The other set of stories related to the ongoing challenges of nursing practice. The first part of this section focuses on the kinds of learning that appeared in the transition stories. These are labeled rites of passage because they characterize becoming a nurse as learning to negotiate specific threats in the clinical environment. There is a strong element of fear learning in these stories. The second part focuses more on these types of learning in participants’ ongoing nursing practice as they learn to live with recurrent chaos. The last part of the section provides quantitative measures of professional quality of life so the stories and themes can be compared to a more traditional clinical perspective of secondary traumatic stress disorders. Within the story texts, bold type is
used to highlight the characteristics of survival, fear and trauma learning as well as intense novelty. Descriptions of body experience are identified with italic type. Again, the reader is advised that story content is graphic and may be offensive to someone who has not worked in clinical acute healthcare.

**Rites of Passage**

Participants’ interviews showed that natural games, an agent’s intentional actions as Kauffman (1993, 2000) describes them, are present for nurses in interaction with the clinical practice environment and they are easily and consistently identified by practicing RN’s. The nurse learns to play these natural games in the process of being assimilated into the profession and the entire span of this process constitutes survival learning. Nurses’ learning trajectories are individually unique, but there are common challenges that characterize the contexts and the process. The passage begins long before arrival at the playing field gates where entrance is controlled. In a practice discipline, the fee for admission is a passing grade on the licensure exam. Once admitted to the playing field, there is a period of jousting and watchfulness while the new nurse learns to identify threats, bringing embodiment to this task which is often achieved through fear learning. Once unsupervised practice begins there are a series of classic events (the first medication error, realizing the weight of responsibility for a human life, the first participation in a code (resuscitation), and the first unanticipated death) during which the nurse learns primarily through fear conditioning to be increasingly vigilant. The nurse achieves a more nuanced ability to recognize signs of approaching threat, and moves beyond frenzied responses or freezing in place in the face of death by learning to trust the body’s pre-conscious knowing and ability to respond. When nurses can do all these things and learn to trust that they are not alone they have moved into the fray.
Becoming ‘Nurse’

The first rite of passage that a nurse must face that relates to fear and trauma learning is going through the process of actually becoming one. In a competitive atmosphere that begins in school and continues to the job, where they are more likely to experience scolding than being held, nurses find themselves being scrutinized. The pre-licensure period may last 2.5 to 5 years. Supervised practice fills the next 6 to 12 months. Then the preceptee has become ‘Nurse’ and may carry a load of patients independently. There are two story themes in this category because there are two gates that must be passed. The graduate nurse must pass the licensure exam and then survive the interpersonal encounters involved with becoming part of a specific nursing staff.

Admission to the games: NCLEX. The National Council Licensure Examination for Registered Nurses (NCLEX) is a looming presence from the first moment of nursing education. Passing the computerized multiple choice exam is the only route to professional practice as a Registered Nurse. Clinical experience in healthcare and academic success do not guarantee a passing grade. Just like the SAT, the best route to success is preparation for test taking, aimed at this particular test. Therefore basic pre-licensure nursing education (AD, Diploma, BS) incorporates huge amounts of graded and practice test-taking which facilitates the memorization of vast amounts of minutae. This stress is separate from the pressures of clinical education although the content of course overlaps. The process is a major stress for students and traumatic experience for some. For Monica, the NCLEX was a fear learning event (durable one event learning that will never be forgotten). She says she will never forget the experience and fear conditioning leaves her with emotions that resurface under certain circumstances.

When I was first starting my job the NCLEX was a big deal. I was really scared to take the test. I assumed that I went to a good school and they prepared me for this exam. I studied, I really did. And the first time I didn’t pass. I was an emotional wreck because everyone around me was passing. At my school 99% of
their students pass the NCLEX. *I felt like I was worthless.* I felt all these horrible things about myself. *I will never forget that experience.*

The **fear** was **how people** at work **would look at me**. I was **scared** about how my family and friends would look at me. Another **fear** was if I **didn't pass it again, what would I do?** Then another **fear** was will my job fire me? What am I going to do with myself if I don't pass this exam? They’ll make me an AIDE. I can't be an aide! I'm an RN, I graduated from school, I'm a NURSE. I just can't pass. I know all the material. I'm just really bad at tests. So that was the **fear.**

**I learned** even though you're so stressed, **just don't give up.** I kept myself busy, I kept working out, I tried to **keep a positive attitude,** not show that I was **sad** even though deep down I was. I think things resurface every time, like right now, **when I have so much going on and so many things to think about.** **Those feelings resurface.** But I think there's nothing I can do about it. I mean, this is the way it is, and I need to take care of all these things.

The NCLEX can also be classified as trauma learning because it is the final and only authority in licensure decisions and the potential for humiliation is great. RN hopefuls can perceive themselves as having little control. As Angela explained, it isn’t just traumatic for those who don’t pass the first time. Many students who pass experience trauma in the preparation and anticipation. The experience of this trauma learning can overlap with other old fear learning experiences and in the clinical setting they all converge.

**You work for two or four years, for ONE EXAM.** So the pressure that builds, the **mental trauma** around that exam is **terrifying!** People have **nightmares.** People go on medication. I knew people in college who were on sedatives before they had to take the NCLEX.

In one sense you can control the NCLEX in that **you can control how much you study.** However, **no matter how much you study, you are always going to get subject matter that you're COMPLETELY unfamiliar with.** Knowing that before you go into the exam is absolutely **terrifying.** You have to wonder, how many of those questions am I going to have? And THEN ... it’s a possibility of 75 questions up to 265. So if the computer doesn't shut off at 75, am I failing the test? There is just a **HUGE LINE of mental trauma** related to that exam. And it’s a SHAME. If you're not a test taker you're kind of SOL. I worked with a girl who failed it three times and she's an excellent nurse. She doesn't want to do any more certifications now because there's an exam for every certification.

**In the body it’s like a panic attack. Everything just tightens up** before you go into the NCLEX. *You feel like crap. You're nauseous,* and I had a **headache before I went in so I wasn't feeling that great** anyway. Stress around
that exam is ridiculous. And then once you get through it’s like it never happened.

I’ve struggled with test anxiety for a long time, which is strange because I’ve always been a fairly good student. I’ve psyched myself out since kindergarten, if they even gave tests when we were in kindergarten, which I’m sure they did, because they’re testing everything now. Experiences like that have a big effect on you. They’re always right there and it’ll just take one thing to trigger it. I don’t know if it’s a fear of failure or just learning to be anxious so I make sure I’m adequately prepared.

I don’t think you ever really forget your first fear learning experience, or your first traumatic experience. You’re forced to work around that from then on, either to avoid or prevent that same situation from happening again or to try to make the situation different or make it better. It’s like a knot in your stomach. My first fear learning, being knocked over by the wave, caught me off guard. Afterward … you feel paralyzed. It is very similar to what comes up in the clinical situation. I’ve felt helpless in a situation with a patient. I did everything I was supposed to do. I called the doctor. I was advocating. I was assessing her like there was no tomorrow. ……But she still died. That creates a terrible knot in your stomach and a terrible feeling knowing that situation didn’t necessarily have to happen.

Entering the natural environment: Horizontal violence. Many nurses, including some faculty, laughingly or proudly repeat the epithet “Nurses eat their young.” The abusive nature of this phrase is highlighted by those who now recognize ‘eating your young’ behaviors as a form of violence rather than evidence of clinical expert power. This is now referred to in the nursing literature as lateral or horizontal violence (Curtis, Bowen & Reid, 2007; Dunn, 2003; Farrell, 1997; Longo, 2007; McKenna, Smith, Poole, & Coverdale, 2003; Randle, 2003; Szutenbach, 2008). The following stories highlight the ways in which these rights of passage can be construed as trauma learning. The new nurse, whether or not they have hospital experience, has little or no control and denigration is a pervasive presence. Even experienced nurses moving into a new work setting are subject to these rituals. These features are not unalterable aspects of a natural environment. They are crafted, perhaps not with malicious intent, but deliberately. They represent misuse of a power differential, and therefore these circumstances represent trauma learning and not simply survival learning.
After a moment of hesitation in the midst of his interview, John offered his perception of the nursing assimilation process as a gendered event. Notable Farrell (1997) and many authors since have analyzed nursing horizontal violence as oppressed group behavior in a women’s field:

As a guy, whenever I go to a new place [in the hospital], I get the Evil Eye for the first day. Sometimes you don't even get it then. When a woman goes to a new unit, they are scrutinized for at LEAST 6 months. Bare minimum. **SCRUTINIZED.** Every move they make, every thing they do .... "Oh, they forgot to do this! ... Or they forgot to do that!” And instead of saying "You didn't do this, could you change that in the future?" it’s picked at .... pick pick pick pick. It’s what they do to one another. For 6 months they get picked at. And then finally, through a series of events, they quit, because they can't take it, or they're able to pick back. And **when the picking back comes in, they're assimilated** into the unit. For guys, they come onto the new unit, it's a guy, “Hey great, we got lifting help, we got this, we got that.” Past the first 24 hours, it’s over with. Then you're automatic, "Hey, can you come help with a turn? Can you get this IV? Hey, can you do this?" It's very weird.

While John is grateful that he doesn’t have to endure the ‘picking’ and that the assimilation of men occurs quickly, he does not acknowledge that the acceptance of men as he describes it is equally demeaning. They are welcomed as beasts of burden.

Gabriella’s story reinforces the picture of intensely critical scrutiny. Talking while she was still within her first year of practice, her story resonates with the fear that pervades that initial period of becoming a nurse.

Being a **new nurse**, under precept, you know you're being patrolled. Doing any type of procedure you're with your preceptor. I know that I'm the **new person**. I know other people handle it differently but I always respect authority. Even though its more like a peer .... I consider that authority. So I always treated the preceptor as the boss. A lot of times **you'd be in their control, and a lot of times those nurses are NOT nice. They are denigrating to you**. How I **survived** that was, I just thought, "You know what? I'm new. I'm gonna learn. I need to learn. I need the experience. I will just not accept the behavior ... the way I'm being treated ... not accept it, but overlook it ... to learn what I need to learn." So, although they would say, “Do this” or “Do that”, or “You're not doing that right!”, and it **wasn't very appropriately spoken, especially in front of a patient** .... I tried to make it a positive thing. My words to the patient would be comfortable and I hoped that maybe the nurse would get the hint.
Where you work you have all these **different disciplines, with all these different personalities.** Some of the **newer people laugh about it,** because **these people are all grumpy, and rough, and negative.** I blew it the other day. I always thank them. But the other day there was this one respiratory therapist who has been rude since day one. **She yelled at me, degraded me, three times.** So then .... THIRD time, that's all I can take. I snapped, and I shouldn't have and I'm embarrassed of my behavior, but I said, "I know a LOWLY RN could never, ever order a blood gas. I understand that. I'm just trying to understand what the plan is for this patient."

*My body was tense, tight. My shoulders tight. Everything’s tight. Because you don’t have any comrades there, really. You don’t have anybody to confide in.* If you confide in someone it’s either spread all around or **people are just afraid to give comfort,** because then it might look like it’s against her. It’s really sad.

Whether or not gender distinctions apply, the series of events that form a nursing autonomous agent are dis-ordering experiences involving fear, because they include intense contacts with death, the possibility of death, or the grotesque and incongruous. Body components are always present and include awareness of an adrenalin rush, losing awareness of their own body as they focus on another, feeling that ‘something isn’t right’ or knowing that ‘something bad is going to happen’, with lingering memories tied to context. The body’s pattern of pre-conscious knowing changes to incorporate these events and prepare for future reactions. In other words, as a psychiatrist specializing in the neurobiology of trauma, Bessel van der Kolk (1994) notes, “the body keeps the score.” (p. 253)

Having made it through the gates of licensure exam and initiation to the workplace, the new nurse is ready to begin the move toward autonomous practice. At this point the rites of passage unfold in a non-linear fashion. The nurse learns through hallmark experiences that arrive as surprises. From each experience the nurse evolves a greater ability to recognize and respond to threats.
Recognizing the Threats

The second aspect of this rite of passage related to fear and trauma learning is transferring book knowledge into being able to identify the threats to a patient’s life in the clinical setting. Before new nurses can claim rudimentary competence they must be able to react in ways that prolong someone else’s life. To do this in any thoughtful way requires that first they know the dangers and are able to recognize them early, before an emergent situation occurs. The best nursing actions therefore are defensive and preventive. Because we learn through experience, the new nurse can also pose an environmental threat to the patient. A classic example of this is the first medication error, presented as the first theme in this category of learning to recognize the threats.

A large body of research exists to identify the behaviors that humans and other mammals engage in as response to threat (Bolles, 1970; Bouton, Mineka & Barlow, 2001; Craske, 1999; De Boer & Koolhaas, 2003; Fanselow & Lester, 1988; Fanselow, Lester, & Helmstetter, 1988; Pinel & Mana, 1989; Pinel & Treit, 1978; Silove, 2007). In minimal danger environments, human beings’ natural preferred patterns of activity include feeding, exploring, nesting and mating. When danger increases, we have to reorganize our patterns of activity to prevent further risk. Typically we eat less often, identify and remove unfamiliar and harmful objects, become more vigilant of movement in the environment and constantly change our patterns of movement in response to what we perceive. Some of this becomes automatic and ritualized. In the clinical environment we see the same things happening. Because there is always some threat present, meals are infrequent. The first task of new nurses is to learn to identify dangers and remove them which requires learning to pay constant attention while scanning and reading the changing environment. The possibility of medication errors and/or patient death and thus being
responsible for life are issues of threat in the nursing environment that often promote fear and trauma learning.

*The first medication error.* Robert’s example of identifying threat and learning through fear was from the time when he was a new nurse, still being precepted, and he experienced his first medication error. Like every nurse, he hopes this error will be his last. Thanks to durable one time fear conditioning and the compulsive rituals it helps to inspire, perhaps he will have his wish.

Certain things happened and I know I will never forget that. It’s either because of the way you learn it, which is maybe not fear but maybe if you were disappointed in yourself because you didn’t know something. So something happened and you say, "Well, I'm never going to forget that again!"

I think it was when I first started being a nurse and using the Pixus System [a computerized medication dispensing system] I forget the name of the pill, but I was to give HALF a pill. It wasn't a narcotic but it was something that would actually calm me down a little. It wasn't Ativan either. I just forgot what it was because I wasn't paying attention. The Pixus would dispense one pill, and I was only supposed to give half a pill. *But I didn't see that. I didn't see the dose.* So even though I checked, for some reason, *I didn't pay attention.* So I gave her the entire pill. As the day went on, she was just a little bit more lethargic and so I talked to my preceptor and went back over the list. Then we figured out that I gave her the entire pill instead of half a pill.

*That was a fright.* I mean that was a frightening moment for me, especially being a new grad and just physically trying to hang on and get along. It was a fearful learning for me in the fact that from that day I always double check all my medications. Regardless of what it is.

I think my heart just sank. I had that gloomy feeling going through me when I realized what happened. *My whole day was ruined pretty much.* It was sad, I think. Sometimes I just get that hot feeling for a second and that’s it. *You know something wasn't right and something's not going right.* (He was speeding up and getting more excited as he told this.) I think it was before I went to my preceptor, when I realized it and I started thinking about it for a little bit, because that lady kept saying that she was a little more sleepy than usual. So I started thinking about all the meds that I had given and ... yeah ... before I went to the preceptor I FELT that. *I think that's when it really hit me.*

In thinking about this story it is first clear that although this nurse remembers checking the medicine, the ‘correct’ behavior, he also remembers ‘not paying attention.’ He reports being
in a state of fear when he began perceiving the presence of an imminent threat. In other words, he started noticing that his patient’s condition wasn’t fitting his expectations and his body began registering anxiety. Possibly he was anxious before he made the error and this impacted his ability to concentrate and pay attention. He heard his patient complain of being sleepy, but he did not process to an understanding of why or what to do. This is perfectly understandable for a new nurse, and perhaps begins to reveal the degree of fear which may exist for most new nurses and for longer periods than we acknowledge. Robert’s body, that ‘hot feeling’ which he experienced as unpleasant, was something that helped move him into action and led him to talk with his preceptor. That interoceptive, interior experience told him that something was seriously wrong. He sought help to figure out what it was.

Robert’s inability to completely unravel the problem was a complex issue with multiple causes. The possible causes include a lack of factual knowledge, a lack of experience, and difficulty accessing his rational faculties because his fear of the context was keeping his cognition in a state of emotional ‘thinking.’ In accordance with the fear conditioning model of trauma, as Fanselow & Lester (1988) note, fear trumps in the presence of perceived threat (Fanselow & Lester, 1988). Fear likely took charge of this learning situation and taught Robert forever a lesson that he needs to survive in nursing practice: ALWAYS pay attention to meds, even if it means repeating the action 5 times. This conditioned fear will protect him, and his patients, in the future.

John speaks from the perspective of someone with almost a decade of hospital experience and also spoke of his first medication error.

I think a lot of nursing is learned through fear nursing. Much like that of the military I would assume. We work in a job where mistakes cost lives, so fear learning is almost essential to make sure to pass on to the next group or the next generation of nurses ... "This is something we found really harms somebody,
so we're going to make sure you don't do that! So **we enforce it by fear learning**, and the body has an amazing way of learning through fear learning.

I remember **my first medication error. Never forget.** And I remember EXACTLY what I DID, and I remember how I FELT when I finally realized my mistake and thought to myself, “Oh, I know why my patient's not going to sleep.” I'll share what it was. It was a Medazolam and Verapamil mistake. And I typed in VER ... and then I went to the Pixus. I'd been a nurse awhile before I made this error, and I was very proud that I'd never made a med error. You know how it is! (Laugh) So I typed in VER and I pulled out a red top file. I wasn't asked to count which **should have been the first red flag in my mind.** I closed it .... and I can go back through this now, but at the time ... BAM! ..... I drew up the Versed, what I thought was Versed ... Medazolam ... aaaaand .... I went back to the room. I had Fentanyl, I gave the guy Fentanyl, he wasn't getting sleepy so I gave him Versed. Nothing. This is a conscious sedation so of course he's on the monitor. And the guy was tachycardic to begin with but he had tons of medical issues. By the time I had pushed what I thought was 10 of Medaz, which is a ridiculous amount and should put anyone to sleep .... that **should have been another red flag** but I didn't think of that .... all these red flags went by me because the guy had all kinds of medical history that would make his response understandable ... (getting anxious as he tells the story ... he's completely in the past)

So, by the time that I realized I had pushed 10 mg, it was a lot, it was a lot ... of ... Verapamil on this guy, .... I had to look at the surgeon and say, “Yeah that wasn't what you asked for.” (laugh, nervous) And I remember just **my entire body, it was ‘lock up’, right here in my chest area and I felt like I couldn't breathe.** My heart, I swear, stopped, and I felt like somebody that had an acute MI. I felt like it. I felt like I couldn't breathe, I couldn't move, I couldn't do anything. And I looked at the doctor and I said "I gave Verapamil and not Medazolam" (laughs again) and the Dr. goes "Well then I suggest that you get Medazolam." And so I went, and I got it, and thankfully enough that worked really well after I gave the right drug. Fortunately the patient was on Verapamil at home which actually made it less serious. He hadn’t taken any of his morning meds, so the doctor actually wrote for the order. It was a medication error. At the same time, **I will never forget how I felt. My body was incredibly tense, incredibly, horrendously jammed up inside.** And **that is trauma, in my mind. That was HORRIBLE trauma.** (Laughs again). **I never want to feel that way again!**

John has just given an eloquent description of learning through fear conditioning, or fear learning. He remembers this as a traumatic experience for him. He felt overwhelmed by it. It was a body experience akin to that of an animal that freezes automatically to avoid detection by a predator in the presence of imminent threat. There is absolutely no movement except that necessary for breathing (Fanselow, 1980). If necessary this freezing can be followed by a burst
of explosive activity. We will see this progression develop in a bit when we move on with learning to respond. In the meantime, medication errors are not the only common threat to be identified and avoided.

*Ultimate responsibility for a life.* There’s nothing quite like carrying your own patient load to let a nurse realize the tremendous responsibility they have taken on for identifying threats to life for someone who is dependent on them. It is inefficient and also painful to learn about every danger through experience. Once the habit of vigilance is learned and constant scanning is at play, it is possible to also learn from others’ mistakes. While the first major error and its fear response carry the nurse across a threshold to new awareness and alertness, what waits there is a dynamic array of constantly changing threats which has the potential to feel overwhelming. The following stories suggest that this realization of the weight of responsibility for someone else’s life emerges through a pattern of connections to the nurse’s collection of past fear learning or past trauma. Of course these could overlap. Both are experienced in the body because the past fear and trauma were registered in the body. It seems that the past learning is being brought into the clinical setting to create safety.

For Gabriella fear was nothing new and she had a lifetime accumulation of rituals for managing it. She brings tremendous attention to detail to her practice. Nursing responsibility is just another form of fear learning and her realization of responsibility emerges from a *collection of instances of fear learning.* She is afraid of killing someone by making a mistake.

I'll have to say, the **fear for me is very bad.** Very bad. I need to find a way to get through that. **If I'm afraid, I'm like the deer in the headlights in a fearful situation.** And I know that with my preceptors I was thankful that these nurses knew their stuff, and then **I was like a viewer.** I was able to go through code situations as an observer. Very thankful. Because then when I had the time that I had to emergently intubate I had something to draw upon. I at least knew things that I needed to do. I was **a little nervous but I wasn't as fearful.**
Even in nursing school, **with some of those nursing instructors you know, you were just so fearful.** Intuitively I know about myself, that in my mind's eye the night before, I always try to go over everything so I that I feel like I've experienced it once so when I'm faced with it, I can do it maybe. **I tend that if I do something wrong, I will never do it again. That's kind of maybe the fear learning. It wasn't that it was significant, but you'll never do it again.**

Like last night, we're getting ready to move a patient and my buddy who's an RN said, Gabriella, “Screw that.” [meaning she should make an adjustment to disconnect a piece of equipment in order to move the patient, but screw was an inaccurate verb.] I said,"OK.” I didn't know. Well when I unscrewed this hose thing [a part on the equipment that could actually be screwed, or twisted off] it **was like this big, loud, sound** and my colleagues were like "Oh, no!" [She had disconnected at the wrong place and released pressure from the mechanical system.] And all I really had to do was push the plate off. **I will NEVER unscrew the hose again.**

Some other nurse had said, "You'll do it once and you'll never do it again” talking about an **A Line (arterial line). If you don't have things connected people can exsanguinate** [unlike an IV, an intravenous line, there’s much more pressure in an artery so it would be possible to bleed to death from a line placed therapeutically into an artery if the system wasn’t connected properly], **so that scared me enough that maybe this is a visceral kind of learning. You don't have to experience it but you're still learning.** I tighten every connection. If they come to me with an A-line in, I make sure my alarm is always on and not turned off. Sometimes you walk into a room and that's one of the **first things I notice. Because I'm fearful enough based on other people's experiences, I never want that to happen.**

According to Cadence her realization of responsibility was a more diffuse sense of awareness in the clinical setting. She does not talk about past fear experiencing as Gabriella did, but she is explicit about making **connections to past trauma** [including abuse]. Being the ‘ultimate stop’ is definitely an embodied experience for her. She reports multiple symptoms of acute stress response and is able to describe clearly how her reactions are connected to and emerge from her personal experiences of trauma. The degree to which she experiences this responsibility as overwhelming at any point in time is the degree to which it has the potential to be traumatizing for her.

**I think the biggest fear** that I had since being a nurse was when I went to the pediatric intensive care unit and **realized that I was the ultimate stop, the**
kids could go no where else. If they would crash and almost die, I would have to save them. And I think in the beginning it gave my body a sense of stress, like overwhelming fear, overwhelming sensation. I could deal with the fact that I was going to be in charge of other people's lives, that wasn't the issue, but that I was the last stop. That the person was either going to live and get better, or they were going to die. That was the biggest fear that I had thus far.

It caused a lot of stress. Nights of restlessness. Days that I couldn't sleep. Times that I still come home and I just cry because I'm frustrated with the situation that maybe the kid is in, and that I can't do anything about it, no matter how hard I try. To overcome that, I do that meditation for myself, whether its a couple days off, and I think of nothing (laughing) .... or I think of anything else outside of work, or I do absolutely nothing. And there are days, I find myself having more days, where I do absolutely nothing. I'll sit and watch movies all day long. That's putting myself into a trance like state. I'm going into a fantasy world; maybe that's my way of coping with it.

Having to be with family members that maybe were abusive to the patient brings up all these emotions. That's hard on my body because I was abused before so I know what its like to go through that. With our first abuse victim that died I realized that I could have been that kid. That could have been me! I could have been shaken and died. I was probably shaken but I didn't die (little laugh) for whatever reason. That's really hard, more stress, and then everybody around you has more stress.

This category, Recognizing the Threats, encompassed two hallmark events: the first medication error and realizing the weight of having ultimate responsibility for someone else’s life. Fear learning was present in both themes. Realizing the extent of responsibility was an emergent quality formed from new patterns of connections between the clinical environment and previous fear and trauma learning.

Learning to Respond to the Threats

The third rite of passage addresses hallmark events through which new nurses learn to respond to threats as they improve their ability to identify them. The greatest threat is death, and the two themes in this category relate to it. The hallmark events that will be described in the following stories are the first code (cardiac arrest / resuscitation) and the first unanticipated death. In some instances the two could present simultaneously, but that was not the case in these participants’ stories, suggesting the two experiences are remembered separately. The code
involves very specific sets of behaviors which are trained and a hierarchy of roles which are specified. An unanticipated death may involve a code, but the learning around this experience is through the aspect of surprise. There were signs of impending threat that perhaps were missed by the novice nurse. The death comes as a shock. A new repertoire of early warning signs and appropriate defensive actions is added to the nurse’s response repertoire.

In describing the way in which we are embedded within a complex pattern of ecosocial survival signals, Silove (2007) explains that our archaic, evolved psychobiological survival mechanisms, the ones nurses use as they assimilate and learn to identify dangers, throw us into a normative survival overdrive state. The reaction is truly future oriented in that its patterning is embedded with one purpose in mind: that upon return of the threat or environmental cues that signal its approach our learned survival reactions will be triggered. Evolutionary forces are directed toward survival, not personal comfort, so the subjective experience can be unpleasant. It is no different in the clinical setting. Once new nurses have a rudimentary feel for the cues that warn or herald the presence of mortal threat, they being to learn how to respond.

The first code. Remember that in the stories about the first medication error the nurses felt extreme body tension and a sense of freezing. This freezing was identified as a natural bodily response to imminent danger which can move into bursts of adrenalized action. This is the same embodied event that shows up in stories of responding to the first cardiac arrest as part of the code team. Rachel, an athlete, who is comfortable with training her body to act in specific ways, was able to identify how the fear conditioning from her first code was enhanced and became elaborated for future use through embodiment.

A fearful learning experience for me was going into my first case (resuscitation) alone. I'm ACLS (advanced cardiac life support) qualified, but thinking I had to remember everything on my own scared me. I was nervous, and sweating and shaking and a little nauseous. I didn't really know what I
would do when I got there. That first time I thought, "Everybody's gonna think I'm stupid." Then I got up there and everything came rushing back. I collected myself, there were other people around who knew what was going on so I was OK and it was relaxed ... and things came back to me.

Now whenever there's a code or a case called, I'm like, "OK, I'll go!" It's still an adrenalin rush, but now I'm not fearful of it. Because I remember what to do and I know what I'm supposed to do. I know that I can do it.

What I learned that I'll never forget is that even though I was fearful, you can always get back what you know. If you have the training and the physical knowledge to do it, you might not do it for a couple years but it’s easier to get it back after you know how to do it.

Monica experienced a combination of freezing and chaotic behaviors before discovering that she could calm herself with breathing. Like Rachel but in her own style she trusted her body to lead her when she started hearing and acknowledging her embodied messages.

If a patient was coding (cardiac or respiratory arrest), I was really nervous, and you know, scared ... because I hardly ever had a patient code. My first time I didn't know what to do. I was scared, but my body, and my mind, told me that I can't show this fear. I have to know or pretend. Act like I know what I'm doing (Smiles broadly, almost laughs) ..... and that's what I did. I acted very competent. And I did what everyone told me to do. I did it fine. It was a good thing at the end. But I was scared. I had to take a couple deep breaths first and then pretend like I knew what I was doing (smiled again).

My body felt really good after it was over. I felt so much relief because I wasn't expecting it at all. Going to work every day you don't expect it to happen. It's just all of a sudden that something like that happens, once in a while. That was my first time after a year and a half of being a nurse. It happened to MY patient. My heart was pounding really fast, because it was just a bad situation. I didn't really know what to do. I was running here and there, and my heart was pounding. I was nervous, I was scared. But then, after I took a couple deep breaths I told myself it's gonna be OK, you just need to relax. Then, I knew a lot of people were there to help me. I wasn't there by myself. That helped me get through it. It was a lot of relief afterwards.

Now every code, I'll know what to do. I won't be as nervous or scared because I'm expecting it. I know it can happen. My heart rate goes up still. I think anybody's heart rate does when they're in that situation. But I don't freak out anymore, like the first time. I was kind of freaking out. You forget when you're in that situation. Your mind just goes blank and you forget what you're supposed to be doing. I started getting nervous and stuttering (laughs) .... cause I didn't know what to do. My mind just went blank. People were like, "Get this" or "Get that" and I wouldn't even know where the things were,
because my mind was just blank. But now, I'm more relaxed, and if they need stuff I'm "OK" you know. The first time I was running everywhere, and now I'll just walk. Because I'm more experienced I'm more confident. I've been through so many, that it’s no big deal now. It’s what I do at work. (smiles) People can tell if you're not so experienced, they'll push you out of the way. That's what they did to me. And I watched them do what they were doing. I was happy at the time. But now, I can push unexperienced people out of the way.

Both Rachel and Monica experienced fear during their first code and responded with some form of freezing and disorientation. The learning for both of them came as they realized they were not alone, watched what was done, followed orders, and trusted the messages they were getting from their bodies. This was durable one time learning, fear learning put to good use, and they reported that it carried over to every code situation in the future.

The first unanticipated death. Every nursing student understands that dealing with death and dying will be a part of the job. Most learn this aspect of care uneventfully in the first year of practice. But participants’ stories revealed that the first unanticipated death is a major fear learning experience. This event brings new learning in an instant that is never forgotten and has a lasting impact on a nurse’s unique patterning of practice activities. It seems to also have the specific effect of shaking the nurse once again to a new level of awareness of all the threat cues that are still not incorporated into their personal red flag algorithm. Because the experience is not just one of mortal danger but actually ends in a death, the impact is severe and the memory very, very durable.

Trudy gave an example that occurred when she was new to the outpatient setting, but had a year of experience nursing in the hospital. The change in context brought numerous connected changes, but these weren’t truly known until they had been experienced.

I had just started a job doing chemotherapy, and of course my very first day a patient had a bad reaction when I gave her the chemotherapy drug. In a
hospital setting you don't deal with it the same way. In the office setting, which was completely new for me, you just do it. You have your little protocol and you just do it. For me that was really scary. Because the patient was blue. It was really really bad. There were just two of us and there was nobody else. The doctor was back in a room. So learning their protocol in that sense was really quick, and I didn't have to re-do it again (laugh) I guess I can think of it that way.

The feelings were at the moment, more numbing. I didn't really think about it until afterwards. And then felt just ILL. Because I did emergency work before. It was the same thing over and over, so it was no big deal. But this experience was different, in that I never had to deal with stuff in that realm before. That setting was just completely different for me. And I had only been in nursing for a year. So it was that area, and the fact that you were completely responsible at that point because you weren't in the hospital setting where you had extra resources. It was you and another nurse and the doctor way down the hallway (laugh) Anything that could go wrong went wrong, at that moment. And unfortunately she ended up dying. That part of it I guess sticks with me too. But there's a whole bunch of factors that went into that too.

It was that initial instance of turning around and watching her, and then realizing what was happening so quickly. There wasn't any time to do anything. Just focus. It worked out well [meaning they kept her alive and were able to pass her on to another level of care], but I would never have to ask them what I needed to do again (laugh). Because everything was right there. So that situation was a very quick learning experience. Now when something like that happens it bothers me but I don’t get numb. I just think “This is what I have to do.”

Referring to Perry et al’s (1995) categorization of acute responses to threat, we can assume that the first day on the job in a new setting, Trudy was not calm and started the day with at least a high degree of vigilance. She was aware that there were many things that she didn’t know. She had no idea what they were, and assumed that she would learn over time. This would be an effective self-management strategy to keep her first day worries from impeding her initial learning of the new natural games. When she saw turned around and saw her patient's color, she describes feeling numb. Numbness is consistent with a mental state of terror, functioning from the midbrain and brainstem, and having some dissociative experiencing (Perry, et al, 1995). From this perspective and explanation for Trudy’s responding would be that she couldn’t ‘think’
rationally because her neurochemistry wouldn’t allow that at the moment. She couldn’t operate reflexively to the specific situation because everything was new and she didn’t have a past pattern, or template, to call upon. So she reacted. She stayed for the ‘fight’ and did as directed by someone who knew the protocol. She behaved reflexively as she could based on past emergency setting experiences.

In the end, she was able to say that “it worked out well” even though the patient ended up dying. This may seem illogical to someone who has not stood in these shoes. But it is true. No one fled. Everyone available contributed to the effort. The patient lived to be passed on to the next level of care. Trudy learned a new ‘protocol.’ She also learned a new template for reflexive body responding if a situation like this occurs again. Her fear learning repertoire was expanded, and she will never forget. There is satisfaction in this learning for a nurse.

The embodied story that Kathy told was more about sadness and guilt than fear. She was horrified that a person would have to die alone. The horror and guilt she experienced were overwhelming to a degree that she still remembers the feelings today. The emotions return to her along with memories. The overwhelming nature of the experience makes it traumatic and Kathy’s response is to always strive to recognize the signs early and be sure to have someone present. This way she avoids and prevents ever having to experience this particular horror and guilt again.

When I worked in oncology, when I was very new, I had a patient who was a young woman. There wasn't much they could do for her. She was OK at the time, she was talking to me, she was fine. Her boyfriend was coming in to be with her. He did not get there in time. I got in there to see here and she had passed away, and her boyfriend didn't reach her in time. I felt very sad. She was waiting, for him to come in there .... and that's .... (shook her head) That was something that I felt. I cried. I just felt like, “Why didn't I have him come in? Why didn't I get him here earlier? I felt if was my fault.

This was when I first started nursing too. It just went so quickly, and I think she was very, very young. I will never forget that, and now I always get
the family if I know somebody's dying. If there's nobody, we're there with them. Somebody always should be with somebody if they're dying. None of us should have to die alone. I felt guilt. Nobody expected her to die. Nobody thought she would die. Not even that day. She went through so much and you would think it was a blessing, and yet she had to die alone. So still I feel that guilt that I could have done more.

The trauma with death and dying, you know ... that doesn't go away. It's always there. Even though you're a nurse and you see it often. You still have anxiety. You still feel when they're in danger. I still feel SAD, when somebody's dying. I like to cry with them sometimes. If the family's there I like to comfort them. I still cry with them. The tears just come, because you're sad for them. I pray with them, if that's what they want. Its hard sometimes but that's something you can't get over with death and dying. Even with my own mother, when she died. We all were there. But it was hard. Very hard. Even though we were there its still ... you cry, and you feel you could do more, to help her.

In these final examples of Rites of Passage, new nurses are confronted with the greatest threat, imminent death. Fear learning is inherent to these situations. Sometimes there is codified response as with the first code and sometimes the death is generally expected but still comes as a surprise as with the first unanticipated death. A common factor in all of these experiences is the requirement for the nurse to respond. These situations are a reminder that ultimately it is the nurse’s responsibility to notice the red flags. The nurse is the one who is constantly present. While the code situation can be shared and passed on to a medical team, it is a specifically nursing concern that the context of a death be managed well for the patient’s sake. When this doesn’t happen for reasons beyond the nurse’s control the nurse can feel overwhelmed, perhaps by emotion. This trauma learning is lasting also.

This completes the collection of Rites of Passage categories where fear learning played a prominent role in the creation of a new nurse. Participants formed individually unique patterns of connection between fear and trauma learning in the clinical environment and past experiences of fear learning and trauma. These connections reached forward into anticipations of responding to new events. This connecting between past, present, and future formed coherence from these
experiences. Each participant described how embodiment was present. As they learned to trust their bodies and connect with other people in the midst of care, using the emotion of fear, they integrated all of these fragments of experience into a cohesive whole. The had formed a new style, an embodied ‘way of being in the world’ (Merleau-Ponty, 1945). This style was an emergent property and fear, as the prevalent emotion, could be considered an integrating factor. This process of integration as learning is a subject for focus in Chapter 5.

In the following section which addresses the ongoing learning for practicing nurses, horror and incongruity take on more importance and trauma learning is more apparent than fear learning. The survival learning becomes increasingly complex as the nurse comes to notice the constant tension of the paradoxical presence of chaos and order in the clinical setting. From patient physiology to organizational policy, the systems are unpredictable.

*In the Fray: Living with Paradox*

Once the rites of passage have been negotiated the nurse is in the fray. The better he or she learns to play the environment’s “natural games”, the more autonomous they will be as a nurse. ‘In the fray’ refers to the constant flow between chaos and order that is present in the dynamic clinical environment. This is paradox, the tension inherent in the co-existence of apparent opposites, both sides being simultaneously true. The challenge for the nurse is to learn to move in both experiences simultaneously. Professional development is ongoing as experiences inspire new patterns of connection with spirals back to the past to achieve coherence, connecting old and new experience, sometimes old and new traumas, and forming new patterns for future survival. Survival in this sense is the ability to keep one’s patient alive while also remaining emotionally and politically intact despite the conflicts in the complex practice environment. The stories of the participants in this section illuminate some paradoxes
present in today’s clinical environment which the nurse must negotiate, finding ways to be present with both chaos and order while creating patterns of connection for knowing and doing that make responsible nursing practice possible. The paradoxes are also explained in light of trauma theory. This section focuses on four areas relating to ongoing learning in this environment of continuing professional on the job learning as discussed by participants that gets at paradox: a) horror and intense novelty; b) the incongruity of complexity of humans in a techno world; c) chaos-order and death-resuscitation; and d) fight-flight.

_Horror and Intense Novelty_

As most nurses continue their professional practice, they are likely to deal repeatedly with death and to encounter experiences of horror and intense novelty. An aspect of survival learning and responding to threat is explored in the research which identified an initial preference to focus attention on fearful pictures, before learning to avoid the situations exhibited in the pictures (Hebb, 1946; Humphrey & Keeble, 1974). This might explain why for many people, intrusive recollections seem to fill the mind acutely after suffering a loss (Horowitz, 1976). To the degree that a threatening event is grotesque and incongruent with previous experience, it will hold our attention until it is processed. According to Shalev (2007), most people exhibit stress symptoms after these exposures and most people recover from this initial distress. Given that this is so, Yehuda (2002) suggests that presence of these symptoms following exposure to trauma might represent a normative reaction to life threat. From this perspective then, social solidarity and support are the factors that bring healing.

Novel and grotesque in this sense means “strange, disturbing, or distorted – a type of experience akin to violation of norms for wholeness, bodily integrity, and species-specific survival schemata” (Shalev, 2007, p. 211). Nursing practice provides exposure to all of these as
the stories shared here reveal. “Flash-bulb memories” (Sierra & Berrios, 1999) begin to occur within minutes of surviving a life-threatening event. These non-verbal, non-reflective experiences are intense and uncontrollable, carry feelings, involve alarm and bewilderment, and often focus on the most horrendous aspects of the experience, like exposure to body parts (Shalev, 2007; Shalev, Addesky, Boker, Bargai, Cooper, Freedman, et al, 2003). Three examples of this kind of experience are discussed here: violation of body integrity; violations of norms for wholeness; and violations of species specific survival schemata. There is a strong visual aspect to the embodied experiencing of these events as told in the following stories.

Violation of body integrity. In Trudy’s interview she re-told a story that she had shared with her learning partner during the complex problems course. It was a story about a complex clinical situation in which she experienced body knowing; it fits into this section because her patient’s treatment involved gross distortions of body integrity.

When I was a new nurse and first worked in oncology, we had a young girl who was 27 when she was diagnosed with cervical cancer. She ended up having a total pelvic exenteration [major surgery to remove all pelvic organs and adjacent structures]. I really couldn't remember what a total pelvic exenteration was. I got her with tubes everywhere, and just THAT was alarming. For me with her there was a lot of surprise. She didn't really cry. She didn't complain. You'd ask her if she needed something for pain. "Yes." It was kind of shocking with her. I don't know if that had to do with when there was family there, 90% of the time, she didn't express feelings. She was just a very different individual. Very different. When I first started with her I just felt very uneasy around her. Very nervous. I think the language barrier had a lot to do with it. It’s very hard to get at that piece.

Ugh. [She shuddered.] I was nervous. Nervous. Because I looked at her and didn't know what to do with her (laughing) to be honest, when I first got her. Just very ... very tense. I felt very tense and anxious. (Sigh). Just overwhelmed. Just overwhelmed with the whole thing. Once I got started I was fine. But when report takes a page and half to write out and some of the words you don't understand, there's a lot of anxiety. Seeing [the wound] didn't really bother me so much. But what she looked like then, compared to what she looked like a month later. There were two completely different people. So that was like relief, when I saw her later. I felt more relaxed around her, because she didn't have all that going on. Having her I guess in the beginning kind of
helped me get more relaxed and more comfortable with that kind of situation. Now if I see it, it’s OK. Not OK, but it doesn't give me as bad a reaction. But I automatically remember her when something is in along those lines. When I see those types of patients now, she seems to be the one I remember the most. So they just take me back to that situation. But I don't feel myself getting nervous, or overwhelmed, or anxious. Not as much as I did then.

It often happens that to save or extend a life the body is surgically altered in ways that make it unrecognizeable. This paradox can be overwhelming for the patient and the nurse. In this particular case, when a body is emptied of pelvic organs all of those functions now happen outside the body. The identity tied to this part of the body is challenged when the body’s integrity is disturbed. More than simply a matter of learning to manage bags and tubes, the sight and the thought of being so changed is a source of horror.

Violation of norms for wholeness. A second example of horror that evokes surprise is loss of external body parts leaving a body that is less than whole. Throughout Robert’s interview there were multiple references to fear and trauma learning events that involved loss of limbs, or the possibility of traumatic amputation. From an event during his youth in Liberia to recent experience in the ICU, the series of memories that returned to him during the interview were remarkable in this way. These memories are included here as a demonstration of the interconnectedness of instances of fear conditioning and the way that one person’s mind achieves a coherent narrative around a particular trauma theme by making its own connections across past, present, and future. Interestingly, Robert described his responses in the language of wholeness. The script was edited for length and continuity but these stories were actually scattered throughout the interview, so the recurrence of references to amputation was notable.

As I get older I'm more in tune to my body simply because I am more aware now. Everything that's on your body is pretty important and I think of it as a whole, so if anything else is gone I think it’s like losing a part of you. I pay more attention to that, and try to keep it that way. When I was growing up I came close one time. It was on a Sunday. My friends and I were riding bike.
Back home they have these market stalls built on the side of the road. The roof is pure zinc. We were riding and one of my friends jumped on one of those table-like counters and it fell over. I was on my back right there and I think trapped right by my feet. If I had been an inch or two closer it would have taken my arm off. When that happened and just thinking about it today, it was ... my life wouldn't be the same. It would be so different. So I think because of those experiences, it makes me be more careful. I pay more attention to my body. Maybe unintentionally, but it's there subconsciously. I think of it as a whole and I don't want anything messin' with it. Yep.

Now that I'm working in the ICU it's a whole different experience. People coming in with some pretty bad injuries. They lose an arm and lose a leg from motorcycle accidents. We know that they're never going to be the same. Your body is never the same. If you're born with a deformity it is different than if you had everything and lost something. (Huge sigh).

With embodiment everything is connected ... in some way ... to one another. So the thing about trauma is that disconnection occurs. Whenever there's a disconnect it's not a good experience. So you disconnect, in any way shape or form from a body part, and it's traumatic. It's a bad experience. Your body is ... is a whole, you know, making those connections from head to toe, so traumatic experiences create disconnectedness and a very deep breaking. Losing an arm or a leg is a disconnection.

Before my nursing job I used to work in a group home setting. We'd take the guys to go bowl every Saturday. While we're out bowling one of the boys that I didn't even take care of caught his hand in one of those holes at the bowling alley. Nobody was paying attention. He got his hand in there and then he started fighting to get it out. He didn't understand his hand was stuck and he was fighting it. He could have broken his arm. So I'm standing there, you know. I'm in nursing school and I'm thinking. Nobody knew I was in nursing school at the time but I'm thinking "Well something should be done." So, not even thinking about it I just went there ...his hand was in the hole and he kept bending them up here so it would not come up. So I went down and just somehow grabbed it and just kept it straight from top to bottom, top to bottom and just kind of guided it up through the thing. It took a little while but it came out. It came out (sigh). That was more of a relief than anything.

I was nervous. I was never as anxious as that. I didn't know what to do at that time. And somehow something just guided me to do something. I didn't even think about it. I just went and did it. So it wasn't like I thought about it and it was just instant. Your body knows that if you need to do something ... I didn't know how I was going to do it but it just happened. I don't think I thought about it logically. It just made sense to grab his hand and pull from above and below and to keep it straight to guide it through the hole. I wasn't in control. I don't think anybody was in control. It was chaotic everybody was just screaming and I didn't even know how he acted. So there was no control there. I couldn't control the situation.
You may have situations that appear to be out of control and you have to gain focus. You have to come back and take control I mean pretty much. Even though you are frightful but you still have to get a hold of yourself. Guide yourself through whatever chaos is going on. You can't solve every problem. You just need to focus on the one thing that needs to be done and do it at that time.

For Robert the particular horror of losing a limb is a well connected pattern. He has memories of this theme from various times in his life and now he has connected them around the concept of wholeness to give him a new understanding of trauma. In a sense he is still ‘staring’; still engaging with that first threat to his own arm and reminding himself to be careful. He identifies that paradox was present in his own responding to a threatened amputation when he had to ‘act without thinking’ in order to ‘know’ what to do.

Violation of species specific survival schemata. A third example of this experience of horror/intense novelty is evidenced when we act to read the environment for threats and protect against danger and our efforts fail. The automatic schemes we associate with survival are violated. We can experience our vulnerability as a form of horror. Monica’s story shows how witnessing the evidence of such failures brought her to realization of her vulnerability and fear conditioning keeps her in connection with it on a daily basis.

I had this one patient who was young, like 20 or 21 years old, a female, and she had been in a motor vehicle accident. She was paralyzed, and taking care of her and watching her just made me frightened inside that anything can happen at any time. So now I'm very cautious, especially like when I'm driving. I'm always worried because anything can happen at any time. This young girl, at such a young age, now is paralyzed because of this. I'm more aware of it now. The first thing I do when I get in my car is say a little prayer. I think about it often, every time I drive. I'm always aware of my surroundings. So if something like that would happen, at least I know that I expect it. It can happen to me too. I'm not gullible! I know it can happen to me. So I'm more aware of it. When I see something on the highway, like an accident, my heart drops. Sometimes my heart rate goes up because I'm just so scared for that person that was in that accident. You know, that's my biggest fear, getting into an accident.
When I see a patient I feel horrible that something bad happened to this person. But more, I'm scared for myself that this can happen to me anytime. It could have been a family member, you know, it could have been ME, it could have been a close friend of mine. I try to feel what they're feeling. I try to make them more comfortable. At the same time, I'm scared because anything can happen at any time. Whenever I'm driving, especially at night time, I get nervous, my heart will start pounding really fast. If I see a big accident or something on the road I'll be worried. My heart will start pumping really hard.

When those things resurface like right now, everything that's going on, I have so many things to think about, the future and stuff, I just keep myself busy. My body knows to do it after I get enough sleep. I can tell when my body's really tired because I can't do any more. I won't push myself to do more because my body's tired. I'll have to rest so I'll take the next day and do only as much as I can do, and I won't push myself.

There are multiple forms of horror here: the disruptions of bodily integrity for anyone who is paralyzed; the disrupted wholeness especially for someone so young whose life was just beginning; and the realization of one’s own vulnerability. A patient’s illness can be rationalized more easily with “It won’t happen to me.” But an accident can happen to anyone. The horror extends from the patient to the nurse. Paradox asserts itself in multiple ways by crossing boundaries. The patient’s existence has taken on extreme limitations and an unnatural order that simultaneously leaves them subject to all the chaos of the context they are dependent upon. The nurse must be caring for the patient but the situation leaves her concerned about and needing to care for herself. The realization of life’s paradox … that you can work to keep safe and remain vulnerable … makes it difficult to sleep, and the more vigilant one becomes the less rested and therefore safe is the outcome.

The aspect of grotesque novelty as violations of integrity, wholeness and survival schema was addressed in this section. A closely related but separate event is the experience of incongruity that throws us outside our way of understanding the world. Intense grief manifested as the acute stress responses accompanying loss is common. When the fear and alarm system
converges with the mechanism for solving the paradox of these incongruities, intrusive re-
experiencing can occur (Barad & Cain, 2007; Brewen, et al, 1996). In the next section the
understanding of horror and trauma extends beyond the individual as unit of analysis. The
trauma is happening at a different systems level where the threat is not a personal, physical life
threat. The threat is to roles and identity, the network of bonds that hold people together, to
human rights and ultimately to the meanings that make life coherent (Silove, 2007).

**Incongruity in Complexity: Humans In A Techno-World**

A second paradox exists in the utter strangeness of using technological solutions to
human and specifically corporeal problems. We take on a machine aspect in order to extend
human life and there is an incongruity in this movement. Incongruity is not just a matter of
newness or first time experiencing. Incongruity means ‘things don’t fit’ expectations, in fact
may violate expectations, and they do so in a way that is horrifying and shocking. From a
complex adaptive systems perspective this would be the surprise event that destabilizes a system
to the degree that it must re-pattern itself or cease to exist. The connection to trauma is made by
Shalev’s (2007) declaration that the power of a traumatic event to harm is proportional to its
incongruity with previous experiences. Neuroanatomically, it is suggested that these experiences
represent the intersection of the midbrain activation of fear and alarm and some other
mechanism, not yet known, which solves the problem of incongruity and intense novelty
(Brewin, Dagleish & Joseph, 1996; Barad & Cain, 2007).

Participants encountered incongruity in the context of quaternary care (super-
specialized, technologic, high-intensity) when their personal ethics, the nursing ideals learned in
school, and their human instincts came in contact with medicine and a market and research
driven health care system. There is paradoxical tension present between technology vs. touch,
research vs. caring, costs vs. effectiveness, and longer life vs. quality of life. Today, hospital nursing practice gives ample opportunity for exposure to all of these. Acute stress symptoms can occur in reaction to these situations. The presence of social solidarity and support, the postulated sources of healing (Yehuda, 2002), varies widely. The following examples of incongruity share in common the nurse’s knowledge that patients and their families have little understanding of the experience they agree to when they say “Yes” to technology. Three sub-categories of ways this paradox presents are a) a marketing approach to medical intervention; b) the human body as receptacle; and c) treatment that borders on torture.

**Marketing approach to medical intervention.** An experienced nurse, Mary Beth, describes how her body identifies situations of ethical conflict for her. She is disappointed that she sees medical decisions avoided and shifted to the family as medical interventions are marketed as products rather than recommended only when advisable. She finds pleasure and amusement in the natural evolutions of barriers to clinical situations she disapproves.

Sometimes, I don't WANT to [participate in a procedure]. Sometimes I think they're so sick and it is so far. It's OK just to let this person go, but that's not what our doctors do. Or that's not what they want. *My body doesn't feel good doing that.* I still go through the motions but a lot of times, I lean toward my personal spiritual beliefs thinking, you know? *It doesn't feel that good,* but this is my job, I'll help them. Sometimes I'll ask the doctors too, "How long are you going to keep doing this? They're not going to get a transplant, they're not going to do this. They say we have to because it’s what the family wants.. And I'm thinking," *You're giving them another week of torturing.*"

The way I make peace with it is by remembering that the family or that patient brought themselves to the hospital for help or service. *So I segregate it.* It's different from thinking I'm really helping somebody, and really making a difference. In my mind I can compartmentalize it. That's *what my body has to do.* My co-workers talk about it too. They do feel that way but the doctors never go there. I always say, "Do you really think this is right? Are we doing ‘good’ here? What's this about?" The attending doctors don't like to talk like that. I'll bug them and if they can't manage to put it [the device] in, like the placement just couldn't be found to have the right spot to place a peg tube; .or the needle wouldn't go through if the skin’s too thick. I’ll say, "Hmmph, yeah, not meant to
be, you know...” and they just can't talk like that. They'll joke around about lots of other things. But I've never been able to get a sense of how they feel about that, if they feel like they just have to, or why can't they just say “No.”

The incongruity in Mary Beth’s setting is that patients are being treated invasively when the treatment can’t cure them and can’t be justified within the broad understanding of their clinical picture. But since the intervention itself is deemed life-threatening, the difficult medical decisions are shifted to the families and services are marketed as consumer goods. The paradox might be seen in terms of a medical response of creating some sort of order in a chaotic healthcare environment driven by lawsuits and economics. The tension for physicians exists between practicing good medicine and staying in practice. As physicians add order to their lives, the chaos is shifted to the patient and their family.

*The human body as receptacle.* The surgeons who provide technology are responsible to provide informed consent but the emphasis is on risks to life, not guarantees that patients understand exactly what the future is going to entail post procedure. Nurses are more likely to be the ones who have to teach the patient and family and certify their readiness to function independently. Those aspects of care are less interesting to a surgeon. Eugene explains how this challenge is present in his work setting.

We get patients with ventricular assist devices and usually it’s a big deal because they have to do dressing changes a lot, they have to do battery checks and changes. It’s a decent amount of work and taking care of yourself. We put a device in this patient that had a stroke, and he really couldn’t move his right side at all. His wife wasn’t too concerned with taking care of him or helping out too much. *It was emotionally stressing,* the fact that we gave him something that is keeping him alive longer, and assisting his heart, and his lungs, and his circulatory system, yet he really can’t take care of himself. His wife? Not really. I think his mother-in-law was going to help some. He’s going to a rehab center for awhile and they had to train all the people there. Their staff didn’t know anything about it. So … it’s nice to help patients but if the resources aren’t there and they don’t really understand …. *I don’t know about it.*
It’s different from the whole pathophysiologic aspect. The patient is at the present time a little more stable and better, in the sense that we’re helping out his heart failure, and his cardiac output. But there are such emotional issues that are keeping him from even taking care of the device we just gave him. From the nursing perspective we struggle. It feels like they put these devices in people just because we can, and because we have this new doctor. It’s frustrating for us. Nothing necessarily critical happened to him during the time I took care of him. Not like a traumatic experience. But at the same time, there were other things that I learned …. socially and logistically I guess I could say … about hospitals and how we care for people. It was frustrating to see that. Yeah, it looks very humanitarian to help this guy out, but is it really the best thing in the end?

In these situations, the incongruity is between the ideals learned in nursing school, where quality of life and ethical principles were taught, and the reality of practice where opportunities to experiment seem to be valued over patient outcomes. Paradox is present because extending the physical body’s capabilities and lifetime with technology can create a situation that outstrips the human capability to manage the new body. Nurses are challenged to find ways to give adequate care in circumstances that are increasingly inconceivable.

Treatment that borders on torture. Sometimes the incongruity, the thing that doesn’t fit, is the gamble taken on a possible cure despite the obvious agony being inflicted on the patient. Sometimes physicians’ enthusiasm for trialing a new procedure leads to less than honest appraisals of probable effectiveness. Sometimes physician honesty is lost on patients and family because they want to try anything available. Paradoxically, total honesty lies in a tenuous balance with maintaining hope. Cadence shared a story of such a case.

We recently had a 17 year old hematology/oncology patient die on the unit. He came back to us from peds/oncology because he originally aspirated, or something. But he came back to us intubated and his skin looked wretchedly horrible. I remember going in there and helping them with the dressings and his testicles looked like meat, you know, like raw hamburger meat. He had blisters all over his hand. He looked like a 90 year old man ... and this kid was 17! His family was in an alternative state of mind, because they just weren't getting it. They weren't seeing the clinical picture we were seeing. For me that
was gut wrenching! I felt like my heart was getting ripped out every time I had to
look at him, because here this kid is with all these blisters, he was intubated,
we had him sedated. Sometimes we had to paralyze him. It was just gut-
wrenching to me that his family was just letting it drag ... out .... forever.

His whole body is breaking down from the inside out. I was with
adult patients and they would tell me about how much pain they would have.
And now, I can't get his parents to understand the situation? That was just
very hurtful for me. Finally we got him better, and we sent him out to the unit.
And we're like "Thank God ... he'll die out there. He'll be hopefully in less
pain. Hopefully they'll come to grips with this." Well, he aspirated, and Damn
It! Didn't he come back to us again.

There was nothing we could do for him. Usually we like to keep our
patients with the same nurse for 3 days. We couldn’t with him, because it was
just too hard on everybody. I mean, you felt depressed, withdrawn. You felt worn
out, you know. And finally his Mom had asked him the next morning when he
was semi-alert .... “If you stop breathing do you want them to put a tube in your
mouth?” and he said “No.” “If your heart stops, do you want them to beat on
your chest?” and he said “No.” And the importance of that was that his parents
were the ones who convinced him to get the stem cell transplant in the first
place. So they finally came full circle, and realized that this was the end and that
there was nothing we could do about it. So at that very moment, everybody else
relaxed. And there was an overwhelming sense like that sigh of relief when he did
die. Because We Knew that he was better off, not suffering like he was. So it
was nice for us (little laugh). It was nice that finally the family came full circle.

Once again, there is incongruity between real life practice and what was learned in books.

Medical disorders don’t suffer. People suffer. Pain isn’t just a quality to be measured on a 1 –
10 scale and medicated away. Pain is an experience. Nurses choose their profession because
they want to help people get well and live and it is incongruous to them when they find
themselves hoping for patients to die. As remarkable as the technology has become, hope
remains a part of the equation for sustaining life. The paradoxical tension between technology as
only hope and hope as necessary to technological success presents intense challenges to nurses
because there is no task list that explains what to do to support the process. The layering of
connections to family members only makes the situation more complex.
Resuscitation vs. Permitting Death

The third paradox exists in the tension between trying to control death vs. allowing it to take its natural course. Both “Do Not Resuscitate” and required resuscitation are regular occurrences. Despite the almost routine nature of these events they were consistently described by participants as trauma learning experiences because they confront nurses with a situation that feels out of their control. The apparent simplicity of the DNR protocol masks the complex emotional and behavioral responses by nurses to whom these situations present an ethical conflict. In a system that strives to save lives at any cost, not doing so is difficult. Alternatively saving a life at all costs sometimes makes no sense.

When ‘save at all costs’ is rejected. The decision not to resuscitate lies with the patient or their medical power of attorney representative and requires a physician’s order. Sometimes nurses disagree with the decision. In Kathy’s case we are reminded of her experience with an unexpected death. The emotions and caring concerns that emerged from that experience reappear here.

You have very little control when you have somebody that is a DNR (Do Not Resuscitate) that is dying. You know the person is ‘do not resuscitate’ and the person is dying. You have fear, you have anxiety. The only thing that you can do is to be there and hold that person's hand, and have family or somebody come in there with them. It’s hard, especially if the person is alert and oriented. They still know that you're there, you have somebody that's young or has cancer or something like that. And there's no chance of them coming back. If you have somebody that has no family, it’s something beyond your control. The only thing you can control is be there with that person, and hold their hand, and have somebody be there with them.

Fred still remembers a situation when he felt a similar ethical conflict over a case in which the patient chose not to be treated and was allowed to go home to die.

I was a staff nurse [still new to nursing] caring for a patient. Got report, the patient had been in pain all night. She was older [very elderly] and in with a
dissecting aortic aneurysm [an emergent, unsurvivable event without surgery], which they decided they weren't going to operate on. I found out later the surgeons were willing to do it and the patient said no. They had issues getting the patient's pain under control [Eventually there is no effective management for this pain without contributing to the patient’s inevitable death with respiratory depression. But the nurse did not seem to understand this fully, had trouble accepting it, or thought the situation was under control. The options are attempt surgery or die.]

The nurse giving report had a feeling that there was something just not right with the son. So I go in and do my assessment of her, and she seems to be resting very comfortably, and he starts insisting that she have an increase in pain medicine. It was ordered PRN [as needed] so I explained that to him. “I believe she's getting morphine” I said “and I don't want to depress her respirations.” And he said, "Well that wouldn't be a bad thing.” So then, you know, my body story ... the hair on the back of my neck starts to stand up a little and little flags going up. You know you just get this feeling. I don't understand, I guess my body picks up, or anybody's body picks up on something sometimes.

He was very insistent on this pain medicine. I can remember being very infuriated with the doctors because the son would tell them "Well she's in such pain" and the doctor would just increase the dose of pain medicine. Never saw the patient or assessed her. It was an older resident, not the attending physician. So I explained my concerns to that doctor. He said, "You're never going to win this one. Just let it go." And that sent up more red flags. It's like OK, who's playing games now? The patient was there for two days, and I exchanged report with the same nurse. So it was two of us and then there got to be another nurse involved. We all had the same feelings. The physicians decided they were going to discharge the patient and send her home with her son as the primary caregiver. And we said “No.” We expressed these concerns to the residents that the son was going to take her home and be giving her the pain medicine and we didn’t expect her to live. And they wouldn't do anything.

I was uncomfortable enough that I called the ethics committee, and they said I had to talk to the attending and go from there. If the attending felt that the son intended for his Mom to die, then risk management would get involved. So we talked to the attending who went in the room and said "Is everything going to be OK?" and they said ”Yep!” and he came out and said, "They're going to be fine." And he didn't evaluate.

Then it was just a whole other body experience. Because I just felt like I lost. And I feared for this woman's life, and she wasn't having pain. I was frustrated that I couldn't do anything else. The next day I was off and I got a call from the charge nurse. The son had called, he had taken Mom home that evening before and he wanted to thank us for all of our care, and tell us that Mom passed away that morning. What do you do? So there were a whole bunch of different body reactions.
When ‘save at all costs’ makes no sense. Alternatively Eugene told a story of trauma learning, feeling out of control in a resuscitation situation that seemed irrational to him.

We had this really sick guy on our floor. Not to be cynical, but he should have been a DNR, DNI (Do Not Intubate). He had a lot of brain infarcts. Once in awhile he talked to you but, he didn’t move at all. For ICU that’s not rare but for intermediate care it’s a little more unusual. *I didn’t have him that night, but his heart rate went down* [observed on a monitor] and I told his nurse, “You know he’s down that low …”

We went to his room and he was white as can be and didn’t look like he was breathing at all. We cored him but as we were coding him I felt very helpless because, ONE …He should have been DNR or DNI already but we couldn’t stop it and we had to do it [there was no order prohibiting resuscitation so they had to follow through with a code] TWO … It seemed like there was really no chance for him anyway because he wasn’t on hospice but he was about to be, because of his state [Now that he has coded, if he lives, he will be placed on hospice and allowed to die naturally]. And THREE …. Although we had the code going …we tried and tried to save him… they finally called the daughter later and she said, “Stop the code.”

I felt very helpless, because although this patient was very sick, and although the chances of bringing him back were slim to none…I didn’t expect him to be dying. You know they’re sick but you can’t predict it. You don’t know when anything’s going to happen. Although it was traumatic, and although it was out of my hands, I still think I learned in the sense that ….. ONE, you shouldn’t be overconfident, like I said before (chuckle) and TWO, you shouldn’t expect things. Maybe I thought that in the near future he would pass away, but I expected he was leaving us to go to long term care. Still I was the one that picked it up. I sensed that we should do something. You have intuition but sometimes it might not be right. You shouldn’t rely on it a hundred percent of the time, but it is valuable.

Perhaps the most basic and common clinical paradox is the case in which caring is best accomplished by allowing someone to die. Policy denotes a binary: DNR vs. resuscitate, but this is a simple answer to a complex problem. Because we are complex creatures with varying ethical perspectives, communication is often poor around these difficult cases. For nurses these events often end in ambivalent feelings.
Fight or Flight: Ultimate Survival Skills

The fourth paradox refers to the way that nurses are repeatedly pushed into the natural biological stress response state of “Fight or Flight”, but flight isn’t actually an option. Nurses who don’t learn to fight when mortal threats are imminent can not nurse. Therefore, the ultimate survival skill is denying the binary and choosing to remain in constant fight readiness for the sake of the patient. But even when they learn to fight, structural features can leave them feeling powerless, and thus engulfed by trauma learning. The fight or flight decision becomes grounded in understanding and using power.

In accordance with the neurobiological fear-conditioning model of trauma (Rau & Fanselow, 2007), we learn to identify threats to life within our natural environment. The emotion of fear evolved to be dominant over our behavior when faced with threat. In response to danger cues, we exhibit unlearned behavior patterns with a history of protecting our species. This is why as nurses negotiate the professional rites of passage, they consistently experience fear during new exposures to mortal threats. They display a consistent set of defensive behavior patterns and they learn the physical behaviors of fighting while watching the more experienced from a safe distance. Ultimately they become the first responders. Participants’ stories showed over and over that the initial tension and freezing in terror quickly became an automatic adrenalized engagement once they learned, through experience, that they could trust their bodies to know what to do and that they were not alone. They learned in the moment that our nervous systems exist to help us move and that the only response to threat that brings relief is a form of action.

But what is survival action when the threat exists not only in the patient but in the complex interconnection of systems in which the nurse and patient are embedded? The
understanding of adaptation needs to be extended into the related ecosocial conception of trauma (Silove, 1999, 2004) which accounts for the ways in which social, cultural, historical and political influences shape each individual’s interpretation of complex events. According to Silove (2007), when bonds are broken, the attendant grief must be assuaged by restoring families and networks. The aimlessness and loss of direction that arise when roles are disrupted and marginalized must be addressed by the creation of hybrid roles and identities. When human rights are being violated, the suspicion, anger, and loss of trust especially in authority must be met with demands that principles be met across all interventions.

This is a hefty assignment for nursing, but the cost of failure to adapt lies in stress disorders; complicated grief, depression and pathological anger; loss of direction, isolation, and loss of coherence. The stories already told contained seeds of both the positive and negative possible outcomes. The two final stories offer examples of complex clinical situations in which the themes of fear, trauma and survival learning converge with intense novelty and incongruity and the nurse must choose a course of action.

**Feeling powerless.** Angela, still in her early years of nursing, told a workplace story as an example of a complex clinical situation in which she was aware of knowing through her body. It contains the major elements described in relation to intense novelty (the sight of the patient’s body, her pain, the nurse’s experience of her pain) and incongruity (the physician’s attitude, all the ethical questions that were raised for this nurse). Whereas Trudy has used her experience with intense novelty and the accompanying memories to facilitate her nursing care of other complex patients, Angela feels haunted by her experience. A major element that makes Angela’s story different will be the focus of the next section of discussion. Angela experienced being powerless.
There was a patient... a depressing one... I don't have any happy ones. I wasn't her primary nurse. That was one of the embodied things that struck me right away. I was very affected by what happened to this woman and I didn't know her from Adam. I had not been taking care of her. She had an allergic reaction to Lasix which had given her skin pustules. The way they were deciding to treat that was with body wraps which are thermal pajamas soaked in sterile water. That's how we do body wraps. I doubt that's the standard. But I don't know how other places do it. They had to be done every eight hours and she was in terrible pain, obviously. Her skin was essentially melting off. That’s what it looked like.

Of course on night shift the primary people are not there. So it is always somebody who's covering who has a list of papers and blocks of medications, history, plan, allergies, blah blah blah. They're just there to get you through the night. I can respect that. And... this woman. It was time for her dressing change at 5 AM. The nurse assigned to her was training somebody. She said, "You know we could just use an extra person" because the patient couldn't get out of bed herself. She was very sickly. It’s hard to get thermal underwear on a patient who's bed bound. Especially when they are wet. So they said,"We could just use an extra person to help us out." I said, "Of course ... I'll help you."

So we were in there, turning her, and every time we turned her she would just scream ... in pain. And we were like,"This is ridiculous." The poor woman was about 90 years old. Every time it just BROKE ... MY ... HEART to do that to her. I knew that it had to be done for her condition. But to hear her, literally every time you touched her, or tried to peel one piece of pajamas. Eventually we ended up cutting off her old ones just to avoid the strain on her. We called the doctor, because the woman was in unbearable pain and she was literally screaming. I've never heard, in my three and half years, anyone scream the way she did. That haunts me. Talk about embodiment, .... I FELT that scream. Things like that just shake you.

So we called the doctor and we said, "Look, she's really having a difficult time with this dressing change. Could we just give her some pain medicine? Because clearly this is a painful procedure. There's a situation, she's screaming. It’s an awful situation." An the Dr. said "Well, you know, she’s been a little confused so she probably shouldn't have the Percocet that's ordered." (Huge sigh as she's telling this story) We said, "She's 90 years old. What 90 year old doesn't forget where they are once in a while?" Grossly she was oriented. But yes, she had her whifty moments. But, doctor's orders. What are you gonna do? They don't order the pain medicine, you can't give it.

Soooo ... we were trying to finish up her dressing change ... and ... she ...DIED ... during ... the dressing change. We were turning her ... and one minute she was breathing ... and the next minute she was not. And that was .... IT. Aaaaamnndd ... the feeling. I STILL have not gotten over that. That still gives me chills and I still think about that woman. I will never forget her because of that. I just can't help thinking, if that ... If that person who was covering had just come and SEEN her, and watched us do that dressing change, they would have given her whatever we wanted.
Because if that was your grandmother, lying there in that kind of pain ..... WHO ... wants to suffer like that? It affected me so much, because I thought: those were her final moments. She probably had this fantastic life. She had all these children. This was 5 in the morning. Nobody was with her. And her final moments were spent in excruciating pain. I promised myself that day, "That will never happen to me ...OR a member of my family." We were all crying. We were all just absolutely in tears.

And of course then we had to CALL the person who wouldn't give her the pain medicine to come and pronounce her. This woman walked in and pulled out her criteria sheet for pronouncing death, and said, "Can you take a blood pressure?" I said, "NO. I can't take a blood pressure. Number one she has no pulse. Therefore she has no blood pressure. .." "Well ... the manual says we have to do three out of four tests blah blah " I thought, "HOW disrespectful were her last moments?"

If I could have sent that woman's family a thousand apologies I would have for the way that situation was handled. I STILL .... NONE of us .... none of us who were involved in that situation will EVER get over that. That's probably the most that I've ever felt, where I just felt completely that there was just nothing I could do. I had no control over the situation. We were trying to do what we could do for her. We were trying to make it better, and there was just nothing. We weren't getting anywhere.

It haunts me still and this was six months ago. I remember what room she was in. I remember who was in there with me. I remember, I can seeee ... that moment ... that hour that we were in there with her, and I don't think that will ever go away. That's the strongest physical connection that I've ever had, to any situation like that.

In this story there is fear learning, bodily experiencing, horror, efforts to prevent harm and to protect, the incongruity of the physician’s responses and the worldview those actions imply. Fear conditioning now attaches to aspects of context so that place triggers memories and some memories are sensory. Angela is still a nurse. She has learned, and this story was a piece of her survival. She is learning the natural games.

This story about Angela’s patient who died during an unmedicated dressing change could also be used to illustrate trauma learning. There were several intersecting power differentials in that situation. The patient was first powerless to stop the treatment or demand medication. She was too weak, perhaps not fully conscious, perhaps didn’t think to question. The nurses could
not control the medical orders or lack thereof, and could not force the physician on call to see the patient. The on call physician was responsible for a large number of patients she didn’t know, under the care of nurses she might not have been familiar with either. And the physician who ordered Lasix, the first offending agent in this medical saga, could not control what would happen when unleashing pharmacology in an aged body. Where does the power actually lie? Perhaps these power differentials can’t be understood without chaotic systems understanding of the unintended consequences of small actions.

Was there fear? Angela reports several manifestations of fear. Was there denigration or humiliation? While this language wasn’t used, we can infer that the nurses felt their opinion was disrespected by the physician, that the physician disrespected the patient when she arrived to pronounce her dead, and that the entire health care team dishonored and humiliated the patient. We see that results for Angela are many lingering reminders that are consistent with acute stress responses. We don’t know what lingers from this experience for anyone else.

Claiming power. This story from Mary Beth recounts the result of survival learning in a two decade nursing veteran. She turns her anger into personal action and accepts that making demands on behalf of the patient is a requisite part of a nursing practice she can live with. Embodiment guides her. She distrusts just enough to spot incongruities in care and follows a few simple rules that let her respond flexibly to changing situations.

I've worked in it enough that if I do get stressed or my body gets all tense, or I find it difficult to talk, I pay attention to that feeling and I speak up. I think my work is based a lot on past experiences. You build on that. You just feel it. I remember intuition type moments where I knew things were just not right, and I wasn't going to be a part of it. I remember a very sick person they wanted to do a procedure on, and anesthesia for some reason said no. So one of our fellows tried to make the case for a conscious sedation which is a whole different realm. It puts the responsibility for the sedation on the RN and that would have been me. [So physician anesthetists felt uncomfortable enough to refuse this case
but the other physician still wanted to do the procedure so he proposed to keep the patient conscious and use IV sedation that would be administered by a nurse.]

I felt like things were not all in order. Even in terms of the procedure wise, it wasn't working. They were trying to talk me into doing it and I just couldn't. I remember saying, "No ... that would be a big mistake." And I didn't know why other than intuition, or just feeling 'this is not the way it's supposed to be.' I remember talking back to the fellow[physician taking advanced specialty training] (takes huge gasp of air) saying, "I don't think that's right at all." I remember this other nurse saying, "You know, it's a good thing you said that." They didn't make the nurses responsible and they DID get a different anesthesia team to come and manage the conscious sedation. The patient crashed and they ended up doing airway emergency and finishing the case in the OR. That was valuable to me, because I did not feel right, physically, but I couldn't say exactly why. I felt good that I was bold enough to put words to what I was feeling and tell them, "I don't think it's OK." People really listened. The attending [senior supervising physician] actually listened. Another anesthesia team was sent over, the case was managed in a much safer manner, and it still didn't go OK.

That happens pretty often in nursing. For me it's a totally uncomfortable feeling that makes me feel tight all over. You feel stressed to speak up about it and not just go with the flow. I HAD to speak up because inside myself I KNEW it wasn't our normal situation, it wasn't OK. Even though this physician was a fellow with much more education, they look at things differently. Some fellows passed a residency and now they're doing an additional two years in a specialty. Some of them have actually been internal medicine physicians in other states, but then decided to leave cardiology and come work in GI, so they do this additional training. Some of them are quite self assured and they want to get ahead of the policy. They want to do things that they're not supposed to. You always have to have the attending with you. That's the rule and the way it is and I HAVE TO DO THAT or I could lose my job.

I remember being in the ICU and I had the processor of the machines turned off. The attending doctor wasn't there, because there was no signed consent form, so he was tracking down the patient's family for consent. This fellow wanted to start the procedure without the attending being present, and he started it. I turned off the processor. I said,"What are you doing? I have to wait." He told me, "It's only going to take a minute. It's just a lavage. It's not like we're doing biopsies or brushings or forceps, or specimens, anything, just a lavage." I said, "It doesn't matter." He leaned over the patient and turned the processor back on. So I walked out of the room, looking for the attending. He wasn't anywhere near there.

It was a bad situation but I didn't feel traumatized or degraded. It just wasn't the policy. It was NOT my unit and it shouldn't happen. I had to make a few official statements afterwards because the charge nurse of the unit came to me and said "Don't EVER let that happen again!" I said, "What do you want me to do? I did everything in my power." They told me I should have unplugged the machine and I told them that this is a man who knows the rules too.
So I had to write up a statement and stand my ground. I didn't really get in trouble but I was pushed to stand up for myself again. I was angry again. It was more anger. When I get angry or upset about something I'm more apt to just put it out there and let them know how I feel. I also respect people where they're making their decision too. He knew the rules as well as I did, and he made a choice. I said to my manager, "How far do you really have to go? I'm not his babysitter. I'm not his mother. He knows the rules." I said everything I needed to say.

These were two stories in which structural aspects of the healthcare setting paradoxically worked to dis-empower nurses while holding them accountable. This is the most complex paradox of those identified here, because it can incorporate the others. It is also perhaps the paradox most likely to drive nurses out of nursing. Nurses often experience feeling powerless in these situations. Effective survival learning teaches how to claim power in these circumstances and the learning can be embodied.

This section detailed the long period of nursing 'in the fray', embedded within the dynamic clinical flow between chaos and order, that follows completion of the nursing rites of passage. It explored 4 paradoxes that exemplify this tension in acute direct nursing care situations. Intense novelty in the forms of grotesque horror and incongruity with previous experience were the first two paradoxes which are often linked with fear learning and fear conditioning of related elements. The other two paradoxes related to DNR situations and fight vs. flight decisions involve chaos at levels beyond the individual patient’s condition. These are likely to overwhelm nurses with feelings of powerlessness, thus opening them up to trauma learning. Survival amounts to learning to fight. Embodied knowledge and learning are involved throughout. At some point the effects of this work-related fear conditioning and trauma learning can cross the pathology threshold and create secondary stress disorders. The next section examines the possible presence of these disorders by taking a very different approach.
This last section provides quantitative data to complement the stories above about the effects of fear and trauma learning. As the complex clinical stories demonstrated, fear learning and trauma learning are integral to nursing survival learning. One outcome is presence of acute and post trauma symptoms as was clearly described by participants. Can these nurses experience satisfaction in working under these conditions? Are their stress symptoms indicative of actual secondary traumatic stress disorders resulting from their work in nursing? The stories revealed ways that participants self-organized to learn by making unique connections among fear conditioning, intense novelty, and situations of paradox. So their resilience in adapting to and using trauma for professional survival is very instructive. Trauma is also interesting because of its known capacity for creating neurobiologic change that interferes with functioning. To uncover this aspect the study turned to a more clinical perspective.

This study takes a quantitative approach to answer these questions, providing a fuller understanding of how the practice environment is experienced as trauma by this group of participants who have shared their stories of fear and trauma learning. When participants were students in the Health Assessment course having their first experiences with embodied learning, the self-awareness thread incorporated self-assessment of the evolving neurobiologic body using research derived tools. Early in the course, self-assessments focused on lifestyle behaviors, temperament, learning preferences and attributional style. As the course progressed, the assessments moved on to body manifestations of stress, histories of potentially traumatizing life experiencing, presence of acute stress symptoms, and acute stress symptoms particularly related to professional care-giving and the workplace. The quantitative data presented in this chapter were collected near the end of the health assessment course, prior to enrollment in the complex
problems course, and approximately 8 months prior to the interviews. Because the stories reported in the interviews were almost entirely from past experience, they would have occurred prior to participants’ completion of these surveys and therefore their effects, if there were any, would have been present at the time of survey administration. This quantitative data were collected at the time of interview when participants were asked if they would agree to release the products of their previous course work.

Manifestations of workplace mediated stress were originally conceptualized as ‘burnout’ then later as ‘compassion fatigue’, a form of secondary traumatic stress that can arise in the course of care-giving (Figley, 1985, 1995; Figley & Stamm, 1996). In a sense, the professional care-giver is infected by the patient’s experience of trauma and being exposed to that. Under researcher Stamm (2002), this work evolved as a multidimensional measure of the balance of positive and negative experiences of work life, tested on healthcare and mental healthcare providers and teachers. This Professional Quality of Life measurement provides three different scores: Compassion Satisfaction is the degree to which one finds professional satisfaction in their current work that involves some form of caring for other people. Burnout measures how effective one feels at work, and can reflect mood. Trauma / Compassion Fatigue is a measure of secondary traumatic stress, or traumatic stress disorder from being exposed to another person’s experience of trauma. It reflects the degree to which work is frightening, so it considers indications of hyperarousal and other signs of neurobiologic change consistent with fear and threat sensitivity. Scores for all three factors are usually reported as quartiles, based on norms. Here, because of the small sample size (N=16), scores are reported as low, medium and high with the two middle quartiles grouped. For burnout and compassion fatigue, the high category
represents the group having problems. The percentages of scoring in each category are shown in Graphs 1 and 2 (p. 199 and 201).

Compassion Satisfaction

Despite the stories about fear learning and the serious challenges of paradox in the clinical setting, these participants enjoy their professional care-giving role. Compassion satisfaction is quite high for the group, in fact 12.5% higher than published norms for the scale (Stamm, 2005). Whatever the problems might be with co-workers, the hospital organization and the healthcare system, the positive elements that contribute to Professional Quality of Life as measured by Stamm (2005) are present. Correlation statistics between the total satisfaction score and individual items revealed the profile of highly satisfied nurses in this particular group. These hard workers who didn’t feel much connection with other people and were very stressed about personal circumstance surrounding illness were deriving satisfaction from their belief that they could make a difference for someone else. This could be a characteristic true of many nurses in general or just specific to this group at this point in time. The statistics only tell us about this group and this moment.

Table 3

Factors Associated with High Compassion Satisfaction

<table>
<thead>
<tr>
<th>Factors</th>
<th>Rho</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feel connected to other people</td>
<td>-.782</td>
<td>.000</td>
</tr>
<tr>
<td>Working late hours and weekends</td>
<td>.719</td>
<td>.002</td>
</tr>
<tr>
<td>Believe they can make a difference</td>
<td>.661</td>
<td>.005</td>
</tr>
<tr>
<td>High continuing stress about life threatening illness</td>
<td>.644</td>
<td>.007</td>
</tr>
</tbody>
</table>

$N = 16$
Compassion Fatigue and Burnout

Compassion fatigue, burnout and satisfaction. Compassion fatigue and burnout represent the negative poles of experience contributing to professional quality of life. Burnout, or feeling ineffective at work, was 6.25% lower in this group than is the norm with professional care-givers. This suggests that participants are comfortable in their work settings, that they are operating within their scopes of practice and are usually able to exercise their professional judgment to identify threats and act on them as they think is necessary.

Trauma/Compassion Fatigue, indicating that work is frightening, was present in 25% of the participants, as normative data would anticipate. Interesting for this group is that 3 of the 4 participants evidencing compassion fatigue also had high compassion satisfaction (Graph 1). Their work is frightening and they are experiencing acute stress symptoms, but they are rewarded by believing they are making a difference. Every participant had some symptoms.

Graph 1. Compassion Satisfaction Related to Compassion Fatigue
This intersection of positive and negative experiencing demonstrated in Graph 1 raises questions about how fear in the clinical work setting, traumatic stress symptoms related to work, and belief that one’s caring can make a difference are interconnected and interacting. For this small group of participants, what can be stated based on the data is that experiencing traumatic stress symptoms, a neurobiologically based phenomenon, does not appear to prohibit experiencing high professional satisfaction. In fact the high trauma/compassion fatigue group was best characterized by enjoying challenge and risk \( \rho = .622 \) and \( p < .010 \). Their trauma was expressed in the inability to recall aspects of their work with trauma patients which could be a form of avoidance or dissociative experiencing \( \rho = .652 \) and \( p < .006 \).

**Compassion fatigue, burnout and gender.** There was a gender difference in that 75% of the compassion fatigue group were male, meaning 75% of male participants were experiencing trauma/compassion fatigue as opposed to 8.3% of the women. This compassion fatigue group included the less experienced men (not John) and a woman experiencing high personal stress and medical problems (Marie). Patient acuity was comparable to women’s. This is not something that was apparent from the qualitative data. It is hard to make much of this finding in such a small group but it does suggest that men, especially when new to the profession, might experience the workplace differently from women. John did note in his interview that the harassment associated with assimilation is different for men and women.

This group with high compassion fatigue also had higher rates of burnout indicating that they tend to feel ineffective at work (Graph 2, p. 201). The reasons for this could be personal or structural. If gender is at play here, it may be that men and women gauge effectiveness differently or perhaps respond differently to the presence of paradox and the power differentials that are embedded there. High burnout had a strong negative correlation with ‘liking work as a
nurse’ \((\rho = -0.720\) and \(p \leq 0.002)\). This is intuitive. Who would like working in a role in which they feel ineffective?

Graph 2. *Burnout Related to Compassion Fatigue*

Age and years in nursing were not significantly correlated with either burnout or liking being a nurse. These quantitative data support and confirm the qualitative data which revealed the pervasive presence of trauma learning through paradoxes.

*Connecting With Personal Histories of Trauma*

Compassion satisfaction, fatigue and burnout emphasize the workplace and post trauma symptoms that are specifically tied to patient care experiences. Yet it seems possible that a nurse’s past history of stressful experiencing could contribute to current experiencing of workplace stress. In this quantitative analysis lifetime exposure to potentially traumatic stressors and past and current experience of stress in relation to those events was assessed using the
Stressful Life Experiences Scale (Stamm, et al, 1996). All of these individual items were correlated with the individual items of the PQOL. Table 4 lists the strong correlations found between characteristics of the life history of traumatic experiencing and current factors showing up as workplace related trauma symptoms.

Table 4.

Correlations with Stressful Life Experiences

<table>
<thead>
<tr>
<th>Stress Characteristic</th>
<th>Factor</th>
<th>Rho</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Like my experience”</td>
<td>Feel body doesn’t belong to them</td>
<td>.609</td>
<td>.012</td>
</tr>
<tr>
<td>Stress at time of past SLE</td>
<td>Stress now handling dead bodies</td>
<td>.750</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>Feel “infected” by others’ trauma</td>
<td>.707</td>
<td>.002</td>
</tr>
<tr>
<td></td>
<td>Often feel anxious</td>
<td>.639</td>
<td>.008</td>
</tr>
<tr>
<td>Current stress over past SLE</td>
<td>Don’t socialize due to obligations</td>
<td>.775</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Nursing work leaves exhausted</td>
<td>.617</td>
<td>.011</td>
</tr>
<tr>
<td>Number of types SLE</td>
<td>Intrusive thoughts from nursing</td>
<td>.540</td>
<td>.031</td>
</tr>
</tbody>
</table>

N = 16

The simple summary of this chart would be that for this particular group or participants, with high numbers and intensity of past traumatic exposure, in one’s personal life, there is greater likelihood of intrusive thoughts from patient care experiences and of feeling disconnected from one’s body. When these historical traumas were experienced as extremely stressful at the time of the event, the nurse is more likely to experience frequent anxiety now, to find handling dead bodies especially stressful and to feel infected by patients’ trauma. So possibly past traumatic experience creates some vulnerability to experiencing post trauma symptoms in the
workplace. This is not the same as manifesting a disorder or even manifesting compassion fatigue. Finally, if personal traumatic experiencing from any time in life creates current stress, the nurse is more likely to feel physically exhausted by the work and to avoid socializing. Apparently the available energy is needed to recoup. This picture brings to mind Cadence’s story about how her own experiences of abuse reappear for her in clinical situations. These experiences both inspire her caring and generate strong emotion that leaves her exhausted, needing to spend her days off escaping by watching TV. And yet she loves her work and feels effective and fulfilled.

Conclusion

This chapter presented a model of fear and trauma learning, grounded in neurobiology and traumatic stress research, as a way of understanding the natural process of learning for nurses in their clinical practice. The model captures all of the process as survival learning. It must be accomplished if the nurse is to remain in nursing, perform effectively, and find satisfaction. Clinical stories from participants’ interviews revealed a process of embodied learning through fear that forms the bedrock of clinical practice. The stories further demonstrated that with these basic survival skills in place, nurses continue their careers in a constantly changing environment comprised of multiple paradoxes, and negotiation of these paradoxes becomes the ongoing survival learning for the nurse who stays in practice. That survival learning might include fear, but frequently constitutes trauma learning in which power differentials are at play. Participants enumerated complex individual patterns of embodied experiencing embedded within these forms of learning.

The second part of the chapter considered the effects of clinical survival learning on nurses’ health in terms of developing secondary traumatic stress disorder. Traumatic stress
symptoms were widely present and workplace related symptoms and dissatisfaction were present. Secondary traumatic stress overlapped with satisfaction in caring. Traumatic stress symptoms also were present in participants who do not score high on compassion fatigue. This finding might be informed by the longitudinal research on civilians living under constant threat of terror in whom the presence of PTSD symptoms below the level of disorder is part of a normal reaction to adversity (Shalev, Tuval-Mashiach, & Hadar, 2004; Shalev & Freedman, 2005). Perhaps experienced nurses who have remained in the fray, learned to identify and move within the paradoxes, and chosen the ways in which they will fight, are no longer as frightened by the clinical environment. And yet, they have experienced fear conditioning and carry its lingering neurobiological effects. This is a very complex picture.

These participants and their experiences of trauma are the R.N. students who came to class to learn health assessment and the management of complex clinical problems. Chapter 5 will use excerpts from their learning journals and interviews to recount the processes of self-organization they used while learning through embodiment and compare their insights to quantitative data measuring their past traumatic exposure and current body expressions of neurobiologic change from stress. Embodied learning outcomes and changes to professional practice are the focus of Chapter 6. The reader may move through these two chapters in whatever order fits their curiosity and personal process of self-organization.
Presentation of Results: From Initial Conditions to Emerging Insights

This chapter presents findings related to the RN students’ process of learning as they made new patterns of connection through embodiment. Individuals’ intrinsic dynamics and initial conditions were recorded in a few different ways during the Health Assessment Class. The Body Stories Journal began with reflection on various types of body memory, accompanied by drawings of their own skeleton. These stories captured the beginning style of self-awareness in relation to body. As a way of recording and presenting the initial conditions as well as participants’ developing insights, data from the participants’ body stories journals at the beginning of the health assessment course as well as some of their reflections on these stories from the final interview are presented in the first section of this discussion of the initial conditions and emerging insights. The second section presents a chart of how each participant’s story unfolded as well as some grounding themes related to differentiation and integration of body stories. This section more or less summarizes and presents the data from the first section in another form.

In the third section, some quantitative measures about the initial conditions of participants are presented, particularly in light of the Stressful Life Experiences Screening (SLES) tool (Stamm, 1999). In the Health Assessment class, students also made use of a series of quantitative self-assessment tools, many of which asked questions linked with stress and
trauma. These self-assessment tools included Maas (2009) “Are you sleep deprived?”, Adrenal Burnout tool (Hanley, 2001), Kolb’s Learning Style Inventory (1976), Stressful Life Experiences Screening (Stamm, 1999), and Professional Quality of Life (Figley & Stamm, 1996; Stamm, 2002). The pedagogical purpose of using these tools is to facilitate self-awareness and similar assessments are incorporated into all the clinical courses because with a complexity informed pedagogy, students study themselves (Fenwick, 2003; Karpiak, 2000). Students practice research skills by collaboratively analyzing the group data in class and they share whatever they want to about their self-discovery. All the tools are based in the traditional biomedical paradigm in that they offer quantitative measures of some aspect of stress and/or trauma or have been cited in education literature addressing trauma (Perry, 2006).

Use of all of these tools and forms of data offered a way that students in the class could begin to examine their own “measures” of stress and trauma as they learned a new holistic and evolutionary perspective of the body as co-emergent with its environment. When they later became participants in the retrospective study of their experience of learning embodiment when the final interviews were conducted, they gave me permission to use the results of these quantitative measures from when they were used in class, as well as data from their body stories journals. The results of the quantitative data analysis identify the history of exposure to traumatic life experiencing. Later these data will inform discussions of participants’ emerging sense of embodiment by describing measures of the neurobiological expression of stress in the body. In this respect the quantitative data allow for an indirect analysis of an additional systems level, using behaviors and symptoms in lieu of invasive testing such as venipuncture.
Body Stories: Early Body Memories and Further Reflections

A different and more individual look at initial conditions comes from the participants’ Body Memory Stories, written in their journals at the start of the health assessment class. The text, *Body Stories* (Olsen & McHose, 2004) suggested types of body memory. Some participants wrote about all of them, some chose a few. Each excerpt given here includes all types addressed by that participant. These stories were accompanied by sketches ‘from memory’ of one’s own skeleton. Many students reported in class that they were ashamed of these because they believed they couldn’t draw, so they didn’t submit them with the original journal or didn’t share them for this study. All the drawings that were submitted are presented here as a way to exhibit visually an aspect of the embodied learning process but also to show how unique these drawings are and how they correspond to aspects of participants written body memory stories. These stories and pictures demonstrate the great diversity, or differentiation, of participants’ body awareness as they began this embodied learning process. There was also evidence of past integration or the forming of patterns of connection around these memories. As Siegel (2001) describes the integration process, these developmental memories capture some of their early life rhythmicity with a caregiver, their childhood interactions with the environment, and the ways they were shaped by interpersonal interaction that helped prepare their embodied selves for adulthood.

Excerpts from several of these journal entries will be shared to illustrate the four recurrent themes in these early body memories. In some stories a few of these themes were present, but one was paramount. They all reflect a time when participants were more consistently aware of being connected with their bodies. The depth of interconnectedness of these stories is glimpsed when participants look back during their interview, almost a year later, to describe their remembered experience of writing the stories. A few of these comparisons are
noted below as well. Here and throughout this chapter, these stories serve as introductions to the participants who offered up very personal information and insights. Therefore, the stories are usually documented as they were given and not broken down into one or two sentence fragments. Observe while reading for evidence of emotion and interpersonal relationships that would have facilitated the integration which holds these stories in memory as meaningful. The four themes running through the early body memory stories were 1) owning, knowing and mastering one’s physical body 2) taking in and exploring the environment 3) body image and health concerns and 4) concerns with safety and vulnerability. These interconnected themes form the integrated pattern of ‘early body memories’ viewed as a whole. Within each category is a great deal of individual diversity. Because the research aims to understand the patterns of self-organization there will be diversity within sameness, some chaos within disorder. So the individual stories are given a label as well, not to designate a sub-theme or another category, but to keep the reader focused on one individual’s unique arrangement within the larger category.

**Owning, Knowing and Mastering One’s Physical Body**

Each of the following body memory stories recalled a past time when learning the capabilities of one’s body and mastering its function and presentation were of paramount concern. These memories of mastery occurred within specific spacio-temporal settings and involved interpersonal relationships with a primary caregiver and treasured peers. Within the context of the educational setting and this study, the body memories helped students spiral back to an earlier time when they were more aware of being connected with their bodies, thus opening the way for embodied learning in the classroom, and conveying some sense of safety through familiarity that might not have been there without making these connections with the past.
This was the most frequently named category, possibly reflecting the developmental tasks of early childhood. The following excerpts were from stories that held this theme as primary. Often there were notable parallels between the written early body memories and the distinguishing traits of the adult student.

*Performance and the action body: expression without words.* Some participants connected with their body primarily through action and thought of the body as a vehicle to help them perform. It was especially difficult to put this kind of relationship into words. For example, it is not surprising that Rachel, who became an accomplished athlete and prefers working in the ER, found an action connection with her body past. Bold type indicates particular references to body or embodiment. Rachel wrote:

> My birth was very long and all natural. I was born into a military hospital where I was almost dropped by the doctor. **The earliest movement I can remember is running around like a crazy child chasing my new puppy.** I was about 3. … I was the proud Mommy of a white mini-schnauzer.

> Growing up as a child I was involved in many activities with training techniques. I was a cheerleader and a dancer involved in tap, ballet, jazz, clogging for as long as I can remember. As I grew up my focus was on gymnastics, cheerleading and track.

> I grew up in Alabama close to the shore which I loved. It was warm year round and I spent a lot of time at the beach. **The beach continues to be my comfort zone.**

> I don’t remember any comments that shaped my body image. **I did grow up very confident and independent and I like it the way my Mom is the same way.** I also feel growing up as an Army child helped sculpt my mind, body image and attitude on life. I’m independent and can fend for myself. I’m open-minded yet strong willed.

This is the happy and self-assured story of someone who is comfortable with her physical body and knows it well. Her skeletal drawing (Figure 4, p. 210) was four times the size of the others. Rachel explained that because she knows her body well the drawing was easier and more enjoyable to do than trying to understand how to do the body stories exercises on her own, because they were so different from her usual athletic training approach to her body. The
significance of this and the other drawings to an educator is that for some students these were an important way of making meaning around these body stories memories. For some participants, the drawings were a better way of connecting than were words. This is very important since the body memory stories turned out to be an anchoring point for much of the later self-organization. To devalue the drawings as merely ‘busy work’ because they are not based in language would be to disconnect some students from the possibilities for learning.

**Figure 4.** Rachel’s Drawing of Her Own Skeleton
Eleven months later when she was interviewed, Rachel couldn’t remember what she had written about as early body memory. The rich story about her own birth, her extended family, her connection with her mother weren’t accessible to her. *Her memory retained the connection with context*, in other words she still reported living in military housing, and the essential movement aspect was present, but *the story had become more about exploration*, and the relationships noted were with friends. The researcher must wonder if the apparent thematic change is coincidental or if it has some meaning in Rachel’s evolving cycle of learning through her body. What really came to Rachel’s mind during the interview was how hard it had been to put her body memory into words for the journal. This task was even more difficult for her in the interview setting where her story-telling was oral. She stated:

> I found it to be hard trying to come up with experiences and putting it into words. *I feel I'm very outward in expressing myself and I'm not very good at writing things down.* Putting into words was hard. I was a cheerleader and I was a gymnast, and I did track and field. So *I expressed everything outwardly into the sports and activities that I did.*
>
> I have no idea [what I wrote in that story]. *Living on an Army base and being outside and playing* on the jungle gyms and riding around on my little big wheels truck with all my friends on the back of it would probably be the first thing I kind of really remember.

Rachel was not the only one to experience challenge when faced with putting words to body memory. The task proved to be especially difficult for participants with past histories of achievement in multiple sports. They had very codified ways of managing body learning through training. Their bodies were inscribed in that way, and finding a new way to communicate and work through the body did not come easily, although sports always had. There is a delicate line to be walked here by an educator. When body awareness as pedagogy is approached theoretically, the body as site of social inscription is often emphasized (Grosz, 1994) with encouragement to help learners critically examine the meaning of these inscriptions through
discussion and to honor bodily experiences by putting them into words. On the other hand, when Michelson (1999) writes from a feminist perspective expresses that experience exceeds our rational attempts to bound it; that too much emphases on critical reflection depersonalizes and disembodies the learner (Michelson, 1996). In closer connection with trauma, she writes that some experiences are so violating that they not be made rational or coherent and so remain beyond expression (Michelson, 1999). This accumulated wisdom of educators along with the findings in this chapter argue for much greater appreciation of the body as partner in learning.

Posture as expression of safety and empowerment. An important aspect of learning to control one’s body is having a feel for posture and the ways it has meaning in our interactions with the world. Our posture has a direct impact on the way and our capacity to move through the work. Like Rachel, Robert was also physically active and confident, but he did not identify himself through his body’s achievements. His body seemed more to be a reflection of his inner sense of self. Still, the primary theme of his body memory was attention to the structural physical body.

Robert works with critically ill neuro-patients and plans to become an anesthetist, as befits his quiet and reflective manner. Growing up amidst civil war in Liberia, he and his brothers were moved frequently to keep them safe. He is far from home and family and his body story ties him to his past in a positive way:

     When the author [of the book used in class, Bodystories, by Olsen and McHose, 2004,] talked about how posture and structure are a choice, it had me thinking. Am I claiming my height? I really don’t think that I am claiming my height. I remember growing up and my grandmother saying “Stand up straight.” She always insisted that I was standing with a humped posture. Every time she said that I would square my shoulders. That actually made me feel better, but is always seemed that I would slip right back to my ‘normal posture.’ I don’t know if it was my way of dealing with some of the issues I went through as a child or what. It just seemed very natural. But as of today I will “claim my height” because I still see myself doing the exact thing (postures)
that I had when I was younger. I have also noticed that when I broaden my shoulders, that I feel better and empowered.

Robert’s skeleton drawing (Figure 5) declares these “broad shoulders” and empowerment. As he has just made clear in his journal entry, standing with broad shoulders connects him with the memory of his grandmother, a good memory among other tragic memories. Today, broad shoulders make him feel empowered. He included the broad shoulders in his drawing, which he chooses to submit in class and to share for the research. These broad shoulders and empowerment matter to him. He will build, and self-organize around this memory with his embodied learning.

Figure 5. Robert’s Drawing of His Own Skeleton

The classic first independent achievement: potty training. What is a more significant indicator that a child has achieved mastery of their body than the ability to use the toilet? This skill was meaningful for ALL of us at one point, not just the athletes among us, or the boys, or
the girls. We all had to make this leap to be ‘allowed’ to explore in settings beyond our home and family. The next body memory story is about pursuit of mastery not yet achieved. John never submitted his body story as part of the journal. He is very physically active, exercises a lot, enjoyed a chaotic work environment in the ER, and in the early weeks of the course his journal entries were peppered with “This is weird” and “What the heck!??” But during his interview, he talked in detail about the first body memory he had retrieved when assigned to write the story. He said the memory surprised him, because it was a new memory. It falls into this category of owning, knowing and mastering one’s body. He wrote:

I thought that this was another weird way of doing things but it brought back memories that I thought weren’t really memories, but, apparently they were. You were supposed to talk about your pre-birth, your life in the womb. I'm not imaginative enough to remember anything like that. I don't think I can go back that far. I did try, and I didn't get back that far. Then it said to get to your earliest memory. This I remember very well. My earliest memory (He laughed a little and looked surprised) ... I sat there in a position of rest [while he did this exercise and retrieved his memories]. I remember being at a park, and it had a red pavilion annnnnnd ... it had a river that went by it. And ... I remember having soiled my drawers! I don't know why I remember this. I do not know. I remember running. It was an outhouse. I was trying to run to the outhouse and I ... didn't make it. And I REMEMBER this. So I actually thought well maybe this is all made up. This has been a weird class and maybe this is just one of those weirdisms. So I called my Mother, and I said "So I have to ask a question." I said "Did we ever go to a park that had a red pavilion? I would have been very young, obviously potty training or something." I just said that I recalled a memory like that, and to validate, you know, the river I had seen, and this whole thing was brown .... And she said "Well the water was really brown that day." So it WAS there.

From the whole body stories, the one you wrote about yourself, that was the most fascinating part for me.

This body memory is physical, its about the action of running, its about learning to control the body, and the memory itself is immersed in sensory / visual memories of context.

We don’t know why John did not write the story in his journal but was enthusiastic to tell about it in the interview. Perhaps, as he stated, he wasn’t sure at the time that it was a real memory.
A point to highlight here is the importance of flexibility in inviting participation and always allowing the option of not participating or sharing only what the student wishes to write or tell. These assignments cannot be graded with an outcomes standard-based rubric. John wanted to emphasize to me the catalyzing nature of this retrieved memory, and the connection he made with his mother around his past. Much of his journal and later his reports in the interview described the ways in which he shared this embodied learning with his daughters throughout the course and the positive effect it had on his relationship with them.

*Unique style: using dreams to learn a physical skill.* As we learn as young children to master and control the actions of our body, do we only use physical action, or is our body and embodied cognition involved in other ways? One participant describes learning a new physical action skill by watching her brother and then rehearsing the skill in her dreams. It is so interesting to note that in other entries from this participant throughout this report we see that she has also used this technique to study for exams and now to learn as a new nurse in the clinical environment on the job. The final story in this thematic category of mastering the body came from Gabriella. The story started with her birth, as told to her many times by her mother. Her body memory story went on to make an intriguing connection with learning. A brand new nurse when she wrote this, Gabriella was in her six months of preceptorship in critical care after making a mid-life career change from engineering. Her story is full of enthusiasm to conquer challenges. Her ‘learning’ is grounded in family relationships. Gabriella wrote:

> Often I try to revisit my earliest memories, and occasionally talk about earliest memories with my brothers. At some level I must feel that there is some type of comfort or “grounding” that I derive from doing so. I do not have any birth memories (maybe this was because back then (1964), they heavily sedated the mother giving birth and “extracted” the baby with forceps! My mom said that she was “not awake” for my oldest brother or me, but demanded to be awake for the birth of my baby brother (times were changing, she said).
One early movement memory I have is when I learned to swing. I was four years old and I remember having a dream about swinging – I could see my legs swing out against a blue sky. The next day I told my brother “I know how to swing”. He didn’t believe me because just yesterday he had to push me. I begged him to lift me onto the swing and I would show him! So, he lifted me onto the swing – and away I went. I guess I was so fascinated about learning to swing in my sleep, I did my grade school science fair project on “sleep learning”.

I was always active, and have many early memories of climbing trees, riding bikes, running, swimming and playing. I always liked my body and my abilities. When I think back to my body, the image of my skeleton I see is tall, strong, flexible and proud. Very different from my skeleton picture today! I want to recapture that movement ability and re-fuse my mind/body. I am glad that I am taking this class to help me recapture the ability to listen to my body’s intelligence.

Gabriella has made a written distinction between her mental image of her youthful skeleton as tall, strong, flexible and proud telling us that her skeleton picture today, which she drew in connection with this body memory story (Figure 6, p. 217) is NOT these things. She writes that her current skeleton is more restricted, less able to move, and her body feels disconnected from her mind. Notice in Gabriella’a skeleton drawing that she has hunched shoulders, something she wrote about frequently in her journal commenting about all the time we now spend hunched over our computers and musing about the subsequent evolution our skeletons might be undergoing owing to this age of technology. She indicated that her drawing also uses lines to denote tightness and pain at her neck, lower back and pelvis. It is interesting that in later journal entries, in this class and the one that followed, she wrote that her growing body awareness led her try cranio-sacral therapy which resolved the neck pain (indicated in her skeleton drawing by lines) and headaches that had plagued her the past four years. She also indentified during the interview that she especially enjoyed the exercises attending to the pelvis, the other spot she marked on her skeleton drawing with lines indicating lost mobility.
When Gabriella thought back to these activities in the interview, she struggled several minutes to remember what she had written. I suggested moving on and returning if something
came to her but she was persistent. By closing her eyes and ‘talking with her hands’ she began to retrieve childhood memories through her body. She went right back to the story about pride at learning to swing in her sleep, and sharing this with her brother. This time, the memory opened a floodgate. She had begun to link this early example of lucid dreaming with a style of learning that she had made her own and found very useful in her work as an engineer. Now she had also begun to tie this with the way she learned to communicate from her Italian father, using lots of big gestures and emotion. Her body memory stories in the interview were full of her father and sensory imagery, and she used movement, sensation, emotion, and that relationship as multiple points of connection. This allowed her to reach back into a seemingly endless trough of memory, through her body, in a very dynamic way. I interpret this as her coming to embrace her body’s way of being in the world.

*Taking In and Exploring the Environment*

Another frequently mentioned theme was connectedness with their environment through exploration. This combined a sensory awareness of context with the physical actions that accompany poking around in it. While the previous theme, body mastery, dealt with body structure and gross motor activity, this theme abounds with sensory images as the body moves through spaces. One could be tempted to try to relate these themes to one or another scheme of developmental tasks, but I believe that would be an error. Merleau-Ponty (1945), the primary philosopher of the body, wrote of the body having a ‘style’, a way of being in the world that is unique for each of us. Neuroscience would confirm this uniqueness of substrate, evolved through interactive experience with the environment (Thelen & Smith, 1994), but the concept of ‘style’ incorporates the aspect of experience as well. It is the experiences that these participants were remembering in their stories, because that is where their connection with their own bodies
lay. Their characteristic ways of being in the world were evidenced in these memories, in their selection of favorite experiences and in what they learned and carried with them. As with body mastery there was a great deal of individual diversity within this category. Unique body styles of exploring one’s world covers a broad spectrum of action and more passive observing, so it is important that the reader not impose a particular notion of what it means to explore.

*Sensory and imaginal fragments that have no beginning, middle and end.* Since body memories arise are memories of pre-conscious experience they are not packed away in connection with a string of words. Body experience is grounded in interoception (Cameron, 2001; Sherrington, 1951) which is the vast array of experiencing linked with the receptive (afferent) aspect of our nervous system. Because they are primarily pre-conscious, these experiences often come to awareness as fragments linked to sensation. They may be visual image fragments (one moment in a story, not a fragmented particulate image) or a time linked with a smell or a sound. When we try to put words to these fragments, we become more cognizant that, although they seem to be linked to the story of our life which lies somewhere in our ‘mind’, this story, when viewed through sensory fragments, has no beginning, middle or end. This is non-linear experiencing

For Fred, who made a recent career change from pastry chef and now enjoys working with wounds on a general surgery ward, the connections made in this body memory exercise were sensory. While all nursing uses sensory skills, in surgery they are often diagnostic tools. We can imagine that his more sensory body style was useful in his career as a chef. Fred’s description of his body memories show that his ‘exploring’ of his environment, his way of noticing it and taking it in, was very grounded in his senses. Sensory aspects of past experience were what lead him back into his body memories. His story presents these sensory impressions
not in isolation but embedded within a context of geographic place and connections to family.

Even his description of being challenged by weight is connected with visual image. His references to body image are included to show the interconnection between these four categories.

But his story was primarily about the sensory. In his journal, Fred wrote:

_The earliest recollections I have of the senses took place when I was two and a half._ I recall riding in the car to the hospital to pick up my mother and brother after he was born. _I remember how bright the sunlight was_ coming into the car and the fascination that my other brother and I had with the new baby. During this time we lived in a new development in Southern California, so there were few trees. _It always felt like we were in the desert with the mountains around us._ I recall the smell of mint that grew by our garage door. _After it rained, the smell would fill the yard._

As I mentioned in the first assignment _I had issues with weight_ probably since grade school. It was a challenge at times because one of my brothers had the opposite problem. My parents would buy skim milk for me and extra rich milk for him. I remember writing an assignment in second grade to describe what animal we would like to be and why. _I wrote that I would like to be a cheetah because of their speed and agility. I was never athletic._ Although I was never seriously pressured to lose weight, _the comments that were made to me about it still influence how I feel about myself now._

When I interviewed Fred he looked back and remembered the experience of retrieving his body memories as very challenging. Like Rachel, he didn’t remember what he had written for class, but his early body memory story given orally was highly elaborated now in comparison to what he had written earlier. Interestingly, _the connection with his own memories came again through his body, by re-experiencing a sensory awareness._ This is his body style and therefore the way that he accessed his memories which were again about taking in / exploring his world through sensory impressions. Most outstanding was his frustration with the process of trying to put words to these memory impressions. He described this during his interview:

_For some reason I don't remember [what I wrote]. Maybe when my brother was born. I did write that. _I do remember part of it because I remember the mint. I remember the house that we lived in. Like I was 3._ And I can almost
smell the mint that grew by my backyard. My back door. *And probably the first experiences with girls, because I had two brothers. So it just reminded me of that. I hadn't thought about it in a long time. I didn't even write about the girls.*

I can remember the day in my Dad's station wagon when we went to pick up my brother. I can even remember my Mom working as a waitress, and us picking her up from work and she had the big beehive hairdo. I'll have to ask her about that, because I don't remember that either. I just remember it was this huge glass building ... very bright. We picked her up. And probably not at the same time. It's just another memory. I think they're blended together at this point. I have a bunch of memories. I'm sure they're not all at the same time. Because we wouldn't have been picking my mother up when my brother was born, from her job at the diner. But it's just real brief things that I remember. Little snapshots.

[Putting it into words] That was hard, to make it clear. Which is why I think, when I look through it now, I probably left some stuff out. I thought *"How do I connect these? Because it doesn't make sense."* It was hard to write down what my memories were unless I just sort of listed them. *So it wasn't one whole event.* It was a piece from here and a piece from there that aren't related, they're just old memories, you know. And trying to make that .... logical connection .... I couldn't do it when I was writing it down.

It's a story. It should have a beginning, a middle and an end. *That took some getting used to in writing this. That it didn't have to be like that. That it could just be incomplete thoughts. And that's not like me.*

This sense of fragmented body memory will show up again in another category with a few other participants. Trudy, Eugene, and Maria noted having this sense of memory fragments. Some were bothered, others embraced the fragments as possibilities for imagination. Possibly the sensory nature of Fred’s memories, packed away without using language to try to explain them, made the retrieval seem more fragmented. It was likely his rational mind telling him what ‘should be’ that was getting in the way. The fact that this experience cuts across categories shows that is not related to the primary type of body memory. It is not a characteristic of early body memories connected with exploring the world. It is perhaps more an expression of
individual body styles in taking in and storing the sensory impressions that become our body memories. We will probably need neuroscience to find an answer to that question.

Joy, visual imagery and memories of moving in the natural environment. In the last story Fred’s sensory body memories were connected with a more passive kind of exploring his world by way of noticing and taking in. Mary Beth provided another collection of exploratory sensory memories but hers are embedded in a more active context of noticing her world while moving through it. While Fred noticed sounds, smell, visual images, and general feel of his world, particularly the natural environment, Mary Beth writes about memories in which this noticing is connected with moving in and through the environment, overcoming obstacles, and she included references to other living creatures. There are also much positive emotional expression. There is physical mastery in this story, but it is not about mastering her body as much as it is about mastering new skills that are connected with her exploring. Finally there is body image and some negative emotion. This is a detailed and complex memory full of many interconnections, but it is primarily about joy in the experience of successful exploration.

Mary Beth was one of the most experienced RN’s in the group, with twenty-three years of working in many different areas of the hospital. Now she enjoys the challenges of same day surgery and procedures and is developing her skills in touch therapy. She wrote an extensive body story that ranged over multiple points of connection within her suburban PA childhood. Mary Beth wrote:

We lived beside a church and cemetery that was safe to walk through. I loved walking there. There was a stone wall that I loved to walk on and climb over. It was a stone wall with a flat cement top. This memory was prior to age 5 at my first home. I remember also steer/cows? (all black) BIG COWS being fenced in on the other side of the yard. I remember outside, big white clouds, sun, and the smell of those black cows! I remember walking back there near the cow fence to a corner store for bread for my Mom and running the whole way back with a dog chasing me! I remember learning to ride my
blue bike! Training wheels and all! My Dad holding on but as gradually the hill sloped down I had to let go. I rode the whole street and tipped over in grass at a bend in the road. I loved my bike! I had a rope swing and a platform in a tree. I still LOVE trees and being outside. It’s tough to think about body image. I’m not biologically related so I’m always aware of being “different” and not looking like my parents or siblings. But I guess the toughness is like some shame or something strange … embarrassment like.

Her body way of being in the world was characterized by the strength of her emotions connected with body memories and an inner sense of unique interior awareness that arose when she was a teen. This sense lends her a somewhat intuitive understanding of alternative healing forms such as touch. Her skeleton drawing (Figure 7) has loose and indefinite connections, conveys movement and emotions, and looks particularly alive.

*Figure 7. Mary Beth’s Drawing of Her Own Skeleton*
Although her body memory was also quite sensory, Mary Beth did not report the same sense of fragmentation that Fred did. Mary Beth is different from Fred in the way she takes in and explores the world. Her body memory suggests that although she relies heavily on her senses, just like Fred, she uses a lot more movement and she also has developed an interior awareness (which exists on the interoception spectrum with other sensory impression). This interior awareness has become a part of how she explores and makes sense of the world as an adult.

**Body Image and Health Concerns**

The two previous categories of body memory stories reveled in the body’s capabilities. But some participants had memories that were more tentative, less confident, more observing and watchful, even of one’s own body. These stories emphasized body image as their own perception of their bodies and memories of how they at least believed other people viewed their bodies. This more exterior way of remembering their own body was also connected with memories of thoughts of a challenge to their health. This might have been in the form of illness or remembering themselves as not particularly vigorous.

*Rational, clinical remembering evolves to the emotional.* In this body memory story Angela is distant and counting off her physical strengths and disabilities in relation to family medical history. It’s told almost from an outside position and without connection to emotions, as if she is a nurse giving change of shift report. In the context of her father’s increasing dementia, she expresses concern about her own lack of memories which she believes is just characteristic of her. Months later, she has many body memories and emotion connected with a single element of her written body story, and this time the story is told very differently. Something has changed. Angela writes:
My personal bodystory. Well, in true ‘Angela’ fashion, I will go right down the list. **I was born via Cesarean section** because I was 10 days late, and **my mother was, needless to say, very uncomfortable.** She was also a **high-risk pregnancy,** because by the time I came along, she was thirty-seven and a G4P0 [Note: 4 pregnancies, 0 viable births]. I was, for lack of a better word, **my parents’ ‘miracle baby.’** After that, they decided not to tempt fate, and thus I am an **only child.**

**My earliest movement memory is being at the beach and trying to make snow angels in the sand.** I am unlike most people in that I really don’t have any memories of my childhood before about the age of five. Most people can remember things from their toddler days, but I really have **no clear recollections** of anything before my 5th birthday.

I was **never a very athletic child, but was rather clumsy** (I am sure that has an implication somewhere in this text). I found my **grace through music,** and started **playing the piano** at about age 6, and **flute** at about 8, and **those skills have followed me throughout my life** thus far. The only sport activity that I **absolutely loved as a child was jumping rope.** I just never felt like myself playing sports, mostly because I was clumsy.

I don’t really remember anything specific about comments related to my **body image as I was growing up.** I was overweight, but I knew it, and I did try to **stay physically active** (i.e. marching band, musicals which involved dance choreography, walking the dog daily). I was **never really teased about my weight,** although I **never really considered myself one of the ‘pretty girls.’** In regards to sensuality and gender images, I was raised not to judge people for their sexual orientation, and in fact, I have a few friends who are gay.

In the **injury** department, I have been extraordinarily lucky. I split my chin open when I was very young at DayCare, and had **my wisdom teeth removed** when I was sixteen. In the last few years, I have **developed hypothyroidism (which my mother has as well), and Vasovagal syncope,** which I am told I will simply grow out of after my twenties. But I have been **extremely lucky in regards to my health. I am not sick very often. I think I got my Dad’s immune system** (if it’s hereditary).

This story is controlled, very detailed, and essentially devoid of emotions. Months later when Angela was interviewed there was lots of emotion present. Her memory of the early body story focused completely on the beach memory (from above), but this time she was not talking about making angels in the sand. In fact, she chose this memory as an example of learning through fear. The memory had evolved to one of concerns about dying and she elaborated on her body’s interior experience, illustrating in advance how this probably arose out of changing
conditions in her life. Now, there is much emotion being expressed and she notices that she has been creating coherence making connections between past and present. Integration has been occurring. The retrieved early body memory story is not longer about body image and health problems. It has become a story about exploring the environment and learning how to notice it, as learned through fear. And she is remembering! Angela wrote:

The writing about body memories was very surprisingly emotional for me. Like I said before it’s easier for me to express myself and the way I'm feeling through writing because sometimes there are just things that you can write but you feel uncomfortable saying them. I write poetry a lot to do that. It was surprisingly emotional because as I thought back to my childhood I would link it to things in the present. What once was a happy memory now isn't. One would be my father playing the piano which he can't do anymore since he has dementia. So it was a very big Catch 22 for me to do that. But again, an interesting experience. You never know what's going to jog your memory when you're writing things like that.

I was at the beach when I was probably 7 or 8 years old. I was in the ocean with my Dad and we were just riding the waves and I looked away. I was looking towards the beach to find our umbrella or something and a wave hit, and I saw it and we were fine. I never turned back around after that wave and there was a second bigger one right behind it that knocked me under. If my Dad had not been right there I probably would have drowned. So that instance taught me. First of all that was terrifying for me. That was probably one of the scariest moments I've ever had in my life. What it TAUGHT me is that you really can never take your eyes off of what's going on around you. Not just in front of you. You have to look. You have to look with peripheral vision and you kind of have to have eyes in the back of your head because you just never know what is going to come up and take you under. That taught me to be more aware of my surroundings.

I think everybody has that one instance that slaps them in the face. Everybody has that moment where you realize "I need to pay more attention to where I am!" I think everybody's first instance of that would be your first real awareness of self, and how you visualize the world and how you have to organize yourself so you're aware of it, so that doesn't happen to you again. Once that experience happens, obviously you'll do everything to avoid it again. Nobody realizes that they're doing it.

I had tremendous trouble breathing after that. It probably would have been like a panic attack. First of all because I had swallowed so much water that I couldn't really breathe correctly. Second, I felt like my head
was swimming? Which it kind of was because it was under water. Once I came out I felt very foggy and the disorientation just took me a good few minutes to realize, "OK that happened ... I'm OK ... and now I need to move on." In the minutes after that the whole thing was in slow motion when it was happening. I remember being underneath that water and gulping the sea water. I can remember that and I can remember my Dad grabbing my arm and pulling me up. I REMEMBER that. And then after, I just remember my head was so foggy, and I [thought], "We're done with the beach today." (She laughed very hard.) "There will be no more beach." Just because it frightened me too bad. I couldn't even wrap my head around what had just happened. It felt like a fog.

Angela made a very insightful comment, which captured what seemed to be true for all participants:

If I wrote that story again it would probably be completely different. It just depends on what jogged my memory that day. For some reason that day ... the beach was what I remembered. Another memory was my family around the piano because that was just something that was always part of my past. I expected it to be there. But today it might not be that. It might be something totally different. It might be my first sled ride because it’s winter. You never know.

So of course I must wonder if this memory of fear learning at the beach was actually stimulated by the body memories assignment. Is that what Angela remembered but did not share in the journal? Was it only her comfort level that changed over time, allowing her to share her experiences more fully during the interview? Or did her awareness actually change? As her sense of embodiment increased, did she become more connected with the experience of her own memories? Her insight definitely highlights the dynamic role of the body in making connections. It seems to have the ability to catalyze memory and to integrate, making connections across time and circumstances, so that the spacio-temporal dimensions are honored without becoming static. In this way memories can serve a variety of purposes, according to need and current circumstance. Emotion comes along as a part of retrievable memory. While
Angela’s written body memory story at the start of the first class was centered on body image and health concerns, over 11 months, looking back in the interview to what she remembered writing, the oral story latched on to just one element of the written story and told it in a very different way, now creating a story that fell into a different category. Story evolution. Story aliveness (Tyler, 2007).

*Common childhood illness and injury linger in body image.* Another way in which on story focused on body image was in connection with childhood illness and injury so that those events still affect a person’s view and explanation of their body today. Kathy’s written body memory story presented conflicting views of her body image and physical competence. She still lives in the rural PA small town she grew up in and has been dealing with a sense of loss as she and her husband assist his aging parents in making changes in their lives. Kathy remembered a unique one-time event with fear that provided a lasting memory that was not logically supportable. In describing her childhood exploring activity she describes herself in playful and vigorous terms and also as clumsy. Her skeleton drawing (Figure 8) is also a mix of sturdy and clumsy. It has a solid core and skull, strong hands and feet but the arms and legs are uneven,

*Figure 8. Kathy’s Drawing of Her Own Skeleton*
In her body stories journal, Kathy wrote:

**My strongest movement memory as a child was trying very hard not to fall off my bike or spill something on the floor or break something.** Somehow I was noted to be the clumsy one, and I was nervous about my body doing something clumsy, which it often did.

I was one of 6 children. One of my mother’s favorite sayings was “go outside and play.” We lived near the river and **we had a favorite spot to go swimming** named Charlie Rock. We **learned to swim and dive off the rock** from one another. They were **fun times**.

I can remember as a child **coming down with the measles**. My mother put me in my bedroom with the blinds down. It was dark. She told me **the light would hurt my eyes**. I accidentally pulled on the blind and it flew up letting all the light from the window in the room. **I was frightened at the time, and thought I would go blind. I am the only one in my family that wears glasses**. To this day I feel that is the reason, although it is not the reason.

This is one of the few body memory journal entries that incorporated fear. As already noted, negative emotion was more likely to come up in the later retelling during the interview, as stories became more elaborated. In her interview, Kathy went right back to the experience of writing and remembering, noting the sensory experiencing that accompanied memory retrieval when she wrote in her journal. The writing of body memory stories had become a new body memory. She stated:

**It brought back my memories. It made me feel and think about what happened. I could see the bedroom** when I was a child, and being put in that room and **having the flashbacks of that blind flying up in the air, and knowing that my mother told me not to do that. I was frightened when she came up, and was afraid that I would go blind. So it brought back a lot of memories, and some feelings. Same way with the being clumsy. I'm still clumsy to this day.** I remember that every time I went by the Justice of Peace, I would fall off my bike. Every time! **It just FELT like I was there at the time, when I was writing these stories.**

**It wasn't hard for me to do. Those were my memories.** My EARLIEST memories. This was something new for me. **It kind of relieved me sometimes, thinking back.** I remember showing it to my husband and he didn't know that I felt like that when I was younger. He was interested in those stories too. I thought it was different, that you wanted us to do something like that. But I thought it was cool, bringing back memories.
The two stories from this thematic category, body image and health concerns, as well as the next and last story in this category all illustrate the importance of interpersonal connection in the present as part of integrating around these memories that contain fear, and the usefulness of returning to the memories through discussion in the interview as a way of continuing to make new meaning by forming new connections. Angela talked about connections with friends. Kathy had shared her stories with her husband. In the next story Marie connects by sharing stories with her husband and children. All three mentioned feelings of relief in connection with written story and interview. At the later point in time, during the interview, the patterns are starbursts in comparison to the often much more linear accounts in the original writings.

*Childhood traumas transformed into stories that can be shared with children.*

Sometimes early body memories are unhappy in their connection with poor body image, being humiliated or being injured. But the stories can be transformed in ways that allows them to live, uncovered, but in a form that can be told to a child. In that way, someone with some unhappiness in their childhood can tell honest stories of these events to their children without imparting the fear or other negative emotion that originally accompanied them.

Marie, who grew up in Philadelphia, told a story filled with explorations, presumably as she was achieving body mastery, but the emphasis in her story was on the injuries suffered and a sense of learning to be more careful. So the focus was really on her body and its health and safety. She still carries concern about her weight. Her journal account was somewhat surprising to read because it was different from most other accounts. The difference lay in the strength of painful emotion and the relatively graphic accounts of injury. These were interspersed with elements of fun, but the exercise had clearly tapped into a difficult past. Marie lost this part of her journal, but recounted the same stories in the interview. That is the source of the excerpts
shared here. When Marie told this story in the interview, she did so noting the realization that these first memories are still with us. As a married mother of three, she made a recent career change from business to nursing and dedicated herself to work in a pediatric ICU.

I was always called the big jumbutz and that’s not a very complementary thing. But I was always the biggest, heaviest kid. So I’m always really conscious about my weight. I’m kind of fixated on that kind of stuff. Your earliest body memories … you may have scars from them. You may have aches and pains from them. There was a shovel accident when I was a child and a scar that I still have. And when I broke my finger, my Mom smacked my bottom and the way my hands were she broke my finger because I was dancing on a piece of furniture. I still remember how it felt and how much fun it was, up there dancing. I remember doing that and thinking, “This is so much fun!”

Eleven months after first writing her body memory story, Marie was able to say that writing these stories had been a relief.

I found it to be very much like a weight lifted. To actually put it on paper, it’s almost like I don’t have to worry about who knows what, who doesn’t know what. And it’s not like there’s anything bad in that story. It’s a facet of who I am that I don’t have to carry around and keep in mind, and it’s out there. And doing things with my kids, I share this that they know about it too now, because of having gone through this. They want to hear those stories about when you were little and growing up. Now they have more stories that they can learn from. They get a kick out of that too. I liked the experience. I really found it fulfilled a part of me I guess I needed to fulfill too, in just writing again.

By engaging in this exercise Marie integrated, achieving some coherence across time and circumstances, so that she could bring old body memories into the present and use them in new ways, making new connections through positive emotions with her children. This exercise opened the way for her to engage her body and emotions in the many follow-on exercises, leading to heightened body awareness in the moment that she used in her own new crisis situation. In Appendix J (p. 377) Marie’s story continues as an illustration of principles of trauma theory and a wonderful example of evolving body awareness put to good use.
Concerns with Safety and Vulnerability

In this category, the early body memory story was brief and the primary content, regardless of details (and there were few) was being vulnerable in a situation and worried about their own safety. Only two early body memory stories fell into this category. Both participants had written a very brief body memory. Both of these were not included with the course materials they chose to share for this study. One of the stories was mentioned only tangentially in the interview and the participant did not want it to be shared. The second story, shared in the interview, is given here. Retrieving these memories at the start of the course did not prevent either participant from engaging fully in the rest of the “Body Stories” experiences. In the example presented here, the interview account was of the first and primary body memory, in fact the only one described by this participant. In other words, despite beginning with a list of several prompts for early body memory stories, only one event was described. This memory apparently doesn’t connect with others because it is the only one being retrieved.

Monica had a durable memory of running while being chased by a dog. She did not tell of the event as a consequence of exploration and she didn’t relate deriving a sense of mastery from eluding the dog. She reports no sensory imagery. She remembers fear and running. Today she pays strict attention to her health and works out regularly. She reported that the most notable “Body Stories” exercises for her were the ones that dealt with the legs, and she has incorporated some of that learning into her workout routine. She stated:

The first thing I remember as a child was this dog chasing me. I was probably 3 or 4 years old and I remember I was outside playing. There was this little dog. I was afraid of dogs at the time and it was chasing me. That’s my earliest memory as a child. Now I’m not afraid of little dogs anymore, but I’m still afraid of big dogs. If they’re jumping on me I get away from them. If the owner wasn’t with them I would run. I still remember exactly where I was, and where I ran to. I don’t remember what color or what kind of dog it was,
but it was my first memory and I always think about it, because it’s the first thing I can remember.

What can be made of this? Perhaps, when very early body memories are connected with fear and vulnerability they overpower other memories. Fear evolved to dominate in the face of threat (Rau & Fanselow, 2007). Perhaps there are other early body memories present but they would have to be accessed in a different way because the first memory was so connected with fear. That is a subject that would be worth studying in relation to embodied learning. In trying to compare this story with Angela and Kathy who also referenced fear, the differences were that Kathy’s fear was in reference to one particular instance. She told other memories as well, and her story did not change in content or detail between writing and telling in the interview. The only change was that she had shared the stories with her husband. With Angela’s story, her written body memory was detailed and addressed many types of memory although without emotion. The beach story was brief and told as a pleasant memory. It was only in the retelling that the fear and trauma aspects arose, and she gave an explanation. When she wrote the body memory she was actually distancing herself in the writing from very strong emotions about her father’s illness. For whatever reason, by the time of the interview she was remembering the story differently. This last category of body memory story, vulnerability and safety, is something else entirely.

So in summarizing, what is learned from the early body memories assignment, for each individual there were story aspects that were lasting and consistent, but the connections with other memories changed according to when the story was accessed and what was occurring contextually at that time. This would be a mark of differentiation among components within the individual, a marker of health in a complex adaptive system. Just enough consistency was maintained to allow the early body memory to be used and reconnected over time, in different
ways. In order to add another layer of understanding to these findings, note that upon completion of this portion of data analysis I returned to the literature to look for connections I had missed. I was surprised to find that the thematic categories assigned to group these stories correspond with cycle of action that Thelen & Smith (1994) identify as foundational to infant development and throughout life. In accord with Johnson’s (1987) embodied cognition view, our cognition arises from our body’s physical interactions with the world, beginning with our need to learn how to master and control our body, then our movement into the world to explore. As we explore, we also discover and meet challenges, a combination of experiences of containment and the need to control force to move our bodies through space. This continuing cycle of challenges and solutions to force interactions via the body is “woven into the fabric of all cognition” (Thelen & Smith, 1994, p. 326)

*Life Histories of Traumatic Experiencing*

One of the three research questions asks how learning is connected with trauma. Chapter 4 uncovered trauma learning in the nursing practice setting. This chapter will consider the connection between trauma and learning in the classroom. To do that, it is important to first establish whether trauma is present. The body memory stories included references to fear and trauma. Now a contrasting method of quantitative data collection provides a fuller picture of initial conditions. It is offered both for its connection to the biomedical understanding of traumatic stress related symptoms as well as a challenge to any who might still assume that the ‘average’ classroom does not find itself interacting with remnants of the histories of trauma.

As noted above, there were a number of quantitative tools that were used in the Health Assessment Class. This section reports findings from the Stressful Life Experiences Screening (SLES) tool (Stamm, 2005; Stamm, et al, 1996), which assesses whether a person has witnessed
or experienced 20 specific events, happening to themselves or to someone close to them. It also assesses stress at the time of the event, on a 1 – 10 scale, and current stress related to the event, on the same scale.

Degree or frequency of exposure to each event isn’t measured, but there is a 1 – 10 rating of ‘how much this is like my experience.’ The four events that were each experienced by 8 or more participants (50%) are noted in Table 5. The immediacy of their connection with some of these events is demonstrated by strong statistical correlations between claiming the experience and the rating of “how much it is like my own experience”.

Table 5:
Correlations Between Stressful Experiences and “How much this is like MY experience”

<table>
<thead>
<tr>
<th>Experience</th>
<th>rho</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Witnessed or experienced a life threatening illness</td>
<td>.746</td>
<td>.001</td>
</tr>
<tr>
<td>Handled dead bodies other than at a funeral</td>
<td>.725</td>
<td>.001</td>
</tr>
<tr>
<td>Witnessed or experienced the death of close friend or family</td>
<td>.716</td>
<td>.002</td>
</tr>
<tr>
<td>Witnessed or experienced a serious accident or injury</td>
<td>.568</td>
<td>.022</td>
</tr>
</tbody>
</table>

N = 16

All participants had handled dead bodies, as would be expected with a group of nurses; this was not an especially stressful experience for most of them but it was for a few. For a relatively young group there is high experiencing of serious illness and death in someone close to them. One wonders what effect this experience plays in their career choice.
<table>
<thead>
<tr>
<th>Event</th>
<th>f</th>
<th>(%)</th>
<th>Mean Score</th>
<th>Stress Then Mean Score</th>
<th>Stress Now Mean Score</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural disaster</td>
<td>4</td>
<td>(25%)</td>
<td>5.3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Man-made disaster</td>
<td>2</td>
<td>(12%)</td>
<td>7.5</td>
<td>1.5</td>
<td>1 – 2</td>
<td></td>
</tr>
<tr>
<td>Serious accident / injury</td>
<td>10</td>
<td>(63%)</td>
<td>6.7</td>
<td>4.3</td>
<td>0 – 5</td>
<td></td>
</tr>
<tr>
<td>Chemical/radiation exposure</td>
<td>1</td>
<td>(6%)</td>
<td>9</td>
<td>2</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Life threatening illness</td>
<td>14</td>
<td>(88%)</td>
<td>8.3</td>
<td>4.1</td>
<td>0 – 10</td>
<td></td>
</tr>
<tr>
<td>Death of close family or friend</td>
<td>14</td>
<td>(88%)</td>
<td>7.21</td>
<td>3</td>
<td>0 – 8</td>
<td></td>
</tr>
<tr>
<td>Kidnapping or hostage</td>
<td>1</td>
<td>(6%)</td>
<td>N/A</td>
<td>3</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Terrorist attack / torture</td>
<td>1</td>
<td>(6%)</td>
<td>5</td>
<td>0</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Lived in war affected area</td>
<td>2</td>
<td>(12%)</td>
<td>5</td>
<td>0.5</td>
<td>0 – 1</td>
<td></td>
</tr>
<tr>
<td>Handled dead bodies</td>
<td>16</td>
<td>(100%)</td>
<td>3.3</td>
<td>1.4</td>
<td>0 – 9</td>
<td></td>
</tr>
<tr>
<td>Felt responsible for death/injury</td>
<td>1</td>
<td>(6%)</td>
<td>10</td>
<td>6</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>As child / teen struck &amp; injured</td>
<td>7</td>
<td>(43%)</td>
<td>3.9</td>
<td>2.1</td>
<td>0 – 9</td>
<td></td>
</tr>
<tr>
<td>As adult, struck &amp; injured</td>
<td>4</td>
<td>(25%)</td>
<td>7</td>
<td>4</td>
<td>1 – 9</td>
<td></td>
</tr>
<tr>
<td>Witnessed person struck &amp; injured</td>
<td>9</td>
<td>(56%)</td>
<td>5.3</td>
<td>2.3</td>
<td>0 – 9</td>
<td></td>
</tr>
<tr>
<td>Child/teen forced, unwanted sex</td>
<td>2</td>
<td>(12%)</td>
<td>10</td>
<td>6</td>
<td>2 – 10</td>
<td></td>
</tr>
<tr>
<td>As adult forced, unwanted sex</td>
<td>2</td>
<td>(12%)</td>
<td>6</td>
<td>4</td>
<td>2 – 6</td>
<td></td>
</tr>
<tr>
<td>Spouse deployed to war zone</td>
<td>1</td>
<td>(6.2%)</td>
<td>10</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 16

0 = Not at all stressful  1 = Not very stressful  5 = Somewhat stressful  10 = Extremely stressful
The summarized results of SLES scores are collected in Table 6 (p. 236). The presence of potentially traumatic experience is quite remarkable. Range of experiencing was 3 – 10 different types of events per participant. The Mean variety of exposures was 6 types of event. Initial stress ratings for each type of event were fairly consistent. More interesting was the great diversity in current stress from the same type of stressful event. The data don’t provide for assessing immediacy of the stressful event.

By examining the ranges of current stressful experiencing, the individual uniqueness becomes apparent. Current stressful experiencing covers a broad range reflecting the continuing stress of past life events and current events. It is very clear which experiences are contributing to lasting and current stress and are therefore more likely to have a presence in the classroom for this group of participants. The lasting sources of stress are exposure to the various forms of interpersonal violence. The frequencies of exposure for this group are consistent with the Adverse Childhood Experiences study by Kaiser Permanente and the Centers for Disease Control (Felitti et al., 1998) which studied over 17,000 adults in the U.S. and found that 11% experienced emotional abuse as a child, 30.1% reported physical abuse, 19.9% reported sexual abuse, 12.5% witnessed their mothers being battered. Other epidemiologic studies in the U.S. which show that 17% to 33% of women in the general population report histories of sexual and / or physical abuse; 10% of women experience rape, 61% occurring before the age of 18 and usually by family members; 63% of assaults on men are by strangers while 62% of assaults on women are by persons they know (in van der Kolk, 2007). So the history of these experiences should probably be assumed to be well represented in any group of adult learners. What the data in this study shows is that people with histories of traumatic experiences including interpersonal
violence are typical middle class people who come to higher education classrooms to learn and these past events continue to cause stress in the present.

Careful analysis of Body Stories memories in the journals and interviews suggested a subgroup of participants who were experiencing greater current stress. Their commonality, within the qualitative data, was the absence of expressed emotion or negative valence of expressed emotion and absence or rigidity of references to interpersonal relationship connections to these early memories. Using these criteria to identify a subgroup of participants, that group was confirmed using data from the SLES and other tools presented later (Table 7).

Table 7. Current Experiencing of High-Stress Subgroup

<table>
<thead>
<tr>
<th>Experience</th>
<th>rho</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panic Attacks</td>
<td>.861</td>
<td>.000</td>
</tr>
<tr>
<td>Snapping at innocent people</td>
<td>.848</td>
<td>.000</td>
</tr>
<tr>
<td>Dissociative experiencing</td>
<td>.827</td>
<td>.000</td>
</tr>
<tr>
<td>Lose sleep of a patient’s trauma (intrusive experience)</td>
<td>.823</td>
<td>.000</td>
</tr>
<tr>
<td>Adrenal Burnout score</td>
<td>.749</td>
<td>.001</td>
</tr>
<tr>
<td>Avoid situations that remind of clinical experiences</td>
<td>.745</td>
<td>.001</td>
</tr>
<tr>
<td>More abstract learning style</td>
<td>.739</td>
<td>.009</td>
</tr>
<tr>
<td>Jump when startled (autonomic hyperarousal)</td>
<td>.719</td>
<td>.002</td>
</tr>
<tr>
<td>Feeling impatient</td>
<td>.710</td>
<td>.002</td>
</tr>
<tr>
<td>Feeling anxious</td>
<td>.702</td>
<td>.002</td>
</tr>
<tr>
<td>Intrusive thoughts from nursing</td>
<td>.674</td>
<td>.004</td>
</tr>
<tr>
<td>Stress felt now over past or current SLE</td>
<td>.656</td>
<td>.006</td>
</tr>
</tbody>
</table>

N = 6
Table 7 lists the moderate (.3 - .6) and strong (≥ .7) Spearman Rho correlations on factors which can describe the current experiencing of participants whose stories lacked emotional connection or were weighted toward negative emotion, and whose integration around early body memory showed some rigidity in terms of connecting with other people around these memories. The items on the list are primarily individual items from the SLES, the Adrenal Burnout Scale, and Professional Quality of Life instruments. Results of these tools are described in later sections and Chapter 5 where they more specifically relate to the qualitative data. The presentation is given here as it flowed from the analysis of story.

From an educator’s perspective, these students could be considered vulnerable because of their current levels of stressful experiencing. I perceived this from their journals and watched carefully to guarantee all students’ safety within the embodied learning experiences. This quantitative analysis allows for consideration within the paradigm of traumatic stress research, which was one of the purposes of this study. Chapter 6 examines fear and trauma in greater depth, when participants purposely engaged in exploring them through clinical stories. But the groundwork is laid here, again to provide a thorough picture of the intrinsic dynamics, what was already at play in connection with embodiment as initial condition at the start of this period of learning.

By examining the ranges of current stressful experiencing (Table 6, p. 236 ), the individual uniqueness of experiencing becomes apparent. The range of current stressful experiencing reflects both the continuing stress of past life events and the stress of current events. It is also clear which experiences are contributing to lasting and current stress and are therefore more likely to have a presence in the classroom for this group of participants.
Neurobiological Expression of Stress in the Body

All stress is expressed neurobiologically in the body in both temporary and lasting ways, and long before the appearance of stress mediated illness, there are shifting neurobiologic patterns in the body. Behavior is both cause and expression of these changes (McEwen, 2000; Sapolsky, 2005c). From both a complexity perspective and in order to facilitate students learning throughout the health assessment course, students used some quantitative self-assessment tools to identify their individual patterns of stress expressed through the body. The results of some of these data are presented here.

Another way of understanding the presence of trauma is through the body’s expression of neurobiologic change in response to serious stresses. The measure of these stresses on the body is labeled allostatic load and it is calculated using direct physiologic measures Seeman, McEwen, Rowe & Singer, 2001). An indirect approach, and therefore one that can be used in class to teach about allostatic load, is The Adrenal Burnout Scale. It captures behaviors and symptoms below the level of diagnosable illness, therefore early in the natural history of chronic disease (Hanley, 2003). It distinguishes among lifestyles that are balanced and healthy, driven therefore contributing to stress disorder not yet manifest, and then three degrees of slow appearance of symptoms, first in primarily one category (Losing It), then more than one (Hitting the Wall), and finally a “Burned Out” category in which there are multiple types of symptoms and a person who does experience frequent stress related illness and perhaps has achieved diagnosable disease.

Another cause and marker of neurobiologic change from stress is sleep deprivation which can exist in the presence of sufficient hours of sleep. So sleep deprivation and hours of sleep were measured together during the health assessment class for two reasons. Nurses,
especially new nurses, often work swing shifts. Additionally, as van der Kolk et al (1996)
explain, with traumatic stress disorder, bodies develop hyperarousal. This is a complex mix of
biological and psychological processes which keep the body in a continued state of anticipation
of overwhelming threat. This is experienced as a narrow attention span and difficulties with
attention and concentration, which Perry (2006) has discussed in relation to learning difficulties
in adults. People with such hyperarousal also tend to have sleep problems. This somatic kind of
stress reaction is then easily triggered by outside stimuli and the person’s own physiology
becomes a source of fear (van der Kolk, et al, 1996). As noted previously, there is a high stress
subgroup of participants experiencing many of the signs just named. This group was also
identifiable by their high adrenal burnout scores. Graph 3 shows hours of sleep, the quality of
which we don’t know from this graph. Eight hours is usually recommended for adults (Bickley,
2009). So most of them aren’t getting the recommended amount of sleep but this is partly due to
shift work among the younger nurses.

**Graph 3.**
In looking for patterns of connection among these factors related to expressions of neurobiologic change resulting from stress, the average hours of sleep were correlated with each question on the adrenal burnout scale. Strong correlations are reported in Table 8.

Table 8. *Strong Correlations with Average Hours of Sleep*

<table>
<thead>
<tr>
<th>Adrenal Burnout Factors</th>
<th>p</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skip meals</td>
<td>-.812</td>
<td>.000</td>
</tr>
<tr>
<td>Work all night</td>
<td>-.755</td>
<td>.001</td>
</tr>
<tr>
<td>Feel attached to cell phone, pager, e-mail, etc.</td>
<td>-.736</td>
<td>.001</td>
</tr>
<tr>
<td>Love ‘butterflies’ in the stomach, the thrill of taking chances</td>
<td>-.715</td>
<td>.002</td>
</tr>
<tr>
<td>Lose weight and regain it</td>
<td>.708</td>
<td>.002</td>
</tr>
<tr>
<td>Age</td>
<td>.695</td>
<td>.003</td>
</tr>
</tbody>
</table>

*N = 16*

This table shows that older participants are the ones who tend to get more sleep and have trouble maintaining a consistent weight. Younger participants, who tend to work rotating shifts, are hard-driving risk takers who don’t eat or sleep on a regular schedule. So their lifestyle, partly driven by their work, is creating stress that is manifested now at the behavioral level.

Average hours of sleep is insufficient to understand the expression of stress since not all sleep is good sleep and sometimes a shorter amount of sleep can be very restful. The Sleep Deprivation Tool (Maas, 1998) bases its assessment on behaviors in the same way as the adrenal burnout tool. Some behaviors that contribute to the sleep deprivation label are needing an alarm
to get up, hitting the snooze button repeatedly, getting sleepy while driving, having trouble with critical thinking, feeling irritable. This tool labeled all participants as sleep deprived to some degree (Graph 4).

Graph 4.

On a measure of adrenal burnout, 9 participants were exhibiting symptoms that are expressions of physiologic manifestations of stress (Graph 5, p. 244). Scores in the two highest blocks tend to include manifestations of early illness as well. Scores correlated with sleep deprivation (rho = .600, p< .014) and with losing sleep over their patients’ trauma (rho = .676, p< .004). So participants manifesting behavioral signs of neurobiologic change related to stress were also sleeping poorly, partly due to their patient’s trauma. Here, the quantitative has suggested a pattern that was not uncovered with the qualitative data. Although statistics on such
a small group can only be suggestive, this pattern of connections appears to show a link between patient trauma and a different sort of body story in this group of nurses.

**Graph 5.**

For this particular group, the elevated adrenal burnout scores were associated with several factors, as measured by Spearman Rho > .700 with p < .02. These factors were dizziness and weakness spells and seeing starts after bending over; craving carbohydrates and salt; using over the counter meds; dark circles under the eyes; being driven by their calendars; regularly pushing past fatigue to achieve their goals; petering out around 3PM and needing caffeine to continue. When they had time off they just vegetated and noticed they would sometimes find themselves in a place and not quite remember how they got there. They frequently felt anxious. Finally, they highly endorsed “I am happy.”
In summary these data demonstrated patterns of self-organization occurring at a systems level closer to cell physiology. It can be construed as emergent story within the body, and this ‘story’ would be a focus of the ‘listening to body’ that one learns to do through experiences of embodiment. It may be that purposeful acting to alter this story requires some embodied experiencing that leads to greater connection with self, as seen in participants surprise to find they had all identified pain and hunger on their body maps … something that was predictable from their sleep and adrenal burnout scores, but seeing it on their body tracings made it more real. The culmination of new connections through embodiment is the focus of the next section.

The Process of Embodied Learning

Because the research questions asked how patterns of connections are formed under conditions using embodied learning, and patterns of connection are the result of a process (self-organization) it is necessary to look at the process of embodied learning in this group. They were learning about physical assessment with experiential anatomy complementing more traditional methods. Examining the process demonstrates how individuals developed their own unique ways of connecting with and through the embodied learning to whatever else they needed to learn.

All participants reported, both in their journals and during interviews, that they had to adjust their various expectations, assumptions, and /or attitudes toward ‘school’ in order to engage with this different type of learning. Most didn't think the Yoga trance dance (led by a Yoga instructor) or “Body Stories” would be useful learning but all chose to be open.

Contextual factors mattered. It took a few weeks before each one worked out their personal pattern of studying and working with the exercises, a way of being with the learning that suited their own body style. Doing exercises together in class and being led through them as a group
was preferred by most to working independently. Several were single and didn’t have someone they felt comfortable engaging with around the exercises. Some found that family members were disruptive in their assistance since they thought the exercises were silly. Anxieties about being watched were present both in and outside of class. The shared yoga trance dance, led by a certified yoga instructor on the first night of class was noted by almost everyone as instrumental in overcoming this concern in relation to their classmates. Most participants described in journals and interviews that learning from the embodiment activities was easier in the health assessment course than in the complex problems course because the connection with content was more straight-forward and evident. Just as was true with the body memory stories, new connections were made through reflection and discussion in the course of the interviews.

This section considers two sets of qualitative data that reveal the processes of self-organization over the course of embodied learning. The first set includes body stories learning journal and interview references to finding a personal style for this type of learning. The presence of integration, and fear or trauma in these stories is noted. The second set identifies the exercises noted during the interview as particularly valuable for learning, looks for a pattern within the group, and then examines journal entries for these exercises, noting whether integration was apparent in the original entries and whether fear or trauma were present. Finally, there is also a set of findings based in the quantitative data that notes the neurological expression of stress in the body that was part of students’ process of learning.

*New Kind of Learning: Reactions to Far-From Equilibrium Condition*

From a complexity science perspective, the introduction of embodied learning introduced a surprise, some extra energy, turned up the heat, generated chaos. The participants, as dynamic systems, found themselves far-from equilibrium, or far outside their usual sense of order in
relation to ‘school’, which is the space where new organization can occur. A great deal of individuality is apparent in the ways they approached this new condition, and this diversity is an example of differentiation within the dynamic system of the whole class, a source of instability that preserved ‘life’ in the system. The experience may have seemed disruptive, but the situation was certainly not stagnant.

Analysis of the journals from the first few weeks showed that individual elements necessary for integration were present, perhaps some emotion or perhaps a mention of interpersonal relationship, maybe even a new question was raised or a particular awareness of self arose, although this was not common. But integration, presence of all three was not happening. This early period was about differentiation, and as was just noted, at the level of the whole class, this engendered new life. The following excerpts are taken from the interviews, so they are a looking back to explain how they came to their own style of engaging with embodied learning, and broadly focus on the following intersecting themes: dealing with being watched; trying to overcome the controlled or overly prescribed body; tension between differentiation and integration, and uniquely integrating the past for current learning.

Most people don’t want to feel foolish and doing something they can’t do well makes them feel foolish, especially when other people are watching. Activities that involve movement, a little dance, putting your body into strange positions and adding imagery would be high on most peoples’ list of ‘stuff not to do in public’.

Being Watched and Being Watchful

Given that many of the exercises were not what is typically expected in higher education classes, many of the participants reported worrying about being watched. The language they used was about having someone else see them. Fred had concerns about being watched, but
ultimately he felt less guarded then when he was writing about his body. The trance dance helped him quickly manage his worries about other people seeing him. Fred said:

It is a certain amount of caution, and I don't know why, because I can control what I write. But there's a certain amount of safeguarding you’re writing about your body, your own personal memories or feelings and everything, and you just put up a little bit of a guard. I think that's why I really enjoyed the group. Especially even the trance dance when you're all there and doing the same thing, but everyone's supposed to have their eyes closed. And if you TRUST that, you can let yourself go. Everyone's doing the same thing so no one's seeing you and you're not exposing anything.

Fred reported that after that night he decided he needed to lose weight. He mentions body image frequently in his journals and the interview, noting that while he participated in these courses he also started a weight loss program and successfully lost several pounds. His story reminds us of the vulnerability most of us feel when engaging bodily in public settings.

Equally concerned about being watched, and perhaps more skeptical in general, Angela was still willing to give the trance dance a try. She found the trance dance surprisingly useful and overcame her concern about being watched. Angela stated:

I liked yoga trance dance and I was surprised that I did. It's very not me. If I saw yoga trance dance at the gym I would be like PPPPFTFFFTT! NO. However, your whole point about opening ourselves to new experiences ... I was really trying to be very open to that. I was surprised at how much of the sensory experience you get just by doing a trance dance. It was amazing to me, because forget that other people are there. I didn't expect that. I thought, "Oh my gosh! We're gonna be here for 45 minutes. What if everyone's looking at me?” But about 5 minutes into it you're like somewhere else. I think it’s a part of sensory experience that most people never think about. I certainly wouldn't have tried that if it wasn't a requirement for class. But I'm glad that I had the experience.

Angela was also quite pragmatic, being the only one who realized that she needed a partner to read the exercises to her and she didn’t have one, so she recorded the exercises and
listened to them with a background of her favorite relaxing tunes. It was somewhat surprising that only one participant went the recording route.

Feeling foolish in front of other people was not the concern for Cadence. Her initial response represents the extreme for this group of participants. No one else described an experience like this. Rather than concern about being watched, her impulse was in the other direction of being very watchful. Cadence experienced the trance dance as somewhat threatening, stating in the interview that in retrospect she thought she envied the ability to just relax and enjoy the experience without worrying about being in control. The initial period embodied learning was infused with emotions related to control. She shared during the interview that she had experiences of abuse in her early life, so the concern with staying in control and always being watchful, on the lookout for possible threats, is consistent with that experience (van der Kolk, 2007). Cadence stated:

I kind of put it to an automatic mode. I knew I had to get it done one way or another. So I just beared down and did it, regardless of how I felt. I was aware of it, I didn't shut my feelings off. They weren't the top priority. The top priority was accomplishing my goal which was finishing the thing that I had to do. (She giggled nervously.)

I felt comfortable when we did the exercises in class with you, because there were other people who had to do the same thing. I didn't feel comfortable when it was somebody else that I had to explain this to, because then they weren't going to understand why I was doing this. So if it wasn't with you in class I usually did the exercises by myself. I found that quiet spot where it wasn't right after work, it wasn't right before work. It was kind of a day where I really didn't have anything going on. I just set time aside. I made sure that I wasn't going to be interrupted and that I didn’t have to worry or concentrate on anything else. So it was usually in my bedroom, because that was where I was most comfortable.

I think it’s just the fact of letting go, that I have to have a certain sense of control over my environment. It’s that whole fear of just absolutely positively letting go. Quite honestly I am jealous of the people who can do that. They can just throw their hands up in the air. I do go with the flow and I don't have plans for everything, but I have to have a sense of structure somewhere to follow by, otherwise I believe that the chaos theory would TOTALLY take over all of us and
that would be it. I guess that's what it comes down to. I am jealous of people who can do that, but I can't, because I'm afraid of what maybe would happen if I did.

Despite the unavoidable difficulties tied to this experience for Cadence, in this interview segment we find lots of reference to emotion, the use of classmates and in class experiencing for interpersonal relationship around these particular embodied experiences, and then expressions of insight and self-awareness as to why these exercises were initially troubling. She even makes a connection to chaos theory, a part of the content in her complex problems class. So integration occurred, across time and space. This excerpt is offered as a negative case exemplar. Cadence responded in a way that no one else did, in a category in which the rest of the group had a consistent response. If anyone were going to reject the learning experience on the basis of living presence of past traumatic experience, it would have been Cadence.

A second theme expressed within the early period of embodied learning had to do with the correct way that bodies should learn, be used and presented in public.

*Trying to Move Beyond the Prescribed Controlled Body*

Many of the participants had overly codified notions about how their own body should be controlled or how bodies are prescribed based on prior experience as athletes and/or as nurses. Rachel’s interview is a reprise of the difficulty noticed as athletes attempted to adapt to embodied learning. In her own words she describes what might be summarized as the need for a trainer while engaging in structured activity so that ‘what we were supposed to be doing’ could be elucidated. She knew she was engaged when she found herself thinking about her body in the usual way. Rachel said:

I felt that I connected to the yoga dance the most. I had a really hard time with the body stories, trying to connect and figure out what I was supposed to be learning from them. From the yoga dance, being able to move and then concentrate on what was happening, I was able to understand what I was supposed to be doing through the body stories. It felt like I was taking it to a
more in-depth level than with the body stories and doing more with my inner self. The yoga instructor made me think about my body in a way that I WOULD normally think about it. I don't think I got comfortable with the body stories until the very end after we did both of the yoga dances. It took me doing activities to understand it.

While Rachel described a connection with the yoga teacher, there was no interpersonal relationship. There is no reference here to relationship or emotion. She doesn’t name a negative emotion such as frustration. The account is all about understanding or not understanding what is to be done and what is to be learned. What is the purpose of this training? What am I to make my body do? She needs the vigorous activity to make any sense of the embodied learning, but without integration occurring, the sense of whole which embodiment implies is less present than a form of somatic attending.

A few participants, like Mary Beth, had to overcome their nursing sensibilities in order to relax and engage in embodied learning.

We had to lay on a floor and it was dirty, or people took their shoes off and I could smell things, and I didn't like it. It wasn't comfortable. It was cold, and I could hear people giggling or looking and that was not what you were supposed to do. It was a distraction. It was harder for me to find the essence of the exercise because I was too distracted by everything around me. I felt like I wanted to get up and wash my hands. I had to get past all the distractions and then I could try to concentrate on the exercise and really let my body feel what I was supposed to be focusing on. It was easier for me to do it at home because I didn't have all that distraction. At the beginning it was foreign and I was too worried about, "Is this right? What am I supposed to be doing? Am I wasting my time or not?" But you just have to get through that. When I just gave up all of that it was easier. I got it then.

Mary Beth was only one of several participants who expressed concerns about dirt and germs and lying on the floor. They laughed about these being nursing concerns but they were real obstacles for some in the beginning. They also talked about being accustomed to attending
to body odors as a matter of course because they are part of assessment. So their nurse ways of using their bodies and thinking about environment in relation to body in the clinical setting sometimes had to be put aside to engage in embodied learning exercises. That was a challenge.

Often students arrive for class straight from the hospital clinical environment where they would never remove their shoes or lie on the floor. Making the switch in environments gives momentary pause for many of them. But Mary Beth’s response is more specifically interesting after recalling her body memory story and how laden it was with sensory imagery. This embodied style of being in the world can be both help and hindrance in the process of embodied learning. In examining this excerpt for signs of integration or presence of fear or trauma, none of these are noted. Emotion has to be implied, no relationships are mentioned, only the smell or dirt of other people, and new connections are not being made. It is all about sensory awareness and managing it, a step that had to happen first for her in order to settle down and start making new connections. Ultimately Mary Beth found ways to integrate and learn through embodiment, as will be identified in Chapter 6, but she did so in a highly individual way that engaged with her inner intuitive sense.

The two previous categories were more about context: who else is around and are they noticing me? What are the rules for bodies in public and in training and are we following them? The next category is more personal, getting at the interface between the individual and this new kind of learning. The question to be answered was to what degree do I retain my unique learning orientation vs. adapt to this new way of learning. Participants responded in a range of ways.

**Differentiation / Integration Tension Around Embodied Learning**

Robert was an ‘early adapter’. For Robert, there was surprise: this was unlike any previous learning experience, his assumptions were disrupted, he names immediately what he
found useful and incorporated. He clearly took charge of his learning experience and owned it. What is especially interesting is his unique personal learning style which is heavy with embodiment, but with other people around he was embarrassed to engage in the movements that he found most conducive to learning. Embodied learning for him was like coming home. In his interview excerpt the elements of emotion and relationship are implied rather than stated very directly, but that is his style. So the elements of integration are all here. Trauma is present only in the most subdued way in that he constrained his use of his most comfortable learning style in order to avoid embarrassment and humiliation from people who did not understand. He stated:

When I said strange [I meant] I had never done it, where somebody says "Pay attention to your body. Lie on the floor." So it was a little different. I didn't think it was going to be like that. I didn't think it was going to be helpful, or constructive. Constructive rest was one of the best activities for me, because I still use it today, actually.

I think I learn through using gestures ... like when I'm reading, especially when I'm alone. When I was doing biology classes where you had to remember a lot, I would talk and use my hands a lot, like I'm explaining to somebody. That helped me remember. But if anybody was around and saw me then I would just lose everything. So usually I would study by myself somewhere where I can explain to myself using my hands. If I was talking more about anatomy and physiology, like blood pressure and stuff like that, I'll use my hands low and high and create a visual. So I'll be putting my hands up and putting them down, and just doing different things. (Using gestures and smiling as he explains all of this)

So for Robert, the decision to integrate into the pattern of students moving easily and quickly with embodied learning was natural. Kathy was less sure because some of the writing in the book conflicted with her beliefs and she had to decide how she could meet course requirements without crossing her own established boundaries. Sometimes being far from equilibrium meant that belief structures were being challenged. It is impossible to teach complexity science without teaching evolutionary biology, since this is one of complexity’s primary threads. Evolution was also incorporated throughout the “Body Stories” book and as
specific focus for two chapters with their accompanying exercises. This is always difficult for some students, and Kathy’s interview story serves as an example. Kathy stated

There were some [exercises] that were difficult. I think, the evolution body stories. Coming out of the water, and pretending you were something [a fish], hopping up and down [a frog]. I can't remember all that, but that was like play stories for me. It was difficult for me to get into some of that evolutionary stuff. Coming out of the water, and acting like a monkey, and in a tree, I think it was something like that. That was one of the body stories that was a little difficult for me to do. I knew this was evolution and it was something I really didn't want to get into. It was contrary to my belief. (Sigh)

Well, I did the body stories and tried to feel like it, but I knew in my mind because it’s not evolution, it’s not … And it didn't feel right, absolutely. It didn't feel right. I didn't want to get into it too much and it was difficult. But I knew that this was something that we were supposed to do and try to imagine ourself. I think I wrote something about God.

Portions of what Kathy wrote in her journal are what follows:

When I think of a cell, I think of how complicated it can be and only God could have created such a fundamental unit. I have two wonderful healthy children who developed from union of two cells, the sperm and the ovum and the cells go on to three healthy grandchildren that I love and adore. ….. Cellular awareness, it felt good to take some deep breaths and actually expand my lungs and slowly exhale through my nose. I felt like I was feeding my cell giving it oxygen. … As I read this evolutionary story it was difficult to understand. Does anyone really understand God’s creation? There is more to the universe than the human mind can grasp. It reminds me of when I was pregnant and how my child was moving in all different directions in amniotic fluid. ….. These exercises remind me of imaginary play as a child, making believe I was an amoeba, then a jelly fish and finally a fish moving in the water ….. crawling and hanging from trees like monkeys. This is all the ways the body moves. We first learn to crawl, hunker, sit and then walk.

Here is an example of another participant who could have opted out of this portion of the course, but chose to engage and ultimately experienced integration. She achieved this in her own way and her process of self-organization is worth noting. She began by grounding herself in the beliefs that she felt were being challenged, and she did this in a rational rather than emotional way. She then brings strong emotion and interpersonal connection to the space by declaring love
and connecting with family through the most intimate act of union. Having done this to center herself, Kathy was then free to explore the embodiment experience, and she engaged fully, noting that she could actually feel herself feeding her cells. She acknowledges her difficulty with evolution but frames this as a problem of understanding rather than morality, then reframes the exercise as play. In this way she minimizes its significance and threat value and is once again free to explore the embodiment aspect. By recasting the activities as a reflection of developmental action across a single lifetime (action being the primary purpose of our nervous system and brain) she again distanced herself from evolution and found a way to connect with the embodiment exercise. Fear or trauma were not present in any way in these stories. For Kathy, maintaining her uniqueness, remaining more differentiated was her choice in making the embodied learning work for her.

This example serves as a wonderful reminder of the developing mind’s capacity to make meaning and forge patterns of connection under challenging circumstances, simply by relying on its own past experiences and allowing for awareness of emotion and human connectedness. Challenged assumptions need not change in order for learning to occur, neither must they be a reason for opting out of a learning experience.

This final category is a segue to the next section, which is about integration. Robert’s integration with embodied learning began with a point of connection fully embraced, that point being his very physical style of rational learning. Sometimes integration to embodied learning was its own big pattern of integrated diversity.

Uniquely Integrating the Past for Current Learning

Perhaps what is apparent in the above stories as well as those told in this section is that each participant had a unique way of integrating their past and repatterning it in a way that
worked for the current learning. The best example of intersection with past trauma and then integration for current learning comes from Maria. This was also touched on above. Her approach to dealing with the “Body Stories” book assignments reveals just how nuanced her technique has become. She has learned to address her fairly intense need to keep moving, feel free, and avoid creating a pattern by crafting every imposed experience to meet her personally identified goal. Formal education, although chosen, still carries elements of imposition, such as specific course requirements.

The following portion of interview was in response to my attempt as the researcher to understand this participant’s approach to learning. She had explained that she merely skimmed the exercises, never read the text or the accompanying vignettes, and re-crafted the exercises to achieve her own goal of being relaxed so that it wouldn’t seem like a homework assignment. What could have appeared on the surface to be a lack of engagement with the material was in fact a thoughtful reflection and renegotiation in order to meet the course requirements and also manage her own reactions, some specifically related to school. Elements of Maria’s story of being chased and running across a field (shared above in body memory story) hint at resurfacing in this follow-on story as she shares her memory of doing the embodiment assignments. She incorporates it into her imaginative extension of the exercises. Maria stated:

I think embodiment is probably the relationship of movement and your body with how you feel and how you behave in the world. I've tried to do things that are comfortable body wise, so that they will be comfortable in my mind and I will have a good memory of it.

So with the “Body Stories” I felt as long as I was doing it [it was OK]. My main thing was concentrating on breathing and being relaxed in a relaxed state, not so much what the technical aspects of it were. So that's how I made it work for me, I just sort of switched it around. (Laughter)

What I would do is that I would get the story, skim through it.
I’d see that it said it requires lying on the floor, or sitting down, that sort of thing. That’s how I would decide. If it would say this will take 15 minutes, I would say NO, I think it’s gonna take 10. Some of them, if I enjoyed it, I’d just lie there for half an hour.

I didn’t want to future read. I didn’t want to know what happens next. Since I wasn’t a big fan of doing it, I wanted to be surprised. I liked that if it had little exercises in between they not require extra exercising, that they not require actual moving. Those were "imagine this" .... I could do that really well. Because you could do that driving, you could do that doing anything, so sometimes I would do them on my own.

I do remember whichever one it was that required just sort of lying there, and moving your hips from side to side. I just thought how nice it would have been if I was in a cornfield, or, in a lavender field. I just sort of thought of that so one day when I drove through one I was like "Oh, that would have been perfect just to pull over and lie there." It was a summer day, but I didn’t actually do it. I did visualize myself doing it. I was having a stressful day, so that sort helped.

I can do the body stories exercises whichever way I want, because it’s all about perception; it’s my OWN thing. So this writer thought that these instructions are helpful to get that experience. That’s wonderful. But if I can find that same experience in an OTHER way I’m just gonna’ do it. (breaking into laughter again)

There is so much here it’s hard to know where to begin. Maria’s story demonstrates concern with being in control just like Cadence, but expressed much less directly. She creates a path that works for her by reframing the exercises just as Kathy did. She finds the piece that is useful, achieving relaxation, and searches for that as end point in all the assignments, whether or not it is there. Robert did something similar. He found early on that he valued constructive rest, the meditative position of relaxation taught in the first exercise. This was frequently the starting position for the body stories exercises, but when it wasn’t, he incorporated it because that was the part that was useful for him. John described doing something similar. Monica did the exercises in bed and used the constructive rest to help her fall asleep. Maria’s grasping of the behavioral piece that brought moved her to a desirable state was very typical, especially among the high stress group, although not only among them. Others, like Trudy, Marie and Gabriella,
connected through the imagery piece and found ways to make connections through imagery to other aspects of their lives. Like Angela, Maria specified that she lived alone and needed to find ways of doing everything for herself, to include this course work. They both took the bull by the horns and made the situation work for them without ever asking “What am I supposed to be doing/learning?”

All participants evidenced recurrent themes across their journals and the interviews. Sometimes these had to do with their embodied style, their way of being in the world, like the primacy of sensory awareness for Mary Beth and Fred, or the body as object of training for Rachel and Eugene. Sometimes, the themes tracked through emotions, like Gabriella’s joy in discovery and curiosity; or the themes were held together by a consistent interpersonal relationship, for instance Kathy’s continuing renewal of her relationship with her husband and John’s exploration of his relationship with his daughters. When there had been major experiences of fear and trauma, the themes had recurrent images relating to these experiences. Maria’s need to keep moving and changing her environment (to evade forms of ‘capture’) continually resurfaced, often contributing to very creative forms of learning. Marie’s stories included abundant references to bleeding. Robert’s stories included multiple references to threatened or completed limb amputations. For Monica there was repeated focus on her legs (beginning with her first memory of running from a dog). Cadence identified with her pediatric patients’ helplessness and acted on their behalf. Kathy’s concern for family integrity and safety and no one having to die alone showed up repeatedly. Trudy was concerned with honoring each person’s dignity. For Angela, the recurrent theme was being helpless to change the outcome.

This topic of trauma and fear is the focus of Chapter 4, so some of the detailed stories that were shared will be presented there. But is important to note that while the journals were
never focused on trauma and there were no complete accounts of specific incidents, over time fragments of memories and stories were revealed and the continuous threads of themes tied them together. These were only apparent when looking over time at the whole, suggesting that these bits of experience were integral to integration in differentiated ways. The fact that they arose naturally without being specifically elicited and did so in a way that was unobtrusive and seemingly facilitative argues for allowing as much personal control as possible when engaging students in embodied learning, knowing that trauma is there, trusting that each person knows what to do with it at levels below conscious awareness, and never directly trying to elicit specific narratives. Individual self-organization allows each person to make of the offered embodied learning experience whatever they need it to be.

**Differentiation and Integration in the Body Memories Body Stories**

This section provides a graphical representation (Table 9) of a particular type of interpretation of the Body Memory Stories data that were just presented. It is an explanation and analysis of some of what the Body Memory Story data mean. It is offered as a comprehensive view of the entire group of participants, considering whether or not integration was occurring in this first assignment. Siegel’s (2001) conception of integration (new patterns of connection to form a whole), was applied as template for data analysis. This perspective states that the emergence of integration is a process of the mind that requires emotion, an interpersonal relationship, and coherence which is new tempro-spatial connections, linking across past, present and future. This is then a demonstration of self-organization in the formation of new patterns of connection, a demonstration of meaning-making. The presence of self-organization is made apparent as well as the uniqueness in style: both integration and differentiation, dynamic process.
Several things can be noticed in the following chart which serves to examine the integrative process associated with these body memories stories. In the original written body memories story, there was much diversity around the naming of emotion. Some participants didn’t mention emotion at all in the written story which took place 11 months before the interview. Almost everyone wrote of memories in relation to mother and/or parents or family, so there was a connection to interpersonal relationship. Grandmother was also mentioned twice. Most of the story content clustered around the given writing prompts but each participant also made at least one new connection, a question or an insight about how they are in the world. This was beyond just telling the memories and linking them over time in some way. The new connection was usually expressed as an influence on current self-concept, or valuing of an adult’s past guidance. So what is observed is the pattern of connections, the self-organizing that was already present around these early body memories.

The intrinsic dynamics, the starting point in their pattern of connections to old body memories, are the degree to which the memories, as told in written body memory story, are linked with both emotion and interpersonal relationship in this initial condition. This already existing pattern, the intrinsic dynamics or initial condition, would be expected to affect the capability to make new connections to these memories in the process of learning and also the pattern of the new connections as they are formed (Kelso, 1995). To be sure, there are differences between written and oral conveyance of story, so stories might be expected to shift according to mode of telling. But these body memory stories change in specific ways related to theory (Siegel, 2001). Thus, Table 9 (p. 261) shows how this played out for each of the participants. Then, the remainder of this section discusses three themes worth emphasizing here:
namely the re-patterning of connections, the role of the emotional valence of experiences in body memory, and the integration of fear and trauma.

Table 9.
Integration: Linkage of Factors within the Human Mind

<table>
<thead>
<tr>
<th>Name</th>
<th>Named Emotion</th>
<th>Interpersonal Relationship</th>
<th>Narrative Coherence: Written Body Story</th>
<th>Narrative Coherence Interview: Early Body Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angela</td>
<td>None Named</td>
<td>Parents Friends Father</td>
<td>* Noting capabilities and health vulnerabilities inherited from parents; * Effect of views of body on friend selection; * Connection with self-concept</td>
<td>**********</td>
</tr>
<tr>
<td></td>
<td>Emotional Terrified</td>
<td></td>
<td></td>
<td>* Noting the changing emotional links to the same memories. * Many physical &amp; interior Body experiences noted * That moment of realization, pay attention to surroundings for safety. * First moment of self-awareness. * How visualize world around you * How must organize self to avoid repeated negative experience</td>
</tr>
<tr>
<td>Cadence</td>
<td>None Named</td>
<td>Family Instructor/ Researcher</td>
<td>* Limited report * Past identified as defining current self</td>
<td>* Process of finding personal space and walking through to find body story memories * Desire to be understood; why reacts in certain ways * Making personal connection around similarities * Getting a vision of future Self * No fear of judgment * Being more true to self</td>
</tr>
<tr>
<td>Eugene</td>
<td>None Named</td>
<td>Family Friends</td>
<td>* Family support allowing for physical achievement and coping with body liabilities</td>
<td>* Supportive relationships with family and friends valued over sports achievements and physical abilities</td>
</tr>
<tr>
<td></td>
<td>Prideful</td>
<td>Family Friends</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fred</td>
<td>None Named</td>
<td>Mother Brothers Parents</td>
<td>Connection made to current self-concept</td>
<td>*Aware of quality separate memories, ‘like snapshots’ *Sense of disconnections *Yet experience of one memory leading to another *Wanting to create a whole with logical connections *“Story should have beginning, middle, end”</td>
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<tr>
<td>------------</td>
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<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Gabriella</td>
<td>Comfort Love</td>
<td>Mom Brothers Brother Dad</td>
<td>* Notices she derives “comfort or grounding” in talking with brothers about early memories. * Sees opportunity to recapture body intelligence of childhood</td>
<td>* Making linkages with several stories from Body Stories Book * Connections in the moment with images, feeling, gestural way of talking tied to ethnic heritage * Ability to go inside self to bring clarity * Appreciation of body, health * Changing body image with age * Unable to uncover actual memories * Sensory memory connected with Dad, being comforted led to original first Body memory * Connections to current visual preparation techniques before performance * And lucid dreaming</td>
</tr>
<tr>
<td>John</td>
<td>NA Weird</td>
<td>NA Mother</td>
<td>Never submitted</td>
<td>* Retrieval of “memories didn’t know were memories” * Noticed that memories came when in position of Constructive Rest * Very sensory memory, visual, movement * Led to direct connection with mother to validate</td>
</tr>
<tr>
<td>Kathy</td>
<td>Nervous Fright Relief</td>
<td>Mother Siblings Husband</td>
<td>* Connecting to present * Valuing mother’s advice * Seeing her wisdom in hindsight</td>
<td>* Quality of being IN memories at time of retrieval * Feeling memories physically * Led to connection with husband</td>
</tr>
<tr>
<td>Maria</td>
<td>None named</td>
<td>Parents Siblings</td>
<td>* First person report of own birth</td>
<td>* Making connections with original stories</td>
</tr>
<tr>
<td>Name</td>
<td>Positive Words</td>
<td>Negative Words</td>
<td>Connections Made</td>
<td>Noted Experience</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------</td>
<td>----------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Marie</td>
<td>Afraid, Surprise, Happy</td>
<td></td>
<td>* Connections made to current self-concept and mastery</td>
<td>* Awareness of lifetime of experience that creates and exists in an adult</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>* Reconnection with old treasured skills and activities</td>
<td>* Connecting with children</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Re-valuing experiences, changing their emotional valence</td>
</tr>
<tr>
<td>Mary Beth</td>
<td>Love!, Shame, Funny, Nice, Warm</td>
<td></td>
<td>* Noted that she developed a private inner awareness as a teen</td>
<td>* Noted appreciation of experience of connecting self to things outside usual daily experience</td>
</tr>
<tr>
<td>Monica</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>* Only connection made to continuing fear with some modifications in contextual details</td>
</tr>
<tr>
<td>Rachel</td>
<td>Love, Confident, Comfort</td>
<td>None Named</td>
<td>* Noting that beach remains her comfort site, connection through senses</td>
<td>* Noting that her sense of competence is tied to body and physical activity</td>
</tr>
<tr>
<td>Robert</td>
<td>Empowered, Missing home and Family</td>
<td>Grandmother, Grandmother</td>
<td>* Connecting with Body Stories readings</td>
<td>* Reminder of childhood when still being told what to do</td>
</tr>
</tbody>
</table>
Re-patterned Connections

The data related to the interview are then a good measure of this re-patterning and increasing complexity of connections. For example, Angela began with strong integration tendencies but lacked the emotional connection. Adding that, her integration became extensive. In another example, Gabriella had all elements present at the start and her re-patterned growth of connection was highly diverse. A very differentiated integration if you will. Cadence originally listed no emotions. Adding a new relationship connection with the instructor and emotion, her connections to the memories expanded. For some, like Kathy, the integration was more subtle and came through changed connection with another person, in her case her husband. Monica, whose early memory emotion was terror and who had no interpersonal relationship associated with this memory, retains an early body memory that is quite unconnected, even after completing embodiment experiences.

Participants who made fewer connections over time (had less integration) fell into a couple of categories: athletes, those who took only the health assessments course, and those who were troubled by the fragmented nature of their memories. Both Rachel and Eugene had lifelong histories of training in a variety of sports. They had very clear and codified approaches to knowing and learning through their bodies and they described how this inhibited them in trying to understand this different type of body learning. Rachel, Mary Beth and John only completed the first course, health assessment with this group. So they didn’t have the benefit of the second course which moved beyond body experiences connecting with one’s own body into...
making connections to the practice setting. In addition, Mary Beth had been on a completely erratic and highly personal sequence through the program, so she had no consistent connection with any particular group of students. Fred was clearly desiring to move toward integration, making many comments of that nature during the interview. While his story was highly sensory both in written form and during the interview, there was no expressed connection with emotion in either case, perhaps inhibiting his ability to integrate the experiences as he wanted to. Notably, Trudy expressed the same sense of the memories seeming disconnected. Like Fred, her memories were connected with interpersonal relationship but not with emotion. So the absence of emotional connecting with early body memories appears to inhibit integration, or learning through making new connections.

*Emotional Valence Connected to the Body Memory*

Perhaps emotional valence, positive vs. negative emotion and the strength of these emotions, is also a factor in whether or not integration occurs, so therefore a factor influencing self-organization. At the time of interview, Eugene, Monica and Robert didn’t describe any new connections to the early body memories. They all named emotion in connection with the stories, and in all three cases the emotion was negative. They demonstrated little affective connection with the stated emotion, so perhaps there was some effort to contain the emotion outside their conscious awareness. They named the same person or people within the interpersonal relationship category, with no additions or new persons and no indication of reconnecting with these people around the memories. So the memories were what they had been, and becoming aware of them did not lead to new interpersonal connection in direct relation to the memories. This is of note because these new connections did happen for many participants. In these few instances there was more rigidity of order, less differentiation around the memory. But all of
them still engaged in new learning through the body over time. When interviewed, they all downplayed the significance of this exercise in their overall learning.

Angela’s reported story-linked emotion at that time was negative also, but her linking with interpersonal relationship became much more focused, moving from parents generally to father very specifically. She identified this shifting as related to her father’s health struggles, and she completed significant integration. John had difficulty specifying emotion and lumped it all under “weird.” Context suggested that weird had negative valence with a positive tinge. Despite the negative emotion, John spiraled back to his early body memory and was inspired to add in his interpersonal relationship with his mother around the memory, leading to forming new connections and therefore integration. So the negative quality of emotion related to the body memory was less important than its availability for making new connections. Availability would be an indication of movement, dynamic process, the presence of some chaos and irregularity. The memory and its emotion are still alive.

**Body Memory, Fear, and Integration**

Maria’s interview provided a good example of body memory stories as integration that gets at how the body integrates fear and trauma. While this will be taken up more in the next chapter, I recount it here since a basic premise of the study is that learners bring their embodied stories of fear and trauma with them as part of their initial conditions of learning.

Maria recounted a collection of early body memories and gave a well articulated understanding of their place in her total sense of self and her way of functioning in the world. In her written body story, she wrote an elaborate imaginative piece about her birth, based on her mothers’ stories. But later in the interview, she engaged in telling stories about many early body
memories. What was different was that she had clearly thought about these memories and created some coherence via forming connections among them.

Maria was brought to the US as an undocumented child and lived in that status for 15 years. She is now a naturalized citizen. But over those 15 years she developed a very complex repertoire of strategies that function as security to counteract the fear learning which was continuous for her. She talked about knowing through her body and remaining calm in crisis.

I've always seen it [the ability to remain calm and rational in crisis] work to my advantage. I'm not afraid of those situations which is probably why I embrace change. It's not scary to me. Every time I've proven that if it's a high alert, a very scary situation, [I tell myself] "Oh, you can handle it. It's going to be OK."

On a personal level, I remember when I was little, there was some man trying to follow me in his car and I thought I was going to get kidnapped. So I was very, very afraid. But somehow I managed to come up with a plan. I had the choice where I could yell and get help, or I could run as fast as I could. I thought about it, "Well, he's in a car, so he's gonna go faster." Even though I was full of fear and I was alone and it was pitch dark and it was very scary, I thought "OK. What to do now?" I tried to do routes that he can't do with the car.

Whenever I get into a fear situation, I always think "What's the worst thing that could happen? If I can visualize it, it’s gonna happen. So that's not good. You shouldn't even picture that something bad is going to happen." For example, if I can picture myself in the car with the man screaming, and something horrible is happening to me ...... Thaat's not goood ..... that's not a good sign. Sooo, quickly, forget that memory, move on to the part where you visualize yourself running, getting away, getting help, and that's sort of how I process it.

When you add the immigrant aspect to it, you're always, ALWAYS on high alert for something. “They're gonna catch you, Don't tell people anything," whatever. You don't know English, how are you going to express yourself when someone asks you and it’s your turn to read? And it could be English class and you knew that, "My God I'm next and I have to read this paragraph. How scary! Oh my God!" So, I just learned, that's not a deterrent. YEAH, it’s scary, but just own it. Just deal with the feeling that you're having and then get to the next place. If you get stuck in there, the anxiety, it’s going to take over and its going to prevent you from the actions, so your body's not going to work. That goes against the purpose of whatever you're trying to do! So ....you can't do that (Laugh!) And no one taught me how to do this.
This is truly remarkable learning, and a tribute to the human capacity to adapt as necessary.

Summary

This chapter presented integrated qualitative and quantitative findings describing a year long dynamic embodied learning process within the context of nursing clinical education. Initial conditions were characterized in terms of earliest body memories and stressful life experiencing. From their first writings about retrieved body memories through retrospective analysis of their learning a year later, participants’ self-organization around embodied learning followed continuous threads of both differentiation (diversity and separation into parts) and integration (clustering of components into a functional whole in a new way). Multiple individually unique experiences of evolving concept of embodiment and sense of embodiment clustered to create body awareness. These embodiment experiences also catalyzed integration, fostering new connections between past and present experience, sometimes by triggering emotion.

In the process of learning, participation in yoga trance dance proved to be a facilitative event and an integrating experience that helped jump start the process by mitigating feelings of embarrassment and demonstrating embodiment through experience. Differentiation was again apparent in the individually unique patterns of attraction to particular exercises and activities. The commonality among these was their bringing attention to the body sensing of alignment, inducing a state of heightened sensory and emotional awareness through imagery, exploration of the pelvic area and legs that was experienced as release and surprise, and an embrace of the deep state of rest that could be achieved through breathing. What emerged from these as product of
integration was the experience of body connectedness, or embodiment. This connectedness spiraled back to allow a new awareness of their body manifestations of stress as something they might be able to change rather than something inevitable imposed from outside. Participants self-organized these embodied experiences in unique ways that resulted in a new pattern of connection with self. These patterns are explored in detail in the next chapter which presents the learning outcomes and changes in relation to the clinical practice environment.
CHAPTER 6

NEW PATTERNS OF CONNECTION: OUTCOMES OF EMBODIED LEARNING

Self-organization in natural systems can only occur when these systems are both complex and open to flux with the environment. Locally organized dissipative systems maintain their organizational complexity only by draining the order from some other region of the universe and cycling high-entropy energy back ... the order and pattern continue to emerge and evolve. (Thelen & Smith, 1994, p. 53)

In Chapter 4 we met participants in their work setting and came to know them through the embodied learning that emerged naturally for them in their nursing environment. Chapter 5 introduced the participants more personally through their entries in learning journals created during two nursing courses. The examination of participants’ embodied learning began with their early body memory stories. Their intrinsic dynamics, the patterns of connection among memories, experience, perception that defined their embodied way of being in the world at the start of the health assessment course were captured in those body stories and highlighted with the drawings they did of their skeletons. These assignments drew forth a pattern of integration that was already in place in relation to embodiment. Learning journal data was corroborated with data from the interviews to understand integration over time. The evolving patterns of integration were arising from participants’ natural individual processes of self-organization.

Chapter 5 continued with analysis of the self-organization that arose as each one found their own way to engage with embodied learning, influenced by their current sense of embodiment and past experiences. To make the connection with trauma, this patterning of embodied engagement was compared to quantitative data reflecting indirect measures of neurobiological repatterning of the body’s physiology in response to stress. The embodied activities were pivotal in allowing them to engage with a new kind of learning, and later open up to a new body awareness and sense of embodiment.
In this chapter, embodied learning outcomes are identified from stories shared during the interview. The learning outcomes are separated into two sections: First are personal outcomes which includes new patterns of connection with self through heightened awareness and a change in preferred style of learning; second are the professional outcomes which include re-patterning of perceptions and behavior in relation to nursing, emerging from the personal outcomes combined with the process of telling clinical embodiment stories and being heard.

**Personal Outcomes**

The identification of personal outcomes began with coding and analysis of learning journal entries and comparison to interview data, described in chapter 3. Within the journals written while enrolled in the two nursing classes, there were many instances of new insight into the concept of embodiment and recognition of instances of wholeness. Participants also made frequent references to individual, differentiated body experiences such as feeling energized and invigorated, or relaxed and free, or noticing the importance of movement. These references occurred alone and in combinations, often in cases where the full criteria for integration were not being met (emotion, interpersonal relationship, coherent narrative not all present), so these were indications of patterning in process and still not complete (See Appendix L, Individual Uniqueness in Most Memorable Exercises, p. 394).

Over time, these experiences of noticing embodiment coalesced into new connections with self and around these connections integration occurred. This was observed in the interview segments as fragments of embodiment experience gave way to multiple demonstrations of embodiment embedded within a dominant type of awareness coding for a single response. For participants looking back in an interview, 11 months after the embodied learning journey began, the learning they described as most valuable and believed had remained with them were forms of
Emergent Connections With Self. In this section, the first main category of findings in regard to personal outcomes, which has several subthemes that indicate how this happened and how it was manifested are detailed below. Discussed next is the second main finding: that participants developed a new learning style preference as this happened. Finally this section concludes with a summary discussion of the personal learning outcomes.

_Emergent Connections With Self Through Interoception_

*The body and subjective awareness of the body, including visceral awareness, instantiates the “self” and provides the intermediary by which the nervous system interacts with the external world.* (Cameron, 2001. p. 708)

Emergence in self-organizing systems refers to new, unexpected patterns or processes that exist at a higher level than the lower level components from which the new patterns emerged which have their own rules and possibilities (Lindberg, Nash & Lindberg, 2008). For these participants, the emergent connections with self were all forms of interoception.

Interoception is a term first used by neurophysiologist Sherrington (1906) in his seminal work describing the nervous system as integrative function for the rest of the body. The term has been in use for over a century in referring to the vague feelings, sensations, muscular sense that exists at the edge of consciousness. Pragmatist philosopher and early psychologist William James (1890) contributed to the development of the concept. Neuroscience researcher Cameron (2002) explains that science now supports a broader conception of interoception. Now there is an understanding of these sensations as arising from a psychosomatic process that connects body to brain to behavior and thought, occurring along a spectrum from pre-conscious to conscious. Research has relied on conscious awareness to study interoception, bringing this body of work in touch with neurophilosophy, thereby Merleau-Ponty’s phenomenologic philosophy of the body.
The process of interoception as described by neuroscience researchers (Cervero & Janig, 1992; Cervero, 1995; Cook, Davidson, Davis & Kelleher, 1960; Vaitl, 1996) occurs within the body’s central nervous system and includes all the afferent (incoming) information from anywhere and everywhere within the body, from the skin to everything lying under the skin, the balance and proprioceptive functions, down to the visceral organs, and the chemical, endocrine and other physiologic mechanisms that transmit information between the brain and other parts / aspects of the body. The outputs of this ‘brain in process’ system include visceral sensations, pain, pre-conscious awareness of the body in relation to time and space, emotion, behaviors that occur within and outside of awareness, and various levels of conscious awareness. This is a dynamic system of changing patterns of connection among all of these elements, the pattern being thoroughly described by neuroscientist Damasio (1994, 1999) as a fluid ‘body map’ within the brain that takes into consideration anatomical placement, visceral function, and body relationship to the immediate external environment. This ‘body map’ pattern is only partially available to conscious awareness (Jones, 1994).

The three sub-categories of emergent connections with self, identified in this study through interviews with participants were: visceral sensation and body in time and space; emotion and behaviors outside conscious awareness; and awareness of connections between interior experience and the exterior world. Connection based on new body in time and space came through noticing in new ways what one’s body does, is able to do, and able to experience, to include experiences of pain. Self-connection through heightened emotional awareness entailed noticing emotions and all the other bodily perceptions and actions connected with them. Emergent connection through noticing the interior’s connection with the exterior issues arose through noticing one’s perception – action links in reaction to things outside oneself and then
having an insight about this. These three sub-categories characterized and distinguished among participants’ analyses of their own learning outcomes. When they talked about how the embodied learning in class had impacted their personal lives, the emergent property of connection was experienced as some type of new or heightened awareness. Indeed, this was a new relationship and was true for every participant. In the following section, each participant’s personal learning outcome is represented with a story. In these stories bold type indicates emergent connection in forms of interoceptive awareness and italic type marks forms of emergent embodied practice.

**Body In Time And Space: Visceral Sensation**

These RN student participants tended to take their bodies for granted and only attend to them when in pain. They explained this behavior as a function of the need to focus their attention on other people's bodies. But they felt that the embodiment experiences in class led them back to greater awareness of their own body, which had manifested in unique ways for each person, and in some way has been lasting. For some, this process of connecting with self through visceral awareness and noticing their body in time and space also provided a path for connecting with a loved one. Related emergent embodied practices included self care, sharing embodiment in a close relationship, and affect management. Below I provide examples of the varied ways this was manifested for participants.

*Awareness of what one's body is able to do and experience.* For this group of participants, connecting to self through awareness of the body in time and space always included new perceptions of their body’s capabilities. Because he had to overcome a couple of challenges, Eugene’s analysis of his learning is especially interesting. First, as an athlete, this new type of embodied learning didn’t make much sense to him. Also, his approach to learning
was very abstract and analytical. He rarely mentions emotion. But in this example we can hear and sense his excitement as he explains how the body learning he did as an athlete connects with the body learning he uses in nursing. He has integrated by making new connections to the workplace and ways that he can understand and interact with his patients’ bodies more effectively. His excitement conveys that he feels the connectedness that he is describing as well as understanding it as an abstract concept.

If you’re giving someone a deltoid shot you pick out certain anatomical structures, bones and things, and you say, “I’m gonna’ go HERE”. Then you think about why, “Well, the muscle’s bigger here.” So you’re not just going through the motion of injecting the needle, feeling the places, but you’re also thinking through the reasoning. So, I guess I could say in that sense, you’re using two parts of your brain, two sections of your brain in both of them.

I played volleyball in high school and we did a lot of drills and swings. You think about the whole context of who goes where and who does what, as well as while you’re running and doing those things physically. I’d say embodiment is a little different. I would say it’s more connected, at least for me, because I think through everything … I use that logical, analytical part of my brain, a lot more than the other parts. I include that in the embodiment section as well as the section I just explained.

With volleyball, I didn’t really take time to think about how my body would react to certain things. I just did it. In nursing school, at least when you start out, you’re very task focused. Although you learn in different ways, you just do it. Like in the film “The Dark Knight” …. The Joker said, “I’m just like a dog that chases cars. I just do things. I don’t even know what would happen if I caught one.” Cause I just do it.” I’m so used to just doing what I was taught. ... I just do the things I’m taught, and then experience them in the body and embodiment comes later.

New awareness and emergent self-care practice. When pattern formation continued to build on the substrate of visceral awareness and knowing the body in time and space, embodied practices emerged. One of these practices was changes in self-care. Both Angela and John learned by connecting course content about anatomy and physiology with increasing awareness of and attention to their own bodies. Both made changes in how they register the messages their body sends them and how they care for their health.
Angela explained:

*I try to pay a lot more attention.* I have **realized that there are very subtle clues that your body gives you**, and that **you can avoid a lot of stress and aches and pains if you listen to it** when its telling you, "I think we're doing too much," or "Get up off the couch and go do something!" I think most people have those urges and we either ignore them or we just do the negative thing anyway. Bodies are kind of made to regulate themselves. We have homeostasis just because we're alive. That's sort of amazing if you think about it. So **when you're out of balance I think you can feel it.** The body stories helped me pay attention to when something is not right. I would just ignore things until it got impossible. **Now when my neck hurts, I wonder why that is.** It just brings you to a better sense of self. I think you just **have to learn to listen to yourself.** I'm not such a very good listener sometimes. This whole experience, **it just taught me that you really need to pay attention or it's gonna backfire.** You know?

For John, the self-assessment experience was eye-opening and spurred him to change behaviors.

He stated:

That was a very **unique way of learning** A&P [anatomy and physiology] and assessment. **Assessment of my own body.** You know, I don't tell my patients to get into constructive rest to do an assessment on them now, but I think if **anything it helped me be more aware of my own aches and pains** It changed the way I would assess my own self. If it doesn't hurt that bad, I'm not gonna see anybody about it. I'll self correct. If you **get a back pain you can go into constructive rest** and think turn this way, turn that way, notice that feels a little better. Before my assumption would be that if I got back pain I would just take an Ibuprofen and move on with the day. Now there's a different way of looking. **I don't have to take medicine.** I used to take Ibuprofen a lot. **Now, I just lie flat ...**

In a somewhat similar way, Marie became more aware of her body and was able to start changing habits to improve her health. The pivotal factor for her was that this new body awareness brought with it a level of self-acceptance that she had not previously experienced.

She reports being surprised at the times and places when she would notice her new attention to body. As one thing shifted, the whole pattern of connections to her body began to change. Marie stated:
For this class we’re in, when we had our Korean dinner with a friend, I was very mindful of HER body, what she was doing, the way she was connected very much with the knife, and the rolling, and the doing .... she was doing 8 million things at one time and still having a really neat conversation. I almost felt drawn into her. I felt myself leaning forward as she spoke. Then trying some of the strange foods I never had before. It felt like I had been humming or playing a harmonica, the way everything kind of just jiggles and vibrates ... my mouth felt that way. She gave off a very strong positive energy and I carried that with me.

In my practice I’m more aware of how I’m standing at the bedside; how I’m changing my patient’s positions; how I’m making sure that they’re comfortable in bed. I’m making sure that I don’t just take care of the initial problem but take care of the rest of them too. I’m much more mindful of that. Like I’m feeding them emotionally and feeding them intellectually ... like ... playing music for them.

I think it has allowed me to be more accepting and not as angry at myself for being where I am. I’m just more in the mode of trying to fix where I am physically. So I’m trying to fix the fact that I’m overweight by eating better and exercising. And I know it will have benefits down the road. For a long time I’ve just been angry that I’ve been this heavy, that I feel this old, that I feel this tired and feel like I can’t climb a set of steps. And I'm still expected to do all the things that I did before. And I still WANT to do those things that I did before. Now I think I'm just more accepting. OK, I'm chipping away at it. I'm not gonna let myself get totally upset by it. So I think having gone through the class and the experiences and being mindful of all that has helped me just say, "OK, this is what I'm doing ... this is where I am. And then these are the steps that I'm gonna do to change things. And be more happy with the results I'm getting. Like "I finally lost 7 pounds!" and this is good!

Sharing embodiment in close relationships. Another embodied practice that emerged in patterning layered on body awareness was bringing the experience of embodiment to someone else. When participants formed a learning partnership with a family member and were able to share aspects of the embodied learning activities throughout the health assessment course, it enhanced the frequency and rapidity of their integration. The attention to visceral messages and noticing the body in time and space sometimes came about through these interpersonal relationships. The participants in this category, who formed new connections with self through new awareness of the physical body, were more likely than participants in the other categories to extend their new body awareness through practices of sharing embodiment in a close
relationship. In other words, the habit of embodied practice that developed during the class was elaborated on to become part of ongoing interpersonal ritual.

Just reading about embodiment also contributed to the learning. Robert was pleased to make a discovery that helped him understand a past experience with visceral awareness. He is using his new awareness of his body presentation in space to change his connections with other people.

In the book they mentioned something about what you wear having an effect on you. When I read that I thought, "Hey, maybe that's why when I took that test [wearing a constricting hat] I didn't do very well." Depending on how you use it your body can either restrict or enhance your ability to learn. The little hat thing didn't work out and me using gestures to be able to understand things did. Everything about it kind of makes sense, that moving around and using your body is a means to facilitate learning.

I've gained some things from [class] that made me believe my body is one and you can be connected with your body in certain ways. Connectedness, knowing your body, influences who you are, the things you do, how you're connected with yourself, how you're in tune with yourself, and the way you take care of your body. The activities I did with my girlfriend were really good. She helped me do the body map. So it was a good .... it helped me with communication with my partner. Because I'm not a talkative guy and I don't talk a lot. So through that experience we were able to talk about something.

Being confident in the way you walk, being confident in the way you speak and the way you use your gestures, even facial features is important. If you go in a room slumped and laid back, they won't see you as being as professional as you would if you walked in the room and stood up very erect and projected yourself that way. Sometimes I find myself not doing that, because I'm a laid back guy, so when I get in a room I try to create that atmosphere. But I think at some point you have to be the authoritative figure.

In Kathy’s case, embodied learning was a vehicle for interpersonal reconnection within her marriage. So much of their shared energy had been directed into care-giving across the generations of their family. They were both surprised by what a course on experiential anatomy brought to their lives. Kathy explained:

Sometimes the exercise had to have a partner. One of those was massage of the skull sutures. My husband and I both did that with each other, and we both found that very relaxing. He enjoyed that, and I did too. It kind of soothed
both of us. He has trouble with his neck and he enjoyed it more than I did I think. So we did it more often. (Laughing) Once in a while we still do that. One of the exercises that I do keep up is the deep breathing. That's very relaxing and I do that every morning.

My husband drew my body map and enjoyed drawing it. I actually laid on the linoleum floor, and I remember him saying "Now you need to hold still." I held still as I could, and kind of giggled as he was going around. I said it tickled. And then the surprising part of it was when I looked at it … it looked pretty good (laughing). I liked it because it looked thin. He wouldn't let me draw him though. I don't know why. He says "No, I'm not layin' on that floor for you to draw me." But he did draw me. So. (Smiling, laughing) Well anything that has to do with my body, he likes to do and touch or draw.

When the health assessment class started, I said "This is what I have to do in school and you have to help me." And he said OK, what should I do? And he enjoyed it. Then the next time I came home from school he said, "What do we have to do for class tonight?" He said to me, "You work so hard. I hardly ever get to touch you". I give him a kiss and go to work. When this class started, he said "I get to touch you, every time you come home from school, at least once a week." (Laughing). So yes, he enjoyed that. And he still does. He says, "Why don't you go back to the body stories?" We do the skull, and that's about all for now. We did enjoy it and it brought us closer together. It did.

Awareness of body in space improves affect management. Sometimes new body awareness made life more pleasant as emotional expression became easier to manage. One example of how this came about from interpersonal rituals is the playful interactions John described having with his daughters. His increased body awareness seemed to arise primarily through these interactions. He imagined exchanging places with their bodies.

They are what's most sacred in my life. With the class what I became more aware of with my body is how it related to my children, how I picked them up, how did that feel for them when I picked them up? I have a daughter who's two, who's 42 pounds, and she's as tall as her four year old sister. She's built like a tank. She's not fat, she's solid. And I pick her up different than I pick up my four year old who weighs 32 pounds. I was more acutely aware of that after this class. I thought, OK, that's why I pick her up this way, because my body tells me "Don't pick her up that way, because it's going to hurt." I became more acutely aware of why that was. Before my body would just do it, it was automatic. I just never thought of it as my body was separated from my mind in that way.
By combining this heightened attunement to his daughters, through his body, with his changed style of acting on his body messages as described above, John found that he was managing anger differently as well. He accomplished this not by noticing the emotion, but by attending to what his body was doing and responding to that. He understood connectedness. He stated:

*I'm able to relax more. I'm able to slow down at a moment of extreme excitement, and you just do the breathing, or even sometimes when I'm extremely mad ... I'm human, I have a temper ... especially in tubby [during his daughters’ bath time] ... I was more aware of what my body did and if I can stop what my body does when you get angry ... if you can stop what your body does then you can stop the reaction.*

This visceral body awareness category of connection to self began with noticing what one’s body can do and experience and then extended to influence the ways in which participants listened to and care for their own bodies, how they interacted with other people especially those close to them, and sometimes affected the ability to manage negative emotions. All of these could be viewed as better health or greater wholeness. The next section attends to how connections were made between pre-conscious knowing and actions taken.

*Emotion and Behaviors Outside of Conscious Awareness*

Remember the broad spectrum of interior experiencing that makes up interoception. First, there is the visceral level of awareness based on the body’s sensory perceptions from internal organs and from the periphery that tell the body where it is in relation to time and space. That kind of experiencing comprised the first category of new patterns of connection to self. This second category grows out of the interoceptive awareness of emotional responses and the actions they drive primarily without using conscious thought. Much of this awareness is
processed through the brain. Some participants, the ones who are included in this category, were most cognizant of their increased awareness of emotions and the interior body experiences that were connected to them. Sometimes connected actions arose from those emotions.

Along with this emotional awareness they noticed an emergent embodied practice in their ability to relax within chaos or calm themselves when experiencing negative emotions. The practice is considered emergent because it arose spontaneously, without purposeful attempts to train themselves in specific practices or settings. All of these participants talked specifically about stress and the impact it was having on their lives. They were experiencing work related stress, and some also had current personal stressors. Their embodied learning was meaningful for the part it played in helping them respond effectively to their bodily signs of stress. Stress and negative emotion were essential to the pattern of connections they formed in self-organizing around embodiment activity. All of them had created new self-calming routines.

*Automatic switching to an altered state of consciousness.* For example, Cadence was very clear and methodical in identifying what worked for her as embodied practice to manage emotions. There was a process that involved achieving an altered state of awareness and she had to be in control of that process. Through repetition she created a default mode for embodied functioning … her way of being in the world … when surrounded by chaos. Cadence stated:

I have noticed learning from those exercises .... that if I do need to calm down, I can do it to myself in a much quicker manner than I would have before. Just because I've had the practice, building it up over time. And that I can do it standing, sitting, lying … because we've done all the different positions. So I think with the repetition we've been already pre-set … sort of like a radio … to automatically go back to that.

That [constructive rest] I find more calming, and I find that I can let myself do that, as opposed to the trance dance, like a state of dancing. That dancing I feel is so out of control and how can I possibly be in control … [With constructive rest] I feel that I'm in control, even though I'm going into a different state of mind, to calm myself down. Cause I work in a pretty stressful environment. With working in that much of a stressful environment, I find that
often times I have to just step back, calm down, reassess the situation ... because things are always changing.

Furthermore Cadence viewed these changes as directly involved in the decisions she had made about interpersonal relationships and where her life was now heading.

In the beginning, when I had first taken the first body story class, it was in the spring. I had been in one relationship and that quickly ended. I think perhaps it ended because I was listening more to my body than what I used to. That I was ... instead of just ignoring it and putting it on automatic .... I listened to what I was feeling, and so the relationship did dissolve, but for good reason. And finally that I have matured, and that I was looking for that relationship that I have found. Now I am going to get married, and I am having a baby. And I feel that I have come full circle to a position where I'm comfortable in who I am.

Through deep breathing over time becoming less emotionally reactive. Although Monica also evolved an embodied practice, her focus was less behavioral than Cadence and extended beyond herself to her interactions with other people. Her pattern of connections is quite complex, involving her emotions, self-confidence, work skills, negotiating conflicts, all connected through embodied empowerment. There is a new awareness of the physical body, but the significance for her is tied to the impact on her emotions, so she is included in this category.

I really liked the breathing exercises that we did as a class. They were really relaxing and made me clear my mind. I really enjoyed them, because once we were done with them, I was free. Like I felt stress free. I can go on with other things. And focusing, thinking about your favorite place. We thought about a favorite place where we wanted to be, and the breathing exercise that went along with that. After doing it, I was grateful that we did it. Because it really made me aware of ... my body. Before I never focused on my body. I thought about how I was feeling inside, and just things I focus on more now, I never did before. So I'm grateful that we did it.

I don't get upset or mad, very easily, after doing these. I'm more relaxed .... and if something happens, I don't get upset with someone very easily. Its hard for me to get mad or upset with someone easily. I'm more laid back now than I was. Before, it would lead to nothing. It would only make me more angry, if I got upset or angry about something or someone. Now I'm more relaxed, and if someone does something that's upsetting, I either let it go, or I just don't associate
with that person much any more. I don't get angry, any more, or frustrated as much.

I'm more relaxed now than I was before. Before, I was really tense. And I'd be tense all the time. But now that I'm more experienced as a nurse, I'm more comfortable and laid back. Going to work, I would be tense, because I wouldn't know what to expect. But now, I can take care of all these things and I expect what happens.

Purposeful breathing and focusing to disrupt panic. Maria’s body responses to stress are much more embedded, physiologically, than either Cadence or Monica. She also has both a deep theoretical understanding and an embodied sense of her current way of being in the world. She shows the same need as Cadence to be in control of what happens to her. One of the ways she manages this is with humor, ever mindful of her interior self, prepared to move to calm herself whenever necessary.

To be honest I have experienced anxiety in the past year. It’s the first time I experienced it. I don't know how to describe it.... uncomfortable. I don't know what to do with it. I just need to get it out because I'm not used to it. I've experienced panic attacks and I find them ridiculous. They come from nowhere. There's no purpose. They're not alerting me to anything. That's because the alarm system breaks. So I understand the physiology of it. It’s broken because of whatever's been happening with me. But it used to work very well. Like, it was very useful. It tells you when you need, and its not broken, and then you do it, you fix it, it alarms you ... DONE. Great. Thank you. And the transaction was GREAT! (Starts laughing hard) You know? Its like the brain, "Oh thank you Brain, you gave me the fear I needed, You gave me the this and that ... whatever" No, not so much lately.

Well, it’s getting better. But for the past few months it was pretty bad. It’s because a lot of other things were out of control, or beyond my control. So I didn't like this anxiety. I don't like it at all. Especially because it comes with no warning. Its usually like, something really stupid will trigger it. I was just watching TV. Why would I want to have a panic attack over this? You know? (Laughing) So I'm getting better at it. And I'm using a lot of these techniques to like, breathe, and just concentrate, and lay down, not in any particular pattern, but they have been very helpful in calming me down. Just owning the feeling and if I can't breathe just focus on the breathing. Whatever it is that I can't do, just stop, and don't think about why this is happening. Just take care of the symptom, whatever you need at the time. And it’s helped. I mean that's how I calm myself down.
Looking inward for the evolved body's answers to stress. The final excerpt in this category is quite philosophical. In some ways, it reaches across all the categories of emergent connection with self, but it rests here because of its emphasis on turning inward and the connections made to stress. Gabriella reaches across time with her frustration, lamenting her and our need to learn again and again the same lessons. Her conclusion is spiritual, recognizing that moving through continuous change requires a center, and perhaps that center is our embodied self.

A key learning point to me was an awakening to the fact ... something I've known intuitively ... that your body has the answers within. If you reflect inward, you can get your answers. I guess it rectifies with your conscience, what you believe is right. You're faced with a situation. If you really look within, you can come to peace. You know what's right. You can solve your problems. And I think all these exercises just reiterate that fact. If you can calm yourself down, reflect inward, really experience yourself, I think you can help solve your problems and navigate the chaos.

That's the other frustrating thing. Why do I always feel that I have to relearn and re-learn and relearn? You see all these great connections to your life and you're in the midst of this and you forget about that.

I never really thought much about the body ... The connectedness and the origins. That was all really fascinating to me and made me aware of how our body evolved into this, what we are. And then that makes me think, “Oh my God, all the stress that we’re seeing. How is our body gonna’ evolve in the future?” There were a lot of enlightenments that made me understand better and make more connections. And then got me thinking about how what happens is gonna’ change us. Even now all the stress .... Is that gonna’ speed up my aging? Is it gonna’ speed up my aches and pains? But then here’s your angel .... Here’s your angel telling you, like your warning ... your first alert you know.... I can do something’ about it now, you know. So I have some tools to do something about it now, before it gets to the point where you can’t.

Connections Between Interior Experience and the Exterior World

The third category of emerging connection with self emphasized experiences of increased self-awareness which were quite different for each person. It relates to interoception in its broadest sense. In these cases, the awareness attended less to the physical body, specific
sensation or emotions. These participants were noticing the connections between the constellation of internal perceptions occurring outside consciousness and actions that were taken at various degrees of conscious awareness in response to the outside world. Every participant who described this category noted how self-understanding came forth in the clinical practice environment.

For some participants, there was a new understanding of embodied wholeness. Participants in this category, like those who connected through emotional awareness, were more likely than the visceral body awareness group to reference stress or trauma, suggesting that stress and trauma were important to their self-organization around embodied learning. By noticing the way these patterns of interoception link to clinical practice, we see that awareness of the connection between the interior pattern of pre-conscious knowing and action in the world facilitates survival learning within the context of the nursing practice. Interpersonal relationships were key to these new insights into self. Strong emotion is implied through actions or even discussed abstractly, but rarely named as clearly as “I felt” this. When participants use their self-awareness to empathize with their patients’ bodies, their nursing practice changes. Emergent embodied practice in this category is expressed in professional nursing, often as advocacy.

**Differentiation of self.** While participants in this category made their connections in relation to clinical experience, the dynamic movement was at a very personal level. Differentiation speaks to the recognition and valuing of one’s own perspective, connecting this with embodiment, and thereby projecting oneself differently in relation to other people. Eugene made some philosophical observations that considered his past motivations for action and realized a growing sense of autonomy and differentiation. He stated:

> I would say that sometimes growing up, I tried to … I mean you try to please people and try to appease everyone. So, looking at and **experiencing these**
[embodiment activities], you almost try to react the same as other people too. But going through the experiences helps you to understand how you personally respond to things. Rather than just saying, well, people want me to probably respond this way, therefore, I should. When you don’t know how to respond … in the body experiences, you should understand how YOU relate or how YOU react or how YOU view …. Whatever it is. Whether it be the movie, or certain activities. Its how your body and you relate to this thing. So I guess for me, I saw how I related to things, rather than “this is what’s usually done, therefore I should do that.” Does that make sense? I guess I had inklings of that beforehand. But it helped to solidify that understanding a little more I guess. Because if you don’t understand how you …. VIEW things, and understand and comprehend things …. How are you gonna learn from that? I guess. Maybe that’s a question.

This theme of autonomy and differentiation appeared again in Mary Beth’s story. She found herself experiencing some differentiation of identity, resulting in a deeper tie to the profession to which she had been committed for many years. Mary Beth stated:

I can get so caught up in some big catastrophe or trauma and have all that adrenalin rushing. I can really tighten up and not be aware of it and maybe feel sore about it a day or two later, but not even realize what it was from. But if I stay in touch with my body, I'm less likely to have stress related to those incidences. Then I realize that I'm there with a purpose, or for a purpose. I don't have to internalize so much and really hurt myself. Instead I can take care of myself by focusing on what's going on in me.

The more in tune I stay with what I'm feeling while doing my work, extending myself into it more, there's a benefit for myself, and for those that I care for and work with. Nursing, the caring component, was always one of my strong points that I brought to my profession. But with doing these embodiment exercises and just staying connected with myself, I think I can do a better job. Not just the job, but also feeling better about it at a personal level.

Nursing is my job, it is my income, but it’s also a piece of who I am. I didn't really like thinking about that before. I liked to keep my job separated from who I am. A lot of the times I don't tell people I'm a nurse, because when you do, you get their whole health history, and their whole crazy family history. When I'm not at work I don't feel like talking about that. So I had an attitude where I didn't share that information. But with this, I have embraced more the fact that nursing IS part of who I am.

A mirror reflection of self. A second form of understanding the connection between interior experiencing and the exterior world reported by participants was coming to see oneself
through others’ eyes. This entailed noticing a disconnect between interior experience, its projected actions, and the exterior world’s perception of these.

Like several participants, Rachel made observations about her interoceptive awareness during crises. What is different for her is that the learning was not about calming herself. Her learning focus was more external and attended to her connections beyond herself. It seems that Rachel came to know something about her body’s style, her way of being in the world. By noticing her embodied interaction with trauma she arrived at new insight into how she might be perceived, because of her body’s actions, and her embodied potential for responding in different ways. She sounds less helpless, more prepared to survive. Rachel said:

Through this class it really **made me understand what a hands on and activity driven person I am.** I always knew that I had to have lots of things going on around me. But I think **now I understand that I learn through the activity and participating and actually doing** it rather than by sitting back and watching.

I think everybody's body reacts differently to trauma. **When I've been through trauma it's hard for me to sit back and relax. I get to be demanding and I want to get up and do it now** (laughing). When I can't and that becomes **extremely frustrating** to me, that I can't get up and do it on my own and do it now when I want to do it.

I guess maybe the **body stories made me see it a little different.** It made me realize that’s what was going on. I never thought about it before. Whenever things in my life were traumatic I just went on about it. **I never thought about the fact that I was demanding and wanted to act right away.** I never really sat back and thought about "Oh, I was probably mean and demanding." **But doing the body stories made me realize how I come across.** It made me realize that everything has an effect, and **even if one thing's going wrong, the whole entire body has an effect and can help fix or not fix the problem.**

The same theme of how others perceive you appeared in Fred’s story. Fred’s new self awareness revolved around noticing gender distinctions in communication through the body. He made connections to both personal and professional life although all of that detail is not given in the excerpt. This story excerpt shows how Fred embarked in an exploratory way to try out new behaviors. Remember that Fred’s early body memories revealed that his way of being in the
world is very driven by sensory perceptions. He is bothered by fragments and likes order, a
beginning, a middle and an end. Fred told:

I learn through my body all the time. And I found I now learn more through my body by how other
people perceive me and what other people perceive that I'm NOT saying. How they read my non-verbals. I think it’s probably more particularly with emotions. I may be feeling one way and I think I'm portraying that but I'm not. I may be focused and concentrating on something else, but whatever my body is displaying is not that I’m focusing and concentrating. My body is displaying what looks like anger or frustration when that’s not what I’m feeling.

It’s a big circle. So I wonder what am I doing that's giving off THAT message? What's my body to saying to ME? Is there something else going on in my body? Are my body and my mind lying to each other? Why am I giving off this other message? What am I feeling? What is it being interpreted as? What is my real intent? I try to realize what I'm doing. Then I try to change that behavior to match what I'm really thinking, so that what I'm thinking and what I'm presenting are the same thing. When I get more feedback, it validates the change I made.

Then there is the factor of what that other person is feeling. So you have three things that I can have some control over and one I that I can't control.

Reciprocal flow between knowing self and noticing another. Sometimes, interoception, this self-awareness of connections between interior experience and the outside world, is recognized and labeled as such. In this case, Angela figures it as an ability to listen to self, an embodied self, and she sees this skill as an emergent feature of embodied learning. She makes sense of her self awareness as it is meaningful in the clinical environment. Self-awareness allowed her to imagine herself in someone else’s embodied place. During the interview Angela explained:

I think it just takes time. In this program I feel like there's a lot of self reflection. Its not a point on the syllabus like "Will receive awareness of self", but when you learn to think and when you look at all these other experiences through the course of the program, you can't help but think how that relates to you. And thinking about that is going to open up your awareness of self. You figure out a lot of things that you didn't know about yourself at the end of the program. It helps you to be a more well-rounded professional and a more well- rounded person. If you don't know who you are, then what good are you to
somebody else? **You have to HAVE that sense of self or you can't flourish in your own environment.**

I think that **listening is key.** **All the information that we need is already there.** You need a way to tap into that field of knowledge, and whether body stories works for you, or yoga works for you, whether tape recording yourself and playing music works for you, **you just have to figure out a way to listen to yourself.** Especially in nursing, **you're constantly listening to other people** and you're focusing on other people's care. You're focusing on your task list and on your meds. **You're not really listening to “What am I saying right now?”**. Learning to listen to that as often as you can **makes you a better observer and listener.** And it probably **makes you a better nurse, just because you look at things from a different point of view.** Then you try to think of how somebody else's sensory experience is affecting them.

During the health assessment class, Trudy found herself interacting with her body’s work related aches and pains. She increased her visceral body interoceptive awareness. Then, in the complex problems course, she really enjoyed the relaxation she experienced with yoga mindfulness exercises. She increased her emotional interoceptive awareness. She wrote in her learning journal, “The room was quiet and I could relax and concentrate. When we do these exercises I think of many things and find it helpful to organize my thoughts. I have even started to take some quiet time in almost the same manner when I have difficulty concentrating. I find it helpful.” Later she began noticing her patients’ behavior and understanding it in a different way. She created a new practice for herself and gave it meaning through connection with her patients. Like Angela, she found the significance of listening to self and came to identify with her patients’ body experiencing. In these ways she came to interceptive awareness of connections between her own interior experience and the outside world. During the interview Trudy said:

> [My cancer] patients use a lot of techniques along the same lines as what we did with the body stories. They do it to put themselves somewhere else [alter their state of consciousness]. **Now if I have an issue that bothers me, I'll try to go somewhere and relax or think it through and calm myself down. That's what my patients do too.** A lot or them get into Reiki [a form of touch therapy]. Sometimes when they're getting their cancer treatments they just need
to be in a quiet spot. They can't be in the same population or the same room with other cancer patients, because they feel they heal better when they pay attention to themselves and everything that's going on. I found that really related to what we did with body stories. The patients learn to pay more attention to themselves than anything else.

There are some that don't want to be in the noise with everybody else, or listening to all the complaints or problems, or stories, things like that. They don't want to talk about their family. They just want to go within themselves and stay there. There are two different groups who do that. One that goes within to withdraw, and then the others that do it to make themselves better.

**I find myself learning from them and what they're going through.** If they can take that information [embodiment] ... and they don't realize what they're doing ... *If they could take that and use embodiment to get through what they're getting through, then it's the same for me. I can use embodiment for pretty much any circumstance that I could be going through, to make it better or find an easier way to get through it.*

Each one of the participants in this study formed a new connection with themselves, broadly categorized into three forms of interoception, showing remarkable variety within these forms. There was integration occurring, a coming together of parts to form a new whole pattern of connection to self, and also differentiation in the myriad unique patterns within patterns that constituted their new connections with self. Many participants also elaborated on this interoceptive awareness by creating new embodied practices. While this section has used stories from the interviews to describe personal outcomes of embodied learning, the following section will call upon quantitative data to describe changes in preferred learning styles.

**New Learning Style Preferences As Re-Patterning**

This section presents quantitative data derived from administration of Kolb’s Experiential Learning Styles (1984). This inventory identifies learning style as one point on a graph of two intersecting continua. The point marks where two sets of binaries (concrete vs. abstract and active vs. reflective) meet. It should be noted immediately that this tool was used with participants as a vehicle for self assessment near the beginning of the health assessment
course. Its purpose was to foster discussion about how participants, as students, experienced learning and how individual differences might need to be considered during patient teaching. Discussion emphasized that we all have preferences, not that each person has an enduring style.

The same tool was used nine months later in a community health nursing course, during a class workshop on teaching patients in the community. Again, the tool was used to discuss individual preferences and how that plays out in nursing. This course was not a part of this research, but students participating in this study were enrolled in the community health nursing class and took the learning styles survey a second time near the start of this research.

When it comes to how we like to learn, everyone has preferences. Some people prefer to read alone and reflect alone. Others like to read and then talk to each other. Some people like to listen to lectures, take notes, and memorize minutiae for an exam. Others like to solve problems in the real life settings and think later about what they learned. These are all different styles of learning, perhaps best understood as patterns of preferences rather than as a single point on a graph. In this study, preferences for a particular style are considered to be separate from learning effectiveness. It is being assumed that preferences might be acquired from habit and that they are often unconsidered. This means that preferred learning styles would be identified in connection with experiences of schooling and not with personal identification of how one learns effectively. Having said that, this section is included because during the interviews, several participants made a self-assessment observation. Their learning style as measured by Kolb’s Experiential Learning Styles (1984) had changed.
The size of the group is too small to allow statistical measures of difference. Neither does the method of data collection support that. But a visual presentation will make the point that a group of RN students presented with a preference for passive learning, and after a sequence of embodied learning moved toward the concrete learning that is essential for responding to clinical situations and they expanded their repertoire along the action/reflection continuum. On the graph (Graph 6), X’s identify the learning style scores at the beginning of
embodied learning. The scores are closely clustered and they lie near the center of the concrete / abstract continuum, with a clear weighting toward reflection rather than action. Participant names mark their scores about 9 months later, after completing the embodied learning sequences.

Individual before and after data could only be identified for 4 of the participants, and their before and after scores are shown in color. For the total group, it is interesting that they moved strongly toward a preference for concrete learning and there is now distribution across the whole action / reflection spectrum. The four individual cases highlight another type of change. Each of these participants moved strongly toward the opposite direction on the action reflection continuum.

John was the first participant to be interviewed and also the first one to note a change in his learning preferences. On the graph, it is noted that this self-described very active, body conscious athlete scored an initial preference for somewhat abstract and quite reflective learning. And yet he noted that this was antithetical to how he actually learned to nurse. He learned by doing in the clinical environment. When his second score shows a move to preference for a much more concrete and active learning style, it may be a better reflection of how he says he actually learns clinical nursing.

The other participant who moved in the direction of action, away from reflection, was Rachel. Also an athlete who has noted her need to stay active, she states that her approach to school has changed. She used to worry a lot more and be hypervigilant about details and due dates and always worked alone. Now she is more relaxed about details and is more likely to collaborate with other students in staying on top of her work. Factors that she thinks have contributed to the change have been the realization through body stories that she does learn very
naturally and actively through her body, as well as growing weariness with school as she comes to the end of her second successive bachelor’s degree.

Gabriella, who began with a preference for concrete active learning that she linked with her past career as an engineer, moved toward greater reflection and even more preference for concrete learning. She explained that she understood this as her response to being in her initial precepted period of nursing, needing to watch everything that was happening around her and reflect on all the new concrete tasks she was learning so that she could pack them away in a form that could be called forth when needed.

Finally Mary Beth, who is the most experienced nurse in this group of four, began with a preference for a mildly active and somewhat abstract style and made a moderate move in the concrete direction and more strongly toward reflection. She gave no particular explanation for this but it is noted that the personal results she described for embodied learning guided her to stay in touch with her interior awareness during clinical chaos and resulted in a new embrace of her identify as a nurse. These outcomes would be consistent with reflection within a more concrete setting.

It is evident that no single trajectory can describe the movement of participants’ experiential learning styles scores and also that there was considerable movement. The individual before / after comparisons that were available show that movement across both axes in a relatively short period of time is possible and that participants view context as a variable. Perhaps embodied learning is a context that supports the re-patterning that is the essence of self-organization.
Summary of Personal Embodied Learning Outcomes

This section presented integrated qualitative and quantitative findings describing a year long dynamic embodied learning process within the context of nursing clinical education. Multiple individually unique experiences of evolving concept of embodiment and sense of embodiment clustered to create body awareness. These embodiment experiences also catalyzed integration (patterning of parts into a new whole), fostering new connections between past and present experience, sometimes by triggering emotion. A retrospective examination of learning outcomes revealed co-presence of differentiation and integration once again as was noted in Chapter 5 within the process of embodied learning. Overall learning style preferences changed in ways compatible with clinical practice where action trumps theorizing. Participants all valued and applied some form of emerging connection with self manifested as different forms of interoceptive awareness and sometimes emergent embodied practices. Each participant formed new patterns of connection that were personally strengthening in their current context. They self-organized in a way that was practically useful to them and supported survival.

This integration was particularly influenced by past body learning (such as sports training) and current experiences of past and present severe stresses. High stress inhibited integration in two ways. There tended to be either intense expressions of emotion (such as anxiety) that weren’t conducive to the interpersonal relationship aspect necessary for integration, or emotion was unexpressed and this seemed to be present with a more abstract approach to learning. But this was not an insurmountable problem as the embodied learning was used in these cases to direct their heightened interior awareness toward self-calming or embrace the new insights accompanying self-awareness to change
behaviors. Even negative emotions can contribute to integration, but they tend to accompany a more frozen pattern of interpersonal connection. By transitioning emotions to a more ordered state, they were able to redirect energy into relationships. In many cases, this happened in the work setting with patients, often achieved through identification with the patient’s body. The outcomes arising from this relationship between embodied learning, trauma and complex clinical situations will be the focus of the next section.

Being Heard and Forming New Patterns In Practice

Certainly it is a moving experience to read the stories that have been shared in this and the two previous chapters. Having the opportunity to tell clinical stories to someone who would listen and understand was also extremely meaningful within the context of class, which is where these participants first shared their stories. Participants attested to the fact that, like war stories, clinical stories are usually withheld. Their bearers realize that the images are experienced as intrusions by people who don’t identify with them. The stories carry such emotional connection and meaning that they are protected from that rejection. But untold stories don’t die. They live with the bearer, waiting for the right time to be told. It is in the telling that they can express their life and move across time and space to part of that pattern formation that is coherence and that flows from self-organization. In this way, the telling becomes essential for the stories to contribute to integration and therefore learning and change. This section recounts the experience of exchanging stories and the changes in practice observed by participants when interviewed 5 months after the embodied learning ended (11 months after it began). The findings are organized in two main sections. The first section details the positive benefits participants identified as resulting from sharing their nurse stories. In the second section, interview excerpts recount the
way self-organization has extended their patterns of connection … their embodied learning … into the practice environment.

*The Power of Sharing Nursing Clinical Stories*

In the following section, excerpts from participants’ journals during the complex problems in nursing class will show how students reflected on the experience of exchanging clinical stories with a partner. While the stories were shared in the class itself, the participants reflected on the power of sharing the stories in the interviews five months later. Thus in what follows, there is data from both the journals and the interviews.

The stories were to be about a challenging, memorable, complex clinical situation in which their embodiment played a significant part. These stories were shared near the end of the semester when these 11 students had known each other for 7 months of embodied clinical nursing education. (Three participants from the Health Assessment Course had already completed this course, and two others who took both courses were unavailable for the interviews). They had completed the Body Stories program and had several weeks of practice using a yoga mindfulness grounding practice in class. The story sharing exercise was initiated with me as the instructor telling a clinical story from my own experience caring for burn patients and describing a particular case, which remained with my dreams for several years. Following this, and then also at the next class, students worked in pairs to tell and listen to each other’s clinical stories, finishing with validating responses. The reaction to this activity was overwhelmingly positive as indicated in the course CIQ, learning journals and interviews.

*Validation for the Instructor*

Because we don’t often tell the stories that reveal our vulnerability, it was a risk to do so in class. What would students think? What would they feel? Would they be willing to respond
with their own stories? Their engagement occurred quickly and began with a thank you, expressed in class and reiterated in the learning journals. Gabriella wrote:

Thank you for the beautiful story! I was so proud and amazed at how you even thought of bringing the soldier out of sedation to allow him to make his own decision about his body. What a priceless gift! I see so many times when the doctors or the family just decide. I thought so much on your story. I was so greatly saddened by how it affected you. I did not think you deserved to have been haunted by that experience. (I know that this was not the reason that you shared your story) but I was so sad that you had to experience those terrible feelings. I am so glad that you were able to work through your feelings, and the beautiful visualization of the soldier parachuting down overhead, whole, smiling is very powerful for me.

I am finding myself in the same situation with some of my experiences in nursing. I do not want to feel that way. It is so incredibly draining. And, I also feel that it is unfair. Talking about it to someone who understands really helps. I enjoyed the exercise, and it really drove home the fact that if you can talk to another nurse that you trust about disturbing experiences, it can really help the healing process. I should have married a nurse.

There were two groups of reflections on the storytelling activity. Some participants wrote about the experience of exchanging stories, others didn’t mention it but told their own story in the way they needed to at that time. In this particular instance, the high stress group (described in Chapter 4) was distinguishable. Perhaps this was coincidental, but with only one exception, those who were experiencing high levels of current stress, high adrenal burnout, and symptoms of traumatic stress were the ones who did not write about the story exchange experience. There were clearly strong emotions connected to what they did write.

Potential for Wholeness: I’m Not Alone

There is a surprised relief in sharing these stories, which are usually rejected by non-nurses, and having someone understand and be able to say something in return. Participants valued not only the telling but also the chance to listen. Still, there were variations in how this occurred.
Problem solving. Kathy’s response was the most pragmatic and devoid of emotion. She has been a nurse for many, many more years than the others and now works as a manager so she is not involved in direct care on a daily basis. These facts certainly colored her response.

We shared a similar situation that involves the whole system in charting medications. I was glad to hear I was not the only one feeling frustrated on the way our charting system is timed out before we get a chance to chart. Now I will be able to take back some information to improve the system.

Changing the emotional valence. Sometimes participants had tried to share a story with spouse and friends but found they had limited empathy or ability to even understand. In the process of telling and retelling that occurred in class, the negative hold of these stories began to change and the tellers saw their stories in a new way. So across time, through an interpersonal relationship, they were organizing a new pattern of connection. Achieving coherence allowed integration to emerge.

As Fred explained:

[After retelling the story the second week to his colleague] He was very good at picking up on the important parts and offering his encouragement that I had done all I could do. I felt myself relax a bit and even felt comfortable with the situation. The gnawing feeling is starting to go away. No wonder break rooms at work are full of conversation that would never take place in ‘polite society.’

Trudy noticed an interesting progression in her responses to the story exchange.

Although I found myself remembering a lot of pleasant experiences, during that time I was telling about them with negativity. I think this is because I have never been able to talk with someone outside the situation. The second time telling my story was more in depth and a more pleasant experience. I felt good about it this time because I told the story in a positive manner. I also remembered much more. It was a positive experience.

Feeling sadness. Robert wrote very little. He enjoyed hearing a story that was different from what he was used to but noted in his journal, ‘She talked about many sad cases, it was at
times too sad to hear.’ Robert doesn’t tell what connections arose for him to other memories, but he has revealed in the past that he wonders whether he uses his slumping posture in some way that relates to negative experiences he had growing up. This is not surprising in someone who grew up surrounded by civil war, had to leave his homeland, and is geographically separated from family members. We don’t know what he did with these feelings that arose and his journal does not suggest that he was using them to support integration, forming new patterns of connection.

Eugene also found the experience elicited some sadness but he found it useful. He had been experiencing very high current stress, much of it related to work, some to past experience. Apparently the telling helped him to retrieve fragments of stressful memory. He continued to elaborate on sadness when reflecting on another student’s presentation to the group and shows integration that leads to some new self-awareness.

It was helpful to relate to someone who works as a nurse and understands medical problems as sad and involved cases. Explaining it again helped me to picture it again in my head.

When Cadence shared her powerpoint about her frustrations and sad occurrences on the pediatric ICU, seeing that and the catharsis she uses to vent about her anger, it makes me consider my own ways to let out my own emotional tension from work.

**Differentiation: Story in Some Other Way**

Those who did not reflect specifically on the storytelling experience told individual stories that related to their own concerns. In every instance, integration was occurring as they connected with other people around and through strong emotion and created a new pattern of connections, between past experience and the present, usually through taking action.

**Validating self.** Monica, who has been concerned since nursing school about becoming a professional and being viewed with respect wrote a lengthy clinical success story. She described
a case in which she became attached to an elderly patient, was distressed at his decline, but managed her grief and persevered to track down his only relative in North Carolina in time for them to visit two days before he died. After all her expressions of fear and anxiety, here was a story of professional confidence and aggressive caring. In this story, Monica is no longer looking to family, friends, or colleagues to reassure her that she is good enough. She is evaluating herself, and she gives herself an “A.”

Positive thinking. Marie set herself the task of bringing positive experiences to her co-workers. This had been a theme throughout all of her journaling in both courses, pushing herself to put memories and experiences into words and discover new ways to use past painful experience to help someone else. She wrote,

Through this course we have determined that venting to another nurse can be very therapeutic, giving a frame of reference and an empathetic ear, which has allowed me to empty more fully.

Then she went on to explain that she wanted to put a positive spin on her sharing by sharing things that excite her with her co-workers. Her thought was that this could build up a reserve of positive experiences to counteract the inevitable negative ones. Her journal incorporated a prayer and a bibliography of online resources for nurses experiencing work-related stress.

Embracing the memory of trauma. Angela was also circumspect about storytelling within a journal that was very specific in its detail of reported events. She wrote that the activity triggered some intrusive thoughts, but she did not reject the experience. This must have been extremely difficult for someone who was facing, every day, the loss of her father to an illness that can’t be controlled.

I have never been so glad to finish a semester in all my life. I would like to thank you for your graciousness during this semester. I know you are aware of how stressful it has been, not particularly with your class, but the other one that I
took in conjunction. I always learn a little more about myself by taking your classes. It’s almost like mini-therapy, but in a good way. Anyway, the Body Stories experiences have made me think about my patient again, and wondering how her family is getting along without her. It’s strange how you don’t think of those things, and then one day it all of a sudden comes back to you. I continue to think of Margery, and hope that I never forget her.

*Revealing self through creative expression to raise awareness.* Cadence was not in class for the story-telling activity. As explained earlier, her clinical experiences are tied very closely to her own experiences of abuse. Instead she prepared a powerful and provocative powerpoint (referenced above by Eugene) which she showed to the class when she returned. According to the description she gave in her journal,

> It cycles through happy children, chaos, and broken children. The music in the background provided a complex rhythm to further entice the audience to think about complexity theory in terms of pictures and sound. I feel that the project left the audience with the impression that I wanted to leave them with: a want for change. The music of my choice might have been too hard core.

Perhaps Eugene didn’t realize just how insightful he was when, after viewing this presentation he wrote,

> The complexity of the alternation of pictures of kids who are healthy with those who have been abused or in accidents makes you shift emotionally and wonder how to sort it out, like Cadence feels.

Similarly, Trudy connected with the presentation and with Cadence through emotion.

> Without saying a word you could feel the complexity that Cadence must deal with at work. The presentation made me feel angry, happy, sad, and sick at the same time. I cannot understand the reasons for others to hurt children.

*Taking action for survival.* True to form, Maria did things in her own way. She missed classes and didn’t finish her reading, but she wrote about leaving “that evil place that makes me feel like a horrible nurse” and finding a new job, finding strength once again from her mother,
“the only person who supports me blindly in all my decisions;” and traveling to visit a frail
friend, dying too young. While we told stories, she was living a new one:

Her little window of hope for me for a fairy tale romance gave me some
hope too. I feel terrible for her illness and it’s hard to watch her slowly die. The
pathophysiology of illness is brutal and doesn’t care about the type of life you
may have lived or still have to live. There is a sort of guilt for being on the
healthy side, and even worse for being a nurse who walks in and out of people’s
lives while at their worst time. I struggle with that and try to find peace along the
way.

In this moving text, behind the nurse, we also hear the voice of the child who cried to her
mother for years, “Why did you bring me to this place?”; the voice of the woman who now says
“I only learned to like the U.S. in the past few years,” notably since she became a citizen.

**New Patterns in the Clinical Setting**

When participants were interviewed for this study, it was almost one year since their
embodied learning journey had begun. All 14 had completed the Body Stories and self-
assessment work in the Health Assessment course. Eleven of these also experienced embodied
learning as part of their complex problems course. They all commented that the interview
process was an additional learning event. At the close of the interview, when they had reflected
on the entire process of learning and shared numerous clinical stories, they were asked to
identify how embodied learning was carrying over, in the present, in their nursing practice. The
themes identified within learning outcomes earlier in this chapter reappear in these reports of
new patterns of connection in the clinical setting. *Connections with Self* (visceral body
awareness, emotional awareness, or awareness of connection between interior experience and the
outside world) and *Emerging Embodied Practices* (self-care, affect management, sharing
embodiment in close relationships, and identification with patient’s body leading to advocacy) 
are present and facilitate the self-organized connection to practice.

Very broad patterns in this section that are interesting include the fact that all the men, 
and only men, show up in the first two categories in which some aspect of dealing with emotion 
is paramount. These results corroborate the findings which showed the men to be experiencing 
the most compassion fatigue. As noted when discussing participants’ responses to story-telling, 
the highly stressed women showed up together. Here, in this high-stress group, 4 of the 5 women 
share in common the emergence of new embodied practice through identification with the 
patient’s body. All six highly stressed participants used the process of connecting embodiment 
to practice as a way of defusing some of the current stress. As discussed in Chapter 4, their 
individual patterns of evolving concept and sense of embodiment varied as did the type of 
interoceptive awareness that brought them in connection with self. But once they started making 
connections with nursing practice, through story and reflection on their actions, the consistent 
patterning of their group became evident.

Throughout this section, data from participants’ interviews is grouped within 5 categories 
of change in relation to clinical practice that participants connected to their experiences or 
embodied learning. The categories are re-evaluating personal confidence, recognizing emotions 
and managing responses, becoming more holistic, achieving balance and the habit of relaxation, 
and connecting through embodiment with the patient’s embodied experience. The text at the 
beginning of each category explains the general constellation of connections among 
subcategories of interoceptive awareness, understanding or sense of embodiment, and emergent 
embodied practices as it is present for that category. This gives an idea of the pattern of 
integration contributing the wholeness of the category. Then, individual excerpts are labeled to
demonstrate the individual uniqueness of patterning and the differentiation present within the category.

Re-evaluating Personal Confidence

Self-confidence in clinical practice can be a contributor to safe practice. It is important that a nurse make an honest appraisal of one’s clinical skills. Two participants engaged in this self-evaluation after experiencing embodied learning. Awareness of body in time and space and awareness of connection between interior experience and outside world are at play in these stories. These participants are using these emerging connections with self to help create new patterns of behavior in their nursing practices. They are reconsidering how they feel about themselves in the clinical setting and testing ways to change in a positive direction.

*Projecting confidence.* Robert describes this challenge of projecting confidence in physical terms which allows him to make a reconnection with his grandmother’s admonitions about standing up straight, a theme we have heard in his story since the first body memories and skeleton drawing. Now, he also places this issue within it historical / cultural context.

Being aware. Being confident in the way you walk, being confident in the way you speak. Being confident in the way you use your gestures, even facial features. Being confident in how you interact with clients and patients. I guess that's all about body movement and posturing. If you go in a room slumped and laid back, they won't see you as being as professional as you would if you walked in the room and stood up very erect and projected yourself that way. Sometimes I find myself not doing that, because I'm a laid back guy, so when I get in a room I try to create that atmosphere. But I think sometimes, at some point, you have to be the authoritative figure, I guess.

I didn't grow up with a lot of choices [in Liberia]. That's the thing. Mostly we were told what to do. That makes it a little difficult when you come here and you have to make all these choices for yourself. Nobody's gonna make it for you. So I think it would have been better if we'd had some choices, being able to make choices growing up. And now we all get used to deciding for ourselves. We knew the difference between right and wrong but you still need to be able to make decisions.
Don’t be over-confident. For Eugene, an all around athlete, embodied learning took him in the opposite direction. He was learning not to be over confident. He believed his clinical judgment skills were being fine-tuned through embodiment as he was learning to trust his intuition. Through intuition he is beginning to identify with the patient’s body. This text shows that his practice is changing as he realizes the unique complexity of pathophysiology. By starting to think past the NCLEX questions and outside the box of abstractions he is noticing new patterns of signs in his patients. He is making new patterns of interpersonal relationship connections with physicians and becoming a safer nurse.

Just not having an over-confidence in myself, but also understanding that intuition is key, and embodiment is key, and understanding a patient’s general status as well as taking care of the patient. As a nurse, we have call orders to follow. When vital signs are too high or too low, or something else changes, you follow the call order and let the doctor know. But embodiment can sometimes tell you the subjective or the other aspects of patient care, and these might not necessarily equate to something on the call order list because it might not be something the doctor would think that he needs to know. Now there are some times that I’ve called the doctor and said “I don’t think this really bothers you does it?” And they’re like, “Yeah, you’re right” and I’m like, “Yeah, I just called to cover my butt” (laugh). So I guess just through experience and understanding the patient overall …. You see things that aren’t necessarily important, legally …. but if it were another patient … it would be, maybe emergent, or more significant.

Recognizing Emotions and Managing Responses

Just like Robert and Eugene, John and Fred are noticing Emerging connections with self but for them this comes not through awareness of the body in time and space but through increased emotional awareness. They are attending differently to their internal body perceptions and their feelings, their emotions. By making connections between this awareness of emotion and their interpersonal relationships affect management is emerging as a new embodied practice, thus they are achieving integration. This is effecting their personal and professional environments.
**Remaining calm when annoyed.** John talked repeatedly during the interview about the “bad attitude” he brought into the health assessment course, and the RN-BS program in general. He experienced some overflow of this in his time at home with his children and at work. The embodied learning that helped him play with his children through the previously frustrating recurrent activities at home [bath time] also helped him as a nurse. He uses another new embodied practice of self care to help make this emerging embodied practice of affect management possible.

Did I learn anything that changed my practice as an RN? Absolutely. Now when I have an annoying patient, I’m able to just say "Whatever", you know? It's nice to know that you can change through just a little bit of .... 5 seconds .... of self-calming. Constructive rest is a beautiful thing.

**Increased empathy.** In a similar way Fred is using increased emotional awareness to build increased awareness of connection between interior experiencing and the outside world, which is another form of connection with self. It is implied that there is an emerging embodied practice of affect management.

Just an increased awareness and OK, If I'm feeling this way and I'm really frustrated and angry, I'll bet when I get a patient that's really frustrated and angry they're gonna feel the same way, or something similar to it. It allows me to have more empathy toward people around me.

**Becoming More Holistic**

Wholeness and interconnectedness are encompassed within the definition of embodiment that participants were exposed to in the health assessment course. These are also concepts embraced by complexity science. As explained in Chapter 5, an evolving concept of embodiment and also sense of embodiment were the two broad categories of embodied learning that coalesced into new forms of interoceptive awareness / connections with self in arriving at learning
outcomes through embodiment. Continuing then to make new connections with other people and
environments allowed new embodied practices to begin emerging. In this category, there are a
few levels of evolving holism, probably related to participants’ degree of exposure to the
embodied learning courses.

Thinking of the body as a whole. Recall that Rachel is a lifelong athlete who learns
through action and does not easily put words to her body experiencing. She struggled to
understand a new way of learning through the body. At the time of the interview she also had
not taken the complex problems course, so she had less exposure to embodied learning activity,
and no complexity science content or story sharing experience. She is at the beginning level of
evolving a concept of embodiment with no mention of a concurrent sense (felt experience) of
embodiment. She is tentative in identifying how embodiment carries over to her practice.

I don't know that it has a lot. Maybe it made me a little bit more aware of
the body as a whole? Knowing that everything has an effect, even if only one
thing's going wrong, or a single something's happening, the whole entire body has
an effect and can help fix or not fix the problem.

Noticing and teaching embodiment. Trudy is further along the trajectory of evolving a
concept of embodiment and she has approached the concept along more avenues. She
understands the wholeness while also distinguishing the way patients use a way of knowing
through their bodies to engage in new embodied practices. She has noticed her own and others’
expressions of stress in the body. She values this new understanding because it helps her
understand her patients and know what to ask them. She appreciates her evolving sense of
embodiment through mindfulness exercises and the connection with self that evolved from the
increased visceral body awareness she achieved. These experiences help her feel relaxed, and
her emergent embodied practice of nurse care is directed at helping other nursing students attend to their bodies and health.

I find myself telling the patients to relax and asking them how do you really feel? I find it easier to connect with a lot of them than I did before. Every part of them, every system is involved. And the family's a really big part of it. Every one is complex.

At our weekly meetings everybody's always so stressed and so on edge, and so ready to growl! So I want to try using some type of stress reduction just for maybe 5 minutes every morning, before we started out meeting. And then compare it to the days that we didn't do anything. Or I thought about seeing if there was anybody else in the group that wanted to take nursing students and do kind of the same thing. I could tell exactly which nurses at work are going to be way into it and which ones are going to be sitting there, "Are we done yet?" and thinking I'm nuts. Which is OK.

Holistic / Non-linear problem solving. Angela has evolved a firm understanding of the concept of embodiment, references ‘sense’ of embodiment experiencing (get grounded), and makes multiple references within the trauma metaphor to the categories of nurse learning identified earlier in this chapter. There’s emotion (terrifying) and lots of connection to other people and practice, so she has integrated not only through embodiment but also by incorporating complexity science principles into her movement through the clinical arena. She is not using specific complexity language, but what she describes is the negotiation of complex problems by using non-linearity. She also shows that she uses the empathy generated by identifying with the patient to facilitate her critical thinking. It is clear that her process of integration enhanced awareness of connection between interior experience and the outside world, so she has a better understanding of her own perceptions and actions and through this come emerging connections with self. Her further reflections about empathy and identifying with the patient appear later in another category.

I think it [embodied learning activity] has made me a more well rounded clinician. I don’t go from point A to point B anymore. I try to get the bigger
picture. When you’re a new nurse you’re just trying not to kill someone or lose your license. You’re trying to survive. It’s a survivalist environment right out of school. They throw you on the floor [meaning the nursing unit] and it’s terrifying. But once you get yourself grounded and you realize, “Hey, I can do this job … I’m pretty good at it,” you can start looking at it from different points of view.

Achieving Balance and the Habit of Relaxation

This group included participants across the age and nursing experience spectra. They worked in very different settings and had come to emergent connection with self through varying forms of increased interoceptive awareness. What they had in common was a primary valuing of the sense of embodiment, the feeling of being relaxed, or energized, or free, because this sense made it more possible for them to go to work, stay there, and still feel somewhat healthy and balanced. Anything that brought them to that state was fine. Emerging embodied practices in the form of self-care were in varying stages of development.

Resetting the baseline level of tension. Monica had a few years nursing experience when she started these courses. What she didn’t have was a belief in herself and her own competence. She didn’t trust her sense of her own experience and looked to others to provide professional validation. She carried the lingering effects of fear and trauma learning connected with nursing school and her NCLEX experience. Learning to settle her nervous system helped achieve some body re-patterning and the ripple effects were broad reaching. She reported earlier that she achieved this through increased interoceptive awareness, something she had never attended to before. Her emerging embodied practices are a self-care routine that include exercise, attention to breathing and constructive rest for relaxation.

I'm more relaxed now than I was before. Before I was really tense, all the time. But now I'm more experienced, I'm more comfortable and laid back. Going to work, I would be tense, because I wouldn't know what to expect. But now, I know I can take care of all these things and I expect what happens. So I'm more relaxed now than I was before.
Practicing and sharing embodiment. Kathy has also incorporated breathing and constructive rest into a regular routine, like Monica. She used her connection to self through body awareness early on to make connections with her husband, so she was an early adapter of the practice of sharing embodiment in close relationships. It seemed a simple process for her to begin a new practice of self-care and she made a smooth transition to the practice environment, transferring her own self-care practice and sharing this in a emerging embodied practice of ‘nurse care.’

The deep breathing part, I keep coming back to that. And the constructive rest when I go home and stretch out and relax. I try to relieve my stress. I don't think I'm under stress a lot as a clinical manager, but there are times when you just need to have some quiet. I can go into my office or a private room or wherever and just take some deep breaths, and feel my body, and relax, and it helps relieve my stress. I have a good manager, I have support. And I always say my door is open, if you're under stress come in, take some deep breaths, feel your body, and be relieved. And they do. I think we taught that to a lot of our employees.

Seeking balance. Two participants identified with this search while also knowing it to be a dynamic process, so that balance would not be a place they reach and remain in permanently. There is a sense of constant movement and striving, with hope, knowing that in the moments when balance is found, the benefits are many and can be shared with many. Gabriella seemed to have more frustration with this aspect of continuous change, searching for a ‘tool’ that she could discipline herself to use to keep the balance in place. She had connections with self emerging through interoceptive awareness but seemed to be working to make new self-awareness connections that might make it easier for her develop a ‘tool’, a daily self-care practice with fairly dependable outcome. Perhaps she needed the understanding of her perceptions and actions that self-awareness would provide to help her act on her interoceptive awareness, which
was prodigious. Perhaps as a very new nurse, the transition stress is still too great and her trust in her experience too little to support this happening in a consistent way. With more time and experience, she might be able to reset her baseline level of tension just as Monica did.

It helped reinforce that there is a better way to tap into, another way …. and that’s good. Like a support tool. I need a tool so that I can get it [relaxation] to remain permanent and I can operate like this on a daily basis. I think I probably wouldn’t need another massage for the rest of my life. I guess that’s why this intrigues me so much. Embodiment really helps, but it needs to be my way of life. It helps me focus on what’s important in my life and it’s a great exercise to find that balance, that’s your base.

Mary Beth had formed her new *connections with self through self-awareness* and a new sense of her identity, particularly her identity as a nurse. So in this way, she was different from Monica and Gabriella who connected with self through interoception, and Kathy who connected through body awareness. She came to the nursing program with a well developed personal routine of embodied practice through yoga and alternative health practices. What the *new self-awareness* in nurse identity did was show her a way to bring her healthful practice into her work environment.

My passion for helping people is rekindled, and focusing and trying to stay connected keeps me more balanced. I can go to work when I'm miserable or having a really bad personal day. And you can go to work and do your job, and you can do your job and get by, its OK. BUT, I think the happier and more balanced I am, the better I can do my job. If that makes somebody's day a little better, that's better, that's the way I look at it. I think somebody would rather have their health care team healthy and balanced and feeling good. I would!

*Connecting Through Embodiment with the Patient’s Embodied Experience*

These four participants are clearly engaged with an emergent ability to empathize with their patient’s body. Prior to beginning the connections to practice in the complex problems class, their patterns of self-organization were differentiated. There are high degrees of stressful life experiencing here, but this is true for some other participants who are not having this
experience. Only one was experiencing compassion fatigue. What they share beyond the history of stressful experiences and current stressful experiencing related to these is that all of them have been dealing with serious illness in someone close to them, or in the case of Marie, herself. All of them also share here, or did previously, stories of recent experience with trauma learning. This is a very complex mix that is best understood as a composite response. It is broken down here to identify what might be some developmental process.

*Emotional connection heightens awareness of patient experience.* Angela identifies that this has begun to happen for her. We don’t know when this started in relation to the trauma learning story she shared earlier. But this is not sympathy nor a rational understanding or even a self-awareness achieved through emotional response. She specifically describes knowing through trauma.

> I think embodiment has given me an awareness that whatever I may be feeling …. Somebody else is having an embodiment experience also. Before maybe I was a little less sensitive to that. You don’t realize how traumatic hospitalization is for some people. Things that I do every day and don’t even think about are a TRAUMA for somebody. Having to catheterize someone, starting an IV … people who are terrified of needles want no part of it. That’s like a daily occurrence on our floor. It has taught me to be more sensitive to how far out of someone’s embodiment experience they might be just by being in the hospital. How much it shakes up what they’re used to.

*Emotional connection heightens awareness of patient’s body.* Marie describes an attachment that enhances her assessment skills and fuels her persistence in communicating with physicians.

> I think embodiment is carried into my practice mostly emotionally. If a child I'm taking care of is intubated, I make sure that they're comforted. Making sure that they realize its not their fault that this happened. Especially if they're more cognitively aware. We had one little guy who died recently. I was very attached to him. Extremely attached to him. He had a congenital heart defect. After surgery he was moving toward feeding and going home. And there just was something not right with him. He would gag and gasp and totally sputter and just
freak out and get upset. I kept thinking there's just something else going on with this child that we don't know. Maybe it's not his heart. Maybe it's this gastric issue that he has. I thought maybe he had some tracheo-esophageal fistula we didn't know about. I kept going to the doctors and asking them about it, and the attending physician at the time said it didn’t seem to be a problem. But when attendings switched and I had the patient again, I mentioned him to the new attending and he goes, “Well what medicines was he on at home?” He was on Reglan. “Well why?” “Cause they thought he had reflux.” He goes, “Did anybody check him out?” and I said NO and he said, “Well let’s do that.” So it took like almost a week and a half for that concern to get heard ….

*Identification with the patient’s body.* This form of experiencing has an emotional component, and may be emotion driven, but it not described as arising from an emotional connection with the patient. It may be some emotional connecting around trauma experience such as Angela experienced, but the quality of this experience is different. These two participants told stories of experiencing the environment as they believed the patient was experiencing it, in the moment, and across a boundary that ordinarily separates two people. In both cases this identification evolved into new patient advocacy behaviors.

Maria was working in a neuro-ICU and had to pass a naso-gastric tube on a patient. She didn’t have a lot of experience with the procedure and was not confident, and she was stressed by the fact that everyone was watching her.

I kept trying to push and push. It wouldn’t go anywhere. I tried again, it wouldn’t go. Something was wrong. I could feel it in my body, like “Why is she trying to poke me with this thing? This hurts!” The other nurses were laughing at me but they wouldn’t help. I told them something wasn’t right, that the tube wouldn’t advance, it kept running into something. They didn’t listen. Then the doctor came and they were all calling me chicken. In the past I would have kept trying because I would think “OK, I just need to keep trying so I learn how to do this.” But this time I thought, “It’s not me. Something is in there. It feels wrong. I wouldn’t want someone doing this to me.” So I put down the tube and I said to the doctor, ‘OK. You do it.” And he tried, and he couldn’t pass it either. So he said, “You were right. Something’s in the way.”

Cadence has had similar experiences and now makes a point of teaching nursing students to be alert to their patients’ experiencing. It is lengthy story but is offered up as summary
because it makes clear how an individual nurse’s past traumas enters the clinical setting and in productive ways can allow them to connect, through embodiment, with the patient’s body and experience.

Sometimes people say things about a patient and I bring up, "Well, how would you feel if somebody said that about you?" People who are sedated ..... if they're paralyzed, they probably hear. So don't talk about the patient. Because if I was the patient, and I was tubed, and sedated, and I heard .... There have been documented cases about this, that people wake up and they know which nurse is getting married or something about her husband. So I try to bring this thinking to other people who haven't had that education.

I had one student for three days in a row. I was able to show her some of our long term kids. Especially one of them that turned two in August. She's been with us since she was born. She was a twin and a 23-weeker. Mom did crack while she was pregnant with her and the twin. The twin died. This one has a G-tube, a trach, she's just a mess. She went home for 36 hours in her whole life. That's it. So she's ours. But she's not legally ours because we can't sign off. The parents don't want to sign off because they get too much money. Cause now that she's gone home … that makes me so mad … but she went home for 36 hours, so regardless of whether she went home or not, her bill is probably up to six million dollars. And we're not seeing anything from her Mom. Her Mom's keeping all that money. So of course her Mom's gonna keep her alive. She's getting free money. She doesn't have to work. And she's pregnant with her third one.

Anyway, I introduced the nursing student to the patient by name and told her she was a long term kid. I said she's like a dog or a bee, she knows when you're scared of her or intimidated by her. If you are, you'll have a bad shift. She's tried to die on numerous people. She tries it all the time.

But, regardless of what we think her cognitive level is, people forget to treat her like a human being above all else, even if she is two. It irritates me all the time. Treat her like she's a little person. Treat her like she has feelings and like she can understand you, because we don't know what she can understand. Again, it comes back to the body stories. I even told the student this. If I was in her situation, and grew up to know that people talked trash about me all the time, or people didn't like me, because I was there, it was all out of my control, whether I was there or not … I would just want to be treated with respect. I'd like to think that she knows that there are people who love her. Because she doesn't have a Mom and Dad like everybody else does who come in and visit her, you know?

I mean, I came into this world, I was adopted, the only person who's been through my whole entire life is my adoptive Mom. Without that love, where would I be? That's kind of an emotional thing, not so much a body thing, but it still ties in. If she has somebody assigned to her that doesn't like her, she tries to die all the time. Because somebody that doesn't know her is somebody that doesn't want her. Whereas she can have a great night with somebody that does love her. She knows. I know she knows. And that's what I tried to pass on to the
student, you never know. You always have to take into consideration, assume that they know, assume that they feel, assume that they would know everything that you know if you were in their place.

Conclusion

There was a flow to this embodied process that has been explored throughout the past three chapters. Participants created unique patterns of coherence in repeated spirals back to the past then forward again to the present and the imagined future. We saw in Chapter 4 that fear, horror / intense novelty, and trauma are present in nursing learning in consistent ways, and the survival learning that constitutes professional socialization includes aspects of all three.

In the complex clinical stories that revealed these aspects of trauma, there was evidence of connection back to the embodied learning process described in Chapter 5, beginning with the early body memories that participants wrote about in their first learning journal as part of the health assessment course. Building on these memories with emotion and interpersonal relationships, they made connections forward, through embodiment activities, forming unique patterns of connection that each one could bring to their understanding of complex clinical situations.

Chapter 6 has explained these individual patterns of connection to self that arose out of collected moments of embodied experiencing. The three types of awareness comprising connection to self assisted that process of spiraling back again, into past and into memory, to retrieve the details of clinical experience. These memories came forth as stories, and the stories carried aspects of trauma. By using the interpersonal relationships among participants while they were in class, the clinical memories were reconnected with their attendant emotion, and in many cases, the emotional valence of the stories changed. Over time, in the retelling, the patterns of
connection within the stories were re-formed. Out of these new patterns, embodied practices that impacted the clinical setting began to emerge.

Where trauma has been greatest and the current experience of related stress most present, the force of new actions taken has been the most dramatic. A year after the embodied clinical learning process began, every participant interviewed had formed new connections to self, attended to emotion related to clinical experience, and reconnected with trauma in some way to make one or many connections across time to present practice and the formation of intentional actions. For everyone, unique patterns of integration occurred. Despite the presence of some burnout, compassion fatigue, and traumatic stress symptoms, no one evidences a post-traumatic stress disorder and no one intends to leave nursing. They find themselves more committed than ever.
CHAPTER 7

DISCUSSION AND IMPLICATIONS FOR PRACTICE

How can a learner who does not know what there is to learn manage to learn anyway? (Thelen & Smith, 1994, p. 280)

The introductory quotation was selected because it speaks directly to the mystery of embodied learning. So much of our learning through the body occurs outside conscious awareness and without any conscious effort. Even when we become purposeful in building awareness of it and use reflection to help us add language, we still don’t encounter rationality. So how is it that we learn through embodiment? How do we manage to learn without a content outline? But we do, throughout a lifetime of experiencing, no matter where in the world we live or how diverse those experiences are.

This study sought to understand more about how this happens by looking at a very specific instance within a specific context: a cohort of RN-BS students exposed to a carefully planned set of embodied learning experiences and theory within two clinical courses and stretching over an extended but delimited period of 11 months. Grounded in a complexity science theoretical framework, the purpose of this study was to explore how RN-BS clinical students learned through their bodies, how they formed new patterns of connection, and how these patterns related to trauma. Research questions asked: (a) when RN-BS students are taught using a neurobiology based mind/body model within an experiential curriculum that actively involved their bodies, how do they make patterned connections about clinical learning; (b) how are their unique patterns of trauma involved; and (c) how do they make connections between the curriculum, their personal lives and professional nursing practice. In the following sections this chapter provides a review of the findings discussed in relation to the theoretical framework, then
implications for adult education, recommendations for further research, and some final reflections are provided.

Discussion of Findings in Relation to Theory

In the findings chapters (chapters 4 – 6), theory was interspersed and discussion from the literature was provided throughout in order to ground the analysis of data, and to make clear how the findings connected to complexity theory in specific ways. This chapter begins by taking a larger view of the study in the first section in relation to complexity theory in light of the context of this study in nursing education. In line with the complexity theoretical framework, two perspectives, global structure and local variability, are examined in relation to the context. This beginning discussion provides background for the following sections in which the language of global structure and local variability are used as a final form of analysis. Subsequent sections summarize the findings in connection with relevant research in adult education, discuss the implications for adult education, and then conclude the study with closing remarks.

The Context-Specific Origin of Knowledge

Thelen and Smith (1994), from the field of human development viewed through embodied cognitive science, write about the context-specific origin of knowledge. There is no shortage of literature that highlights the importance of context in adult learning (Merriam, Caffarella, & Baumgartner, 2007). Learning frames dealing with professional practice in the situated cognition / communities of practice literature, highlight the importance of context in relation to learning through reflection (Lave & Wenger, 1991; Warhurst, 2008; Wilson, 1993, 2005). Situated cognition shares with embodied cognition and embodied cognitive science an anti-Cartesian perspective on cognition. Research informed by situated cognition has demonstrated the importance of context for learning with and through the body (Beaudoin, 1999;
Chan, 2002; Cheville, 1997). From a feminist-poststructural perspective, Tisdell (1998) suggested that experiential learning could challenge binaries such as person / context in order to recognize the interplay that occurs between bodies and the world. The fact that Thelen and Smith (1994) highlight the importance of context in the construction of knowledge is certainly not new to adult learning.

What is new, however, is their attention to the context-specific origin of knowledge from a complexity science and embodied cognitive science perspective. The dynamic systems approach to development of cognition and action (Thelen & Smith, 1994) is an empirically derived alternative theory of human development, and it undergirds much of the applied neuroscience trauma literature cited in this study (Beebe & Lachman, 1994; Schore, 2005; Siegel, 2001). For these reasons it is being emphasized in this discussion. Thelen and Smith’s (1994) view of the global structure allows us to focus from above on the shared, emergent, integrated pattern by which participants performed the same general act. Viewing local variability uncovers the view from below where we see the fluid, differentiated patterns and details, which are highly context dependent. From this view what appeared to be a cohesive whole is seen differently as having many meanings. Global order (integration) and local variability (differentiation) are two aspects of the same thing, tied together so that context, the here and now, is very important. Global / local dynamic is essentially the same as Siegel’s (2001) explanation of greater complexity being formed by movement between states of integration and differentiation, influenced by emotion and interpersonal interaction. Emotion and interpersonal interaction would be considered part of the context, one internal and the other external. The emergent quality Siegel writes about is the human mind and the aspect of context
is centered on interpersonal relationship. This is the template for integration that was used in the analysis of findings.

This chapter’s discussion will consider embodiment as an emergent quality. Using the dynamic systems approach to cognitive development allows for a broader consideration of context and its influence on the self-organization of pattern. Thelen and Smith (1994) explain the process in this way: we each have a history of perceiving and acting in specific contexts and the history of these repeated here- and – now experiences make the global order, our pattern of possible actions. Context then effectively selects the global order so that we can perform specific acts. In other words, we have a repertoire of acts, a style for being in a situation, varying by specific contexts based on our history of experiencing in that context. Students’ body memory stories written at the start of class presented themes and memories that showed up in later stories, sometimes repeatedly. The repertoire differs for each person because their history of here and now experiences differ. That’s why we don’t all behave the same way at a ball game or in the classroom. Students didn’t all behave and react in the same way to the yoga trance dance on the first night of class.

There is a certain general global pattern of apparent sameness, but underneath the sameness veneer is a mass of variety dependent on our personal past histories. What was generally true was that students in the yoga trance dance context were concerned about being watched by other people and feeling ridiculous during a movement activity. The general learning in that event was that no one was watching. Therefore, it was possible to participate and not feel ridiculous, and with that anxiety removed, it was actually a good, fun workout. When re-exposed to a context, we already have a global order, a pattern of integration and simple
rules learned as useful in that context. So without having to analyze the context our actions are selected. The context draws them out of us.

The impact of past history interacting with context was also apparent in the trance dance event. Athletes Eugene and John were able to identify with the dance as a workout. Students like Mary Beth who had practiced yoga or who had used some meditation or relaxation practices found connection to that aspect of the exercise. A student with a history of abuse, Cadence, didn’t like the imaginal portion that altered her awareness and made her feel out of control in her body. Nevertheless, she didn’t feel out control in the experience because she knew she was free to decline the activity, and she chose to stay.

Finally, context adapts the global order by fitting the past history of here-and-now experience to the shape of the task at hand. Context changes us. Wonderful examples of this quality were given in the extensive stories about Maria and Marie. Maria used her experiences with evasion to craft her own version of body stories to meet her need to relax. She moved from initial resistance to finding the activities useful in a most personal way, and then extended them into work, changing her confidence in advocating for patients, and then for herself when she decided to change jobs. Marie used the experience to change the way she told her own story of her past so that hurtful memories became useful stories to tell her children and she embraced herself in ways that allowed her to change her self care and manage herself through a medical emergency.

Continuing with this explanation summarized from Thelen and Smith’s (1994) research program, global order is defined as pattern. It is the pattern of real-time activity in dynamic systems. The application to the data in this study would be that students, who are dynamic systems, while learning through experiential anatomy were engaged in real-time activity. They
brought a history of real-times experiences within the nursing school context, the clinical practice context as well as body learning and experiencing and trauma as contexts. These histories created students’ current global patterns around embodied learning and clinical learning. They came to class with a style, and this pattern is what Kelso (1995) means by intrinsic dynamics. This global pattern at the beginning determined what the global pattern could be (not would be) at the end of class.

Since knowledge can only be made manifest in a real-time task, context makes, selects and adapts knowledge (Thelen & Smith, 1994). This means that as students were perceiving and acting in real-time, going through their body stories exercises, working in the clinical environment and sharing clinical stories with each other, their individual perceptions and actions were being patterned into meaning by the context and each participant’s past history of that context. Context is not simple to delineate, since context included formal nursing education, the social group of a cohort, the practice arena which was our clinical learning context, and perhaps other perceptions of context. Context was complex.

Developmental research in the dynamic systems paradigm (Thelen & Smith, 1994) found that early on in a developmental trajectory, actions are tied very closely to the specifics of experience and the details of task provided by the context. This is one explanation of students’ concern with details and expectations the first night of class. In this study, students couldn’t move forward with embodiment until they had figured out their own style of doing the body stories. This new global pattern for ‘studying’ arose from their past histories with school, studying, learning styles, sense of embodiment. Initially they questioned what they were supposed to be learning, what the body stories had to do with learning assessment, and whether they could learn anything in that way. Once they developed a pattern for study, each one began
to notice aspects of the experience that pleased them or were meaningful in some personal way. They built new individual patterns of connection with other people, with memories, with new ideas in connection with the parts of the experience that stood out for some reason. After they build new experiences there is a new more complex global pattern that can be carried into other contexts. Once students had progressed through the semester of experiential anatomy many were still not sure what they had learned but they knew how to reflect on their activities and were ready to start connecting through them to the clinical setting.

The final phase of this process (Thelen & Smith, 1994) specifies that as the activity is continued, the history of perceiving and acting in real-time-experiences is extended to more contexts and two kinds of change can occur. Two things can happen in developing toward greater complexity. There can be a selection for associations that work across diverse contexts or there can be a selection of details that causes the system to reorganize and jump from one global order to another, changing structure. The pattern of global structure is knowledge. By the time students were interviewed 11 months after beginning to learn through their bodies they all could identify some aspect of their learning in the two courses and their change in interoceptive awareness that worked as connector helping them make a new pattern of some experience or behavior in a new context.

For some students there was change in global structure and manifestation of new knowledge, as when Eugene noted that he had learned in nursing school to just do what he was taught without thinking, and that harmonized with his past history of learning as pleasing people by doing what was expected. His body was something he trained into a vehicle for athletic success. The new global structure of knowledge for him is the awareness that he has his own way of seeing the world and acting and he can notice and respond based on his own assessments.
of situations. *His guidance doesn’t have to come from outside. Some of it can come through messages from his own body as with intuition. So now his body is training him.*

The language of global structure and local variability will return at times throughout the following sections while the findings are being connected with adult education theory and research. Continuing the linkage with theoretical framework in that way allows for a final level of analysis, like seeing the forest after being lost in the trees, and also demonstrates a way that complexity can speak concurrently, through adult development, with adult teaching and learning, as a language of connection. Any of the following questions might be asked to understand how patterns of connection are forming new structure at different levels: Discussion will consider how context is selecting the global order and how context is adapting past history to fit current task. There is an attempt to identify the pattern of global order since that would be knowledge. And finally there will be consideration of how far the global pattern has progressed in terms of stretching into new contexts. What are the associations being selected to work in diverse contexts? Have there been any changes in structure and if so, what details were being selected to make the pattern reorganization?

*Connecting Findings with Research in Adult Education*

Nurses always encounter the issue of trauma in the nursing environment; indeed, it is part of the context within which they work. Their way of learning to deal with this hearkens back to Aristotle writing in the Nicomachean Ethics that the things we need to learn before doing them, we learn *by* doing them. Students become nurses by practicing nursing. The categories of learning by doing that are visible when viewing this study from above are first, the ubiquitous presence of trauma in the survival learning of nurses.
The aspects of this trauma learning that are not attributable to the education and socialization processes are sourced in the tensions generated by a high-tech environment. Emergence of embodied connection with self is the second category. The last set of findings is summarized as new patterns of connection forming personal and professional knowledge.

Trauma and Survival Amidst Technology

_Trauma inherent to professional learning._ The first thing the findings made very clear is that fear conditioning and trauma learning are an inescapable parts of nursing education and practice. This is probably true, but with different patterns, in any healthcare profession that involves direct patient care. The picture drawn by participants stories is one of constant learning through fear during the periods of education and professional socialization, with certain rituals and structures that contribute to that experience. These beg for deeper study to understand the sources of trauma that are being created as structure and could therefore be changed vs. the sources that are inevitable, such as facing controversies about death and dying and being responsible for another person’s life. These types of situations need to be studied as recommended by Janik (2005) and Simonelli (2001) who both claim that trauma is being widely perpetrated within our formal education system.

The focus in this discussion is a bit different, attending to the embodied aspect of this early period of professional learning. A strong message coming from the data was that these RN’s are disconnected from their bodies at work. Yet their reports of the significant fear learning that accompanied the events all nurses must negotiate as survival learning, such as medication errors, unexpected deaths, responding to a cardiac arrest … in all of these cases what nurses reported was learning through their bodies in the moment. During first time events
they experienced forms of freezing and numbness along with the bodily acute stress responses. By watching and connecting with other people during the events they learned that their bodies knew what to do, that they could trust their bodies to know and remember, and in the future they didn’t have to worry because in essence, their bodies were now in charge. This is a beautiful tribute to naturalized embodiment. But the picture becomes chilling in light of the way people and bodies can be commodified for profit. This special kind of knowledge, learned naturally through fear conditioning, becomes a body’s tacit knowledge which organizational theorists (Nonaka & Takeuchi, 1995) seek to harvest to increase performance. Just as organs are harvested from one body to save another … at a profit … nurses’ body knowledge, hard earned through fear conditioning, serves to keep the hospital in business. This becomes more evident in examining the data connected with nursing practice context. In returning to this data a final time I am reminded that Leys (2000) taught us in her genealogy of trauma that the shift toward a psychological notion of trauma arose in the 18th century as industrialization was noted to carry a new form of violence and related stresses.

*Trauma inherent to high-tech environment.* In this study, nurses’ fear and trauma learning related to continuing practice were linked over and over again to stories about paradoxes that arise when treating patients in a complex, high-technology environment. It turned out that workplace education dissertation research using a complexity theoretical framework was quite useful in making sense of these findings. It should be noted then that complexity holds promise for future research around these work-based traumas.

Research on workers in high-tech organizations (Kerr-Edwards, 1994), found that there is frequently a disconnect between the educational requirements and expectations by the
organization and the support and rewards offered for efforts made. Knowledge often goes unrewarded while the perception of being knowledgeable is highly valued (Beutel, 1989). What these workers wanted from education rather than more facts was something of deeper meaning that connected to their personal and professional lives (Kerr-Edwards, 1994). The nurses’ stories collected for this research were full of wide divides between the ones who had direct knowledge of patients and their families (the nurses) and the ones who were more distant from embodied people but were ‘knowledgeable’ as required for making decisions about care. This polarity, in different forms, was a source of stress and at times, trauma learning.

Education responses that have proven useful in responding to these overbearing climates were those supporting learners’ self-organization (Eckert, 2003; Olscheske, 1999). Participants in this study appreciated being able to self-organize their own meaning around embodied learning and find ways to connect it to their personal and professional lives. Proficiency using embodied knowledge built up through an iterative process where they supported each other’s learning, shared embodiment activities, and connected with real world problems by clinical stories (Eckert, 2003). While high-tech organizations seek knowledge creation through networks of self-organizing groups with high-content communication sharing (Olscheske, 1999), nurses and others can use their new skills in self-organized learning to connect with each other to increase their self-care. Learning through embodiment opened up that type of connection when Marie, Trudy, Fred and Eugene chose to carry their coursework into the workplace, each in a locally variable way.

Trauma registered in the body. Adult development literature has documented that stress and trauma expressed in the body can interfere with classroom learning (Kerka, 2002; Kosbab,
The high stress group in the study demonstrated that this is true. What showed up as a challenge to learning with this group was not the fact of past traumatic experiencing, although past traumas were present. It was high current experience of stress, over old or current events, that was an interference. In other words the perception of being overwhelmed, van der Kolk et al’s (1996) definition of trauma, distinguished them. Embodiment provided a way to manage that stress, self-organized in uniquely chosen ways. Past trauma showed up in what was noticed in the clinical environment, as with Robert and amputations; or in responses to situations, as when Cadence identified with abuse victims and Maria identified with a patient who was not in control and couldn’t ‘keep moving’ as she always needs to do to avoid vulnerability. But all of them were high functioning. They each had a cluster of acute stress symptoms but not a traumatic stress disorder. Their symptoms were an expression of current complex context.

By engaging students in embodied learning connected with their personal past body memories and current and past embodied clinical stories the education process studied here sought to naturalize trauma rather than medicalize it in accordance with the perspective expressed by adult educator, Burstow (2003, 2005). Toward this end it was very useful to think of students’ embodied intersection with trauma as instances of fear and trauma learning under an umbrella of survival learning that encompassed family life, work life, life within a specific culture or geography, etc. The evolutionary neurobiological view of trauma expressed at communal levels as written about researchers such as Cohn, Mehl & Pennebaker (2004), Rousseau & Measham (2007), and Silove (1999, 2007) shares the naturalizing view. Their international research intends, like Beathe’s radical work on teaching adults (2005), to bring to consciousness the socio-political contexts that create trauma. In its own small way, this study of
RN-BS students’ embodiment sought to do the same. Adult education might productively work with this body of research to do as Rousseau and Measham (2007) challenge … uncover the structural violence in larger social contexts that both engenders and obscures the sources of trauma. Pragmatically, the model of communal trauma that Silove (1999) developed can be used to understand and respond to nurses’ professional fear, trauma and survival learning.

This discussion has started to explore the complex interconnections between bodies and trauma within a specific professional context that includes not just the workplace but the process of education and socialization and probably other factors as well. It ends with attention to one of the few adult educators engaging work with trauma. Danish lifelong learning educator Horsdal (2009) argues that social constructivism and discourse theory seem to neglect our embodiment while focusing on language. She suggests that a theoretical orientation that includes cognition distributed between people, and an understanding of bodies that includes brains, makes more sense. Personal experience, she writes, is embodied and its consequences are biological. On that note, we move forward to discussion of results and embodiment

*Self-Organized Emergence of Embodiment*

In this study of nurses learning through their bodies and the relationship to trauma, embodiment appeared as a recursive, self-organizing process. The following section distinguishes three aspects of that learning process that connect well with adult learning. These factors are the engagement that occurs to permit reconnection with self through body; the evolution of body memory stories over time as self-organization leads to integration; and the necessary attention to creating a context that supports self-organization of embodied learning.
Engaging for reconnection with body. One of the first calls for attention to the body in adult education came from critical writer bell hooks (1994) whose engaged pedagogy called for educators to transgress the acceptable, for example by acknowledging body’s presence in the classroom. For hooks (1994), to call attention to the body would be “to betray the legacy of repression and denial that has been handed down to us by our professional elders” (p. 191).

Strong words … but this is bell hooks. She sounds a bit gentler when she says that our bodies are the source of the passions that make us whole. Hooks doesn’t usually appear among the references on body, but she inspired me first to think about body and learning with her words, “it is crucial that we learn to enter the classroom ‘whole’ and not as ‘disembodied spirit’ (p. 193). It is appropriate then to begin this section with a discussion of ‘engagement.’

This research adds to the growing body of research on body as site of knowing: In regards to body as meaning-making system (Ahn, 2006; Powis, 2005; Raingruber & Kent, 2000); body and educational wounding (Simonelli, 2000); embodied learning in higher education (Freiler, 2007, 2008); gendered bodies (DiRubbo, 1995); patients’ bodies (Ellingson, 2006); and somatic authority through dance (Green, 1998). Most of these studies claim inspiration by Simon (1998) who did theoretical research that is tangentially connected to complexity through Gregory Bateson’s ecological systems perspective. Simon writes about body as lying within culture and the natural environment, and suggests that culture has objectified bodies making learners unaware that they are experiencing bodies which have an inherent way of knowing. Simon (1998) called for re-embedding subject within the body to promote sustainability and interdependence. Michelson (1998) has a somewhat different view of the culturally constrained body as site of cultural inscription, a less optimistic view in which body seems more a site of others’ knowing than of its own. Brockman (2001) in advocating for a somatic epistemology
also recognizes body as site of knowing. In this case body knowing is privileged over cultural as the more fundamental knowing. All of these views are at play in current adult learning understandings of body knowing.

Like Freiler’s (2007) study this one also confirmed what Simon wrote, in that students were initially skeptical that anything could be learned through embodiment. They were generally disconnected from their bodies except when they were in pain or limited in some way. And yet their clinical stories from their first months of practice all describe a process of fear conditioning that was resolved once they started trusting their bodies. They were doing it, using their bodies’ capacity to learn and be the site of knowledge, but they had no awareness of this.

Most studies of embodiment have been with primarily female groups of students (Ahn, 2006; DiRubbo, 1995; Freiler, 2007; Horst, 2007; Powis, 2005) with the exception of the Richard and Birge (1995) in a physiology class where men and women both preferred active learning to passive. Because this study includes 4 men (25%) and represents ethnic diversity it adds a different demographic to this literature. What it demonstrates is that local variation in embodied learning process and outcomes was not attributable to gender. The group as a whole moved to preferring more concrete learning and the men’s engagement with embodied learning was no different from the women’s engagement. Local variation in engagement had more to do with past experience, which is what Thelen & Smith (1994) would predict.

Evolution of body story. Students’ embodied learning began with writing about early body memories, then adding to these body memory stories in journaling about body stories. When interviewed 11 months later they reviewed many of these stories again. It is notable that participants’ stories became more elaborated over time, from first writing to the oral telling of story in the interviews. There are many possible reasons for this, including increased familiarity
with the researcher, established trust, and the inherent differences between written and oral conveyance. Time itself provided a context for interior self-organization as each participant worked with their memories, probably often at levels below conscious awareness. Between the time of written story and the time of interview, all had completed a series of embodied activities within a learning context, aimed at helping them develop self-awareness and connect with bodies in a subjective way, rather than only objectively as is traditional in clinical nursing education. Being able to trace a direct line from cause to effect is not possible, and is less important than demonstrating the dynamic nature of the process, which the examination of story and interview did in this study. From a constructive developmental perspective, learner participants are spiraling back to their past as part of the continuous process of organizing meaning, making new connections within and to their current context. In so doing they create order from the disorder that arose when presented with a new learning experience (Kegan, 2000; Tisdell, 2003). But the order is not rigid and lasting, as the new connections made open new areas of chaos and possibilities for learning.

It is of further note that the individual stories of early body memories cluster around a few themes. This clustering suggests an integrative process: “the clustering of differentiated components into a functional whole” (Siegel, 2001,p.81). Looked at in this way, these body stories of early body memories reveal a dynamic process of continuous flow over time between chaos (differentiation) and order (integration). “Systems that move toward such complexity are the most stable, flexibly adaptive, and capable of a wide range of ‘self-organizing’ processes” (Siegel, p.81). By providing for participants to become aware of these components, over the course of two semesters of embodiment activities, the entire process was perhaps invigorated.
The fact that stories became elaborated over time and increasingly tied to interoceptive awareness, an awareness of interior body state, supports this idea.

**Facilitating embodied self-organization.** Teaching intentionally for embodied self-organization requires planning and an approach. Two elements that must be considered are the space in which learning happens and the role of the educator. Both self-organization and embodied learning are supported by open space that is aesthetic and that fosters energy (Daniel, 1994; DiRubbo, 1995). Open space is said to engender a sense of freedom, sharing, and optimism. In my teaching with embodiment in RN-BS classes we move around to different spaces as required by the activity, while maintaining a hub in a traditional classroom. It is difficult to find a truly ‘aesthetic’ space in the traditional classroom building, but sometimes meeting elsewhere, and including changing if not aesthetic environments helps to create a sense of energy and possibility.

The purpose of open space for teaching with complexity is to allow the system (the students) to experiment with itself. This is a helpful attitude to have when teaching with embodiment as well. Enlarging the ‘space of the possible’ (Sumara & Davis, 1997) means openness to people participating in increasingly complex ways that are somewhat planned, but not organized, and allowed to evolve. The roles played by the educator include interpreter / story-maker, and tuner which refers to noticing all the disturbances, drawing attention to possibilities, making connections between part and whole (Fenwick, 2003; Karpiak, 2000).

Teaching in this way made it possible to have students assessing themselves as individual and group throughout both classes, even around topics such as trauma experience and stress symptoms that would not be traditional course content, even for nurses. Using embodiment in connection with story-telling, RN-BS students began to take on the traits of story-makers and
made their own observations about connections. Some of these connections carried over into other contexts. This is the subject of the next section.

New Patterns of Connection: Personal and Professional Knowledge

This section highlights three aspects of learning outcomes that resulted from nurses’ embodied learning and discusses them as they might be of interest to adult educators. The first outcome was the changes participants noticed independently as their learning style preferences diversified and moved toward concrete experiencing. Personal changes in experiences of calm and new practices for relaxation were connected with the mindfulness aspects of the embodied course work. Finally, changes in connection with professional practice were facilitated by the pedagogy of clinical storytelling. All of these are described below in relation to this study.

Learning preferences. Previous research by Richardson & Birge (1995) and Green (1998) found adults preferring active learning over passive, even if learning of content outcomes was equivalent. Like dance students learning under a watchful eye, and appreciating the somatic authority that is an outcome of their training (Green, 1998), nurses learn physical exam skills while being closely watched and examined in simulated and real settings. Nurses in this study also preferred learning actively for clinical courses as indicated by learning style preference changes. They also reported that making connections between embodiment and course content were helpful. In Freiler’s (2007) study learning outcomes were enhanced.

There are interesting points of intersection and divergence around learning styles between this study of nurses’ embodied learning and Keyes’ (2001) study of group learning in a formal learning setting. In a quantitative study Keyes used experiential learning as pedagogy and looked for integrative complexity while measuring change in Kolb’s learning styles. Keyes found Kolb learning styles determined the initial integrative attainment, then jumps in
complexity were influenced by the emerged shared group perceptions. For that group 46% of variance in attaining integrative complexity was attributed to factors of style and group perception. I did not assess group perception in my study and methodologies don’t allow for comparison. But since the distribution of learning styles in my group of RN students changed, in no one direction, except to greater diversity towards concreteness, the learning style preference wouldn’t seem to be influencing their integration. Since everyone had some integration of both body memories stories and of interoceptive awareness, which was itself an emergent property, other factors had to have been at play.

The qualitative data for change over time compared to the learning styles doesn’t show any kind of consistency within styles. Another methodologic difference lies in Keye’s quantitative approach to measuring integration as an outcome related to learning content, in comparison to qualitatively looking for emergence of self-organized integration. Perhaps the differences between our findings reflect some difference between integrating specific ‘content’ which Keyes studied and self-organizing into some pattern of embodiment understandings and senses to greater interoception. This is like comparing apples and oranges. But the study is highlighted to show how the same theory, language and measures can be used but arriving at differing conclusions because of the intervening lens, perhaps the research paradigm.

Despite the inability to make comparisons across research, the disparate results are a reminder that Kolb’s model of experiential learning styles has been critiqued for failing to attend to context (Jarvis, 1987) and the results of this study of embodiment are more consistent with what Jarvis (1987) proposed as changing constellations of learning responses with movement in and out of various situations. There is something energetic in this suggestion about learning
across time and space which certainly harmonizes with dynamic systems perspectives (Kelso, 1995; Thelen & Smith, 1994).

**Mindfulness for change.** Ahn (2006) and Freiler (2007) both incorporated mindfulness based stress reduction in classes with health care professionals. Ahn taught as content and a transformative element to enhance body/mind/spirit. Freiler (2007) used embodied practice. This study used yoga mindfulness practice. Mindfulness can both enhance meaning-making when used as an adjunct to reflection and can be a stand-alone vehicle. In this study it did both, as indicated in journals and interviews. Done in the context of class, it cleared ‘clutter’ and brought focus at the start of class. Although students in general did not enjoy teaching the skill to each other because they were together in one room and were distracted by each others’ voices. Most frequently occurring was the unique integration of some aspect of mindfulness or breathing that was picked up in one of the sessions and brought into personal practices for relaxation, sometimes in a new daily routine (Kathy, Monica) and sometimes automatically generated (Cadence). In a similar way Horst (2007) used yoga as action with female managers and discussion about their bodies’ presence in the workplace supported new connections creating self-management abilities with yoga and work situations where these could be used.

**Storytelling for forming patterns of connection.** In healthcare there is polyphony of body stories, an interweaving interconnection of stories within and stories about bodies, some lying in the past, others being made in the moment. The story that is stored within the body is like what Tyler (2007) describes as story aliveness. She means that the story is independent from the telling, existing prior to and outside of telling, which it waits for until the timing is right. The telling becomes a negotiation, a collaborative co-creation with the listeners.
Storytelling is a method of choice in teaching with complexity (Fenwick 2003), creating an embodied experience, (Powis, 2005) and healing from trauma (Rousseau & Measham, 2007). Nothing could be more appropriate pedagogy for this particular study. Telling a story to others and having them bear witness is sense-making and it’s important to connect with social and cultural context in healing. Story allows for that. Rousseau & Measham (1997) learned from their international trauma work that often, acknowledging the absurdity of violence and suffering may be as important as helping to co-construct meaning. They figure storytelling and sharing as an approach that supports self-organization as a flowing back and forth between disclosure and containment of the unspeakable. Theirs is a therapeutic approach, but adult educator Horsdal (2008) is also doing work with narrative toward therapeutic ends with trauma. Storytelling of inner subjective stories of the body has also been by Powis (2005) in sacred context to get tellers in touch with somatic wisdom and create an embodied learning experience. Perhaps my students had an embodied experience with our story sharing exercises. What they wrote about most was feeling validated and connected and Powis (2005) does stress that storytelling promotes interconnectivity with all of life. I used story in open setting with no expressed expectation of specific outcome. As with any exercise there is the issue of framing and what students expect. This highlights that storytelling can be used in different ways to enhance embodied learning. If my students had not had a semester of embodied learning in health assessment, perhaps their storytelling activity would have been more about embodiment. I see self organization present here in that the storytelling becomes, to a degree, whatever is needed.

Implications for Adult Education

Because the theoretical framework for this study was comprised of interconnected theories, the contributions to the field are interconnected as well and difficult to describe in
discrete categories. Perhaps the fact that this challenge is present underscores the primary contribution. The study increases complexity by making multiple connections across boundaries between cognition, embodiment, complexity in education, experiential learning, holistic learning, narrative, development, trauma in learning, and neuroscience. There are even weak links to transformative learning for those who wish to notice them. That is the picture from above, the global order. Observed from below the view is quite messy because there’s a great deal of local variability. From a complexity perspective, all those connections and diversity and swings in variability mean life. Nevertheless, we can focus on science, embodiment, and trauma. These are connected to and communicating with each other in multiple ways.

**Complexity Science / Neuroscience / Embodied Cognitive Science**

This study of RN to BS students’ embodied learning highlights the interconnection of complexity science, neuroscience and embodied cognitive science. It forms a stronger connection between adult education literature and the natural sciences in general by using complexity science as a connecting language. Throughout history there have been spoken languages that facilitate communication across the local variability of dialects and language families. Complexity science arose as that kind of connector among the natural sciences and then across other disciplines. It can serve this purpose as a connecting language in adult education as well. Because this is a discipline comprised of educators from very diverse backgrounds, it can be understood as an emergent property of a self-organizing system, adult education knowledge existing as the global structure for intense local variability when viewed from below. Some of that messy local variability is people with backgrounds in science.
Complexity science offers the promise of a way for them to make connections between their disciplinary knowledge and the discourses of adult education. Learning that language for communication within the system, adult educators can use that language to access other disciplinary knowledge where complexity is being spoken. This study provides a blueprint for how this can be done to connect with research in natural science and apply it to lifelong learning and teaching questions. This is important, because when we rely on other disciplines, such as psychology or sociology, to make the first connection to science, they interpose a separate disciplinary discourse, so adult educators, like nurses, can become disconnected from the source and inhibited from creating their own meanings from the research. There is another way, and complexity science makes it possible.

Adult education is showing great interest in neuroscience findings and curiosity about how these can be applied to understand learning and develop pedagogies. There are three broad categories of approaches: complexity, gestalt, and constructive developmental. The rationale for applying these labels is given for each set. In the Systems / Complexity Thinking category, Caldarelli & Taylor (2001) suggest forming a link between evolutionary psychology and situated cognition, noting the brain as product of evolution. Similarly, Hill (2001) wrote about consciousness and neural network connectivity, and mind as emergent property. These papers come closest to the embodied cognitive science perspective, a contrast being Thelen & Smith’s (1994) resonance with ecological psychology rather than evolutionary psychology. The Gestalt / holistic group looks to Gestalt psychology in support of whole person learning, with special interest in the neuroscience of visuality (Anderson & Woodill, 2004; Blakemore, 2003; Gray, 2006; Janik, 2004; Marks, 1998; Shusterman, 2006). The ‘constructive developmental’ (Kegan, 2000) group has chosen to link itself with Kegan’s transformative learning paradigm.
They have taken the most organized approach toward constructing theory by building on Kegan (2000), brain-based learning (Zull, 2006), learning cycle (Kolb, 1984), and mentoring as pedagogy (Daloz, 1999). The approach aims to lead to greater epistemological and individual neurological complexity (Taylor, 2006), the direct link to complexity being expressed by Caine & Caine (1997, 2006).

Looking from below, as we are, there is a lot of messiness, activity, overlapping and movement. One challenge in connecting to neuroscience, and particularly any of the cognitive views that address embodiment (enactive cognition, embodied cognition, embodied cognitive science) will be to bridge this gap between a strictly evolutionary view as it is appearing in the adult education literature and the cognitive embodiment which are all grounded in Edelman’s theory of neuronal group selection (Edelman, 1987, 1992). Edelman (2006) has been careful to note that his theory is different from both evolutionary epistemology and evolutionary psychology. He recommends a naturalizing of epistemology, away from philosophy, to be based on evolution since all brain mechanisms arise through evolution, an implication being that brains are not designed for knowledge. It will be a good challenge for educators to tease apart these differences, a task best done collaboratively since we learn by making connections.

Because this study highlights trauma in connection with neuroscience, complexity, and embodiment, there needs to be a brief follow-on to the neuroscience discussion regarding trauma. Physician and educator Janik (2005) who is listed in the Gestalt group has written about trauma and learning from a neurobiological perspective and also brings insight from his previous work in linguistics (2004). Psychiatrist and neurodevelopmental researcher Perry (2006) has adapted for adults his considerable body of research on the effects of anxiety on learning, providing that connection through the ‘constructive developmental’ group. This study is the
first connection to trauma and learning from the complexity perspective. Connecting adult education with neuroscience was also the point of a 2008 session (Swartz, 2008) at the Commission of Professors of Adult Education annual meeting.

Complexity science, or the science of dynamic systems, is embedded in understandings of neuroscience, so again, learning this language enhances understanding of findings. More specifically, what this research contributes is a connection with embodied cognitive science. A primary critique of complexity, even among educators who explore the uses of complexity (Davis & Sumara, 2006; Fenwick, 2000), has been that it is a totalizing discourse and demands subservience of the autonomous individual to the group. I submit that a reason this perspective arose is because in adult education discourse on complexity (Fenwick, 2000), complexity has been linked with the enactivist perspective of cognition as described by Maturana and Varela (1980, 1992) which posits the organism as a closed system.

This is quite different from embodied cognitive science which is empirically based and draws more from physics than did Maturana and Varela (1992). Embodied cognitive science has been the source of specific research on the brain as a self-organizing system, learning as self-organizing process in interaction with the environmental context, and a non-linear theory of human development as a series of recursive spirals of behavior built over time as new experiences present themselves as opportunities for learning (Kelso, 1995; Thelen & Smith, 1994). These are not completely new ideas in adult learning or development. Tisdell (2003) described spiritual development as a non-linear process, building on Kegan’s (1982; 2000) theory of evolutionary development in adults. What inclusion of embodied cognitive science does is allow adult educators to interact with a body of research that has a method for understanding these non-linear processes as they apply to people, which has the potential to
bring new understanding and generate new connections, enriching the complexity around these ideas.

All of this is additionally important considering the growing interest in the ways that neuroscience can inform education. The ideas of complexity science and dynamic systems are embedded in neuroscience. Via embodied cognition, enactive cognition and embodied cognitive science comes the concept of a cognition distributed throughout the body, not centered only in the brain (Johnson & Lakoff, 2002; Thelen & Smith, 1994; Varela, Thompson, & Rosch, 1991). These sets of ideas all share a basis in Edelman’s theory of neuronal group selection (Edelman, 1987, 1992). These ideas are also embedded in the neurobiological model of trauma where the practical application of such understanding is of pressing importance (van der Kolk, et al 1996).

Beyond these connections there are multiple places that complexity and embodied cognitive science intersect with theories about learning in adulthood. The theory of complementary pairs (Kelso & Engstrom, 2006) is a scientific look at how people can transcend their brain’s proclivity for dualisms. Their work is an attempt to tease apart our holism through research in a practical way that will help people find a middle path through polarities and paradoxes, for example when they are faced with a power differential. It is difficult not to see the links with emancipatory learning and post-modern or post structural perspectives in adult teaching where there is an interest in power. Furthermore, as a science of change, complexity science seems to be a perfect fit for transformative learning, its primary interest being change (Janik, 2005; Taylor, 2000, 2001). As stated earlier, Karpiak has made this connection, but she also connects her work to an alternative non-Darwinian, unifying theory of evolution (Jantsch, 1981 in Karpiak, 2000). This makes it difficult to connect this work to embodiment in neuroscience since that work is built on neural Darwinism (Edelman, 1987, 1992). Kegan (2000) also seems
to come close to complexity via evolutionary biology, but dynamic systems isn’t present in his work. A challenge that may have to be overcome to embrace this knowledge coming from science would be moving out of the view from above, in which adult education exists as emergent structural property of its own discourses, and shifting to the view from below where adult education becomes one of many sources of local variability, along with complexity science, neuroscience, embodied cognitive science. There are many possible opportunities for forming connections. What opportunities will be perceived, based on the discipline’s collection of past here-and-now experiences? What polarities might arise around ownership of knowledge? What fertile middle ground can be found when doing as Kelso and Engstrom (2006) advise and relinquishing the either/or position for the position of either/or ~ both/and?

Embodied Learning as Cognitive Phenomenon and Sensory Process

In a much more practical vein, this study’s contribution to the understanding of embodied learning is that it reinforces the growing evidence that somatic practice and mindfulness can be incorporated into traditional higher education settings with positive outcomes ranging from reinforcing content to facilitating re-connection with self, enhancing self-care, and inspiring changes in action in the workplace, not just changes in perception. One thing that is new is a participant group that includes men and cuts across cultures, despite the small size of the group. The four men in this group were no more or less skeptical than the women regarding this new way of learning through their bodies, and they all engaged with material and self-organized to find what within was valuable for them. All of them named significant personal and professional effects from the experience. So this study demonstrates that embodied learning is not for women only.
The period of embodied learning is also longer than previous studies as is the period studied by the research. Looking back during interviews 6 months after the two semesters of embodied learning ended, it was clear that students had continued to make new connections around their learning. So they had assumed responsibility for their own learning, were no longer concerned with the details and were carrying their learning into new contexts by associations that mattered to them, whether that be improved communications with other people, finding new ways to improve their own health, or re-evaluating nursing practice. Local variability was evident in the choices made to form new connections. This group experienced changes in personal connection to self, connections to other people, and was able to identify some major changes in their connections to work and actions taken there. It is beginning to appear that increased body awareness and connections with self and then some changes in self-care practices are general outcomes that occur when embodied practice is incorporated over several weeks (Ahn, 2006; Freiler, 2007; Horst, 2007). Connections between the embodied learning and the work setting will arise spontaneously (Freiler, 2007) but are much more prevalent and elaborated if these connections are encouraged, as with clinical storytelling in this study or discussions that connect work stories with the embodied practice (Horst, 2007).

In terms of the emergent connections with self, this study chose to view these through the lens of neuroscience, categorizing within the spectrum of interoception (Cameron, 2001). This is in contrast to the classification system which Freiler (2007) used. This is significant for future research so it will be discussed in some depth. Since Freiler’s theoretical framework included Embodied Cognition (connected to embodied cognitive science and also neuroscience based) her approach to the embodied person included a phenomenological aspect. Embodied cognition (Lakoff & Johnson, 1999) included knowledge from several disciplines but especially cognitive
linguistics and philosophy, particularly Merleau-Ponty’s (1945) phenomenology of the body. Therefore her interpretation of participants’ reports of body experiencing were classified as phenomenological embodiment (experiences of general body awareness, feeling whole, etc.) or as neural embodiment (more visceral, with an emphasis on visual perception, and pain sensations).

As the themes began to emerge in my own data analysis, I noticed that I developed two broad categories that had to do with more brief impressions or definitely phenomenological experience, and these were considered to be evolving concept or sense of embodiment. These categories were all similar to Lakoff and Johnson’s (1999) phenomenological embodiment. The other two broad categories related to body experiencing were three forms of awareness that broadly were new connections with self, and then new practices related to the body. The three forms of awareness included but went beyond Lakoff and Johnson’s (1999) category of neural experience. Later in trying to make the connection with the neurobiological trauma literature and the concept of interoception, I saw that all of these forms of awareness fell within the neurophysiologic construct of interoception (Sherrington, 1951), so I redesignated them.

On repeated analysis I saw that over time the fragments of experience comprising concept and sense of embodiment (or more phenomenological experiencing) coalesced in individually unique ways to form one of the senses of awareness, all of which served as a new connection with self, as if fragments of embodied experiencing were self-organizing into patterns of interoception. Self-organization is what the study hoped to understand, so this was a valuable finding. But it was additionally revealing for suggesting that fleeting experiences of the whole might contribute to bringing forth conscious awareness of interoception, nervous system experiences that are primarily pre-conscious, and this interoception would serve as connecting
factor to self, a new form of whole. So in effect there is a recursive process in connection with oneself moving between part and whole at different scales. Comparative examinations like this will be useful in studying how the pedagogy of embodiment contributes to learning.

_Trauma and Learning in Adults_

A surprising amount of past traumatic experiencing was present in this group of study participants, suggesting there might be a high level of trauma experience in many adult classrooms. Considering the negative effects that trauma can have on learning (Perry, 2006), perhaps more attention should be paid to this factor. As noted earlier, study participants whose stress showed up in their journals were experiencing current stress in relation to current or past stressful experiencing. The current experience of stress was the distracting factor. But participants also had ample experiences of fear learning in the clinical setting, so for clinical education of any kind, this is an area of interest for adult educators. By the time one reaches adulthood, there have been ample opportunities to accumulate fear learning, and some unpredictable aspect of classroom and educational process context might stimulate fear. Most students did write in their journals or on tests about anxiety responses they were experiencing in relation to quizzes (which accounted for only 10% of their grade). The original stimulus may have had nothing to do with education, or there could have been fear or trauma learning related to the classroom. Some form of freezing response may present for the educator and the student to deal with. Since the fear learning can never be completely extinguished, and the educator can’t alter context ad infinitum, if there is a desire to respond in order to maximize students’ learning, the place to focus would be self management of the fear response. Access to this response is through the body, not via language through the mind (Schore, 2005; Ogden, et al, 2006; van der Kolk, 2006)
The Whole Student

I finish with the most absolutely practical section of this entire paper. As I was moving through data and searching in Grbch (2007) for unique forms of data display, I was inspired by the postmodern section to create something visual that would collect each participant’s story in one page. Well, it wasn’t a sensible approach in terms of methodology because this isn’t a narrative study, but it is a study full of stories, and I found the result so appealing. When I continued looking with different sets of eyes, I saw that my chart gave me a new way to see the whole student. By combining the highlights of answers to interview questions and quotes from journals, pictures of body map, learning style and temperament, I could capture on one page the dynamic, embodied creature with a history of body memories and traumas and successes who came to my class. The story moved across the page and I knew it would continue to change before my eyes for as long as I was connected with this person. So I am sharing one of those charts here to show what is possible when complexity and embodiment are combined in a higher education nursing classroom and hope that it inspires other adult educators to see their whole students in new ways.

The participant I selected is John, because John is male, making him unlike the typical nursing student. He admitted to having a very bad attitude about taking the health assessment course, and he was an athlete with very specific ideas about how to use his body. John also had 7 years of high-intensity nursing experience, so he acknowledged thinking he ‘knew everything’. This is an excellent survival skill in quaternary care. Without it one might not go to work every day. But it also contributes to classroom dynamics. So John was an excellent candidate for rejecting embodied learning. He did not. View his profile in Chart 9, p. 349.
JOHN

Temperament: Artisan (Sensory Perceiving)

Demographics: 29 yr. old white male; grew up in East Coast urban center; 
Married father of three girls’ 7 years of staff nursing, 6 in ER, now critical care 
Past 

Body story/First body memory: With laughter – “being at a park ... it had a red pavilion and ... a river that went by it ... I was trying to run to the outhouse and ... I didn’t make it !”

“Fear Learning” memory: “I think a lot of nursing is learned through fear learning. We work in a job where mistakes cost lives. “My first medication error ...all these red flags went by ... so by the time that I realized ... I had to look at the surgeon and say ‘Yeah that wasn’t what you asked for’ ... just my entire body, it was lock up, right here in my chest area, and, and, my ... I mean I felt like I couldn’t breathe ... I couldn’t move, I couldn’t do anything ... I will never forget how I felt. That was HORRIBLE trauma ... To make sure I never feel that again, ... I changed like three steps of my practice.”

“Trauma Learning” memory: “I had to go to this new unit (ICU) ...I remembered a similar situation when I went to another ER ...I walked on my first day .... I’m three weeks late ... and I feel like they’re aaaallll staring at me .... I just remember you always crack a joke ... the most terrifying time for me cause I thought all these women were staring at me .... I thought I’d done something horribly wrong ... I’m late! ...I think its easier for guys in nursing ... I get the evil eye the first day, or even sometimes you don’t even get it then ... umm ... When a woman goes to a new unit, they are scrutinized for ... oh .... At least 6 months. SCRUTINIZED Every move they make, everything they do .... “Oh, they forgot to do this! .... Its picked at ... then finally ... through a series of events ..they’re able to either quit, because they can’t take it .... Or they’re able to pick back. And when the picking back comes in, they’re assimilated to the unit.” 

Resurfacing Fear and Trauma Learning: “Every time I give a drug that’s going to alter somebody’s life. ...This is something that’s good. .... If some nurse is giving my Mom a medication I want them to already have made an error before.” “You always wonder what people think of you ... there’s a whole chain of responses that you watch for ... my hands, it’s a little shaky ... you’re hungry, your heart rate’s a little higher, almost a little anxious, I just get edgy. You know. That’s the way I feel in a new situation ....”

Class Experiencing 

Reactions to Body Stories: “I think at first it was just kind of weird ... to view your body in that sort of way. After the first class when somebody else narrated it to me it was a little different. I was able to relax and its like ... almost I got the idea of what we were supposed to be doing ...It was weird ... very different type of learning. And it’s still there, like I could ... if I went back and sat in my work chair in my office, I could still ... be in constructive rest again.” 

Learning Routine: “It was weird for me to feel like, you know, ‘I’m gonna allow my body to go ahead and get into this position ... something you didn’t do naturally ...and then I’m gonna allow feelings to come across’ .... It was weird at first. ... Like, I’m supposed to be relaxing and letting this whatever it is flow through me. That’s actually weird. ...It was relaxing ... I felt ... I melted into the floor ...I was more aware of what my body did. ....At home I sat in my black chair in front of my computer .... You modified it to the things you enjoyed.”

Particular Exercises that Stood Out: “You painted your body and you could actually feel yourself going into the color red. It was fascinating ... There’s another one where we were to descend down a stairwell ... whatever was narrated you felt ... as you came back up and it was sort of like this warm thing .... And you felt relaxed, and you let something go.”
Experience of Yoga Trance Dance: “... part of what allowed me to let down and actually enjoy the class... not at all what I expected... GOOD MUSIC... maybe that was the key that unlocked everything for me... in an instant better mood... open my mind a little bit... almost like a workout... nobody was watching me... the lights were out... another key... like you were just there by yourself. A combination of music and movement that opened my mind up.”

Learning Insights / Key Learning: “Attitude is everything. I was an ER nurse... so naturally cocky... I knew everything... not conducive to learning...I came out learning a lot more things through my own body. It was very unique to learn nuances in my own body. ...a new way of looking at assessment... my own personal assessment... think about the way that I think... how my body interacts with bodies of my children and my wife.”

Embodiment Defined: “a fluid movement between body and mind and conversation that’s probably on a different level, uh, between body and mind that you’re unaware of”

Sense of Embodiment: “Oooh (laughing), ummm... I’m workin’ on it.”

Embodied Knowing in Clinical Setting: “Nurses use this more than anybody else... something that happens between the body and the mind... something that you, you inherently know... when you just know that there’s something wrong, that something bad is going to happen... your mind and your body are making a decision together. That’s part I think why nursing has issues defining their job... you know, you can’t sell that. So.”

Body’s Connection to Trauma: “I know trauma in first hand. At one point in the course...I was able to almost visualize... all those different things that I did on X-ray... I could see trauma, but I could also see the mended parts... I have a good imagination.”

Changes

Changed assumptions: “That would be anatomy and physiology... a unique way of learning... to do assessment of my own body... it changed the way I would assess my own self. The assumption would be that if you got back pain before you would just take an Ibuprofen... now there’s a different way of looking... you don’t have to take medicine. Maybe you just lie flat...”

Effect on Personal Life: “I guess I calm myself down easier and quicker... it’s nice to not just react on impulse when you’re angry... so they dumped a bucket of water outside the tub... tubby time is, I don’t know why... tough... the difference between ‘I can’t believe you did that!’ and ‘Oh, its OK... yeah, its really OK’... and actually its kind of funny. It has made our household much more enjoyable.”

Carryover into Professional Practice: “Well I was able to overcome this terrible attitude that I have. So if you can control an attitude, now you have an annoying patient and you’re able to...”Whatever”... you know? Constructive rest is a beautiful thing.”

Body Map

“The body map and the last trance dance were coinciding. ...Laying on the ground at the last trance dance, I felt like I melted into the ground... I do a lot of stuff with my family... This Body Map was actually a chalk outline on the driveway (laughing).... So my daughter and I... she draws around Daddy... here I am, this sort of blob... we’re strugglin’ together and scriblin’... squiggles that go in and out... my daughter... it looked like she had felt the...
The Educator’s Body

My personal sense of embodiment also deserves brief mention. When I began the teaching project that became my research, I didn’t know exactly what I was doing. I had to learn in the doing through trial and error. My guides were the experiences of being a student in an active, collaborative, culturally/spiritually grounded setting with Libby Tisdell; in a student-centered, self-directed/self-organizing setting with Patricia Cranton; as a student story listener and teller with Jo Tyler; and as a yoga student with Shani Stevenson, all faculty at Penn State Harrisburg. I noticed what happened for me and my body in these different contexts and used that, along with theory, to start creating a setting for embodied learning. I was also inspired by my experience with Tammy Freiler conducting her embodied learning research with my students. Without such experiences I don’t know if this research would have been possible. It was clear to me that my learning in the classes always connected with past experiences and memories and had an emotional and body component. I reflected on my own experience and followed that to create pedagogy. Faculty who want to experiment with embodied learning should begin by gathering their own experiences of learning differently, noticing and reflecting on their own embodiment. One can’t learn how to ‘do’ embodied learning by reading a book.

Like my students, I also formed new patterns of connection. In the process of carrying out this research, my past trauma experiences, which were the source of my research interest, became thoroughly integrated into my professional identify and teaching practices. An aspect of self that was kept separate and only opened judiciously is now fundamentally woven through my work. As this happened, I became more and more comfortable following my own instincts in crafting classes and talking about the complex relationships between my past experiences, my body memories and interoceptive awareness, my nursing practice and my choices in teaching.
Previously I was very aware of my body as a function of learning to manage autonomic reactivity and return myself to a relaxed state under many conditions. Now, my new patterns of connection allow me to be body aware, in the moment, in closer connection with student body experiences (as I am when working with patients) and this awareness brings automatic connections to theory that is now embedded in my total understanding of experience. Theory and nursing practice exist in a most naturally interconnected state. Now I can’t imagine teaching clinical nursing without including embodiment. My commitment to holistic and integrative nursing has been enhanced, and my elective content on those topics has now migrated throughout the required courses, so all aspects of my teaching are self-organizing.

**Implications for Nursing**

A significant gap exists in the nursing literature around non-traditional pedagogies and nurses and nursing student embodiment. After two decades of calls for more interactive and alternative pedagogies in nursing education the vast majority of nursing faculty still use conventional pedagogy (Diekelman, 2002; Greer, 2007; Kohtz, 2006; Pugsley & Clayton, 2003). The research that exists doesn’t connect directly with practice (Greer, 2007; Ridley, 2007) Even in qualitative research about patients’ embodiment, the researcher’s body remains obscured and there is no theory of embodiment in nursing (Ellingson, 2006; Wilde, 1999). In this study possibilities are offered for developing theories of embodiment in connection with neuroscience, complexity science, and trauma. The findings suggest we should strive to foster connection with self.

Advantages for educators identified in the research on interactive and co-creative nursing learning (Prowse, 1998; Ridley, 2007) were present here: positive student evaluations and relationships with students, and increased personal creativity. I felt what Prowse (1998)
describes as re-creating myself in teaching. The possible disadvantages: loss of control, possible loss of credibility with students who expect to receive ‘grand knowledge’, concerns about outcomes and mandates and large class size were not present in this study but they are significant for many nursing educators so they need to be discussed. The ability to manage class size is an issue of local variability. The nature and size of the RN-BS program and local policies support manageable sizes in clinical courses. Maintaining ‘control’ was partially a function of small class size, but also a matter of confidence in the methods and comfort with the process of allowing groups to self-organize, with guidance and support. This is not a skill that most nursing faculty are taught or that they have developed through nursing practice experience. Having many past here-and-now experiences like this influenced my sense of the possibilities.

For nursing faculty to adapt a pedagogy such as this might require collecting experiences prior to teaching so that their teaching present has an alternative pedagogies past to connect with. Nursing faculty must be taught using alternative pedagogies if they are to teach their students differently. There was certainly the possibility of losing credibility since most students had no previous experience with the instructor and they came with traditional expectations. I believe there are three primary reasons this didn’t happen. One, my sense of possibilities based on past experiences. Two, an ability to exercise expert power. And three, noting the findings related to the NCLEX and students’ anxiety, most students are truly relieved to realize there are other ways to learn.

It is interesting that Ridley’s research claimed students might experience anxiety about doing advance preparation for interactive classes. As noted in the findings, students did express skepticism and initial discomfort with some of the activities, concerns about being watched, environmental aspects like lying on a floor that might be dirty, and wondering how to study.
They were anxious about self-organizing, but within the first month local variability had stabilized into a unique pattern of study for each student, and they maintained that pattern. Having a book to follow gave structure to their reflections and they developed variability in patterning these responses as well. Anxiety about the reflective journals decreased as they realized that they were not being graded in comparison to a standard but rather on completion. Finally, many students noted that they liked best when we did body stories exercises together in class, and often they remembered these exercises more than some others. This finding resonates with guidance from Simon (1999) that body learning which is interactive with the entire body’s intelligence will promote interdependence. Social process surrounding body learning was also noted in research (Chan, 2002; Cheville, 1999) as contributing to greater connectedness with body and each other.

In a study that addressed trauma in learning this is the final lens through which traditional nursing pedagogy must be viewed. Participants were very clear about the presence of fear learning and trauma learning during their rites of passage into the nursing profession and the lasting presence of paradoxical situations as sources of fear and trauma learning. It can be assumed that many nursing faculty have past here-and-now experiences in connection with these situations. Research on faculty resistance to non-traditional pedagogies always refers to concerns with losing control of the classroom and losing credibility (Greer, 2007; Kohtz, 2006; Ridley, 2007). In light of the definition of trauma as perception of being overwhelmed past the ability to cope (van der Kolk et al, 1996), the faculty expressed concern can be reframed as fear of being traumatized. Losing credibility in an interpersonal situation is fear of humiliation such as can occur in an abusive relationship or with horizontal violence. It would be fascinating to
explore these faculty fears more thoroughly and examine their connections with trauma past and present.

**Recommendations for Future Research**

Several recommendations for further research have already been made throughout this chapter. A few additional considerations are given here, many expressed as questions.

The concept of transformation has direct links to complexity science. Of the seven adult education dissertations using complexity as theoretical framework since 2001, four also include transformative learning. There should be purposeful work to develop a conversation between these sets of ideas.

Self-organization should be used as a concept to study other learning processes. The creation of patterns of connection could be studied across different pedagogies to understand where self-organization is possible and where other forms of pattern formation must be used. Having answers to this, questions of effectiveness can be raised. Study of self-organization should be done in clinical settings to understand in real time how practitioners learn to read and respond to the threats in this environment. One area of focus could be the way in which paradoxical situations contribute to compassion fatigue.

Research to better understand the conditions that facilitate embodied learning would help to develop pedagogy. It would be interesting to begin with a study of embodied learning that is occurring naturally in settings other than nursing. What kinds of embodied learning exist in the traditional adult education doctoral classroom? What sort of connections could and should be made to this learning? This study used a pedagogy that intersected embodied learning and complexity. What would results be with the same student population and same content but different pedagogy mix for embodied learning?
In repeating and expanding on this particular study, it would be good to know what happens when educators with different teaching profiles enact the same curriculum. Since syllabi are shared across the school, how would this work? How could these two courses be translated into an online format? Can embodied learning happen that way? What would be learned if physiological measures of stress were added to the data, and before and after measures were made? What happens with different student populations, like pre-licensure BSN students or medical students, or nurse practitioner students? What could be gained and learned through incorporating simulation education with this teaching approach?

Closing Thoughts

I am about to take the biggest cleansing breath imaginable. After that, I’m going to feed my body and take my dog for a much deserved walk. Recently I’ve been struck many times by the absurd irony of writing a big paper about bodies moving to stay alive while I keep myself sitting in one place and staring into an electronic screen. Often I’ve thought to myself, “I’m a dying organism.” But I’m not. That would be the perception of an overwhelmed mind, and I am not overwhelmed past the point of endurance. Simply, I find myself barely moving within the intensely ordered polarity of my student/mother/faculty life context. My students, my family and my dog have been impossibly patient with me. What I see in my mind’s eye are the wonderful nurses who did that crazy body stuff with me and told me their stories … how they watch me now with curiosity, and joy, asking if I’m done yet. They are finishing this thing with me and they know it. I began 15 years ago, chased by a story embedded deep in body memory. The story became a question. The answer now lies in other nurses’ stories. Part. Whole. Part.
Appendix A: RECRUITMENT SCRIPT

Nurses’ Embodied Learning in the Classroom and in Nursing Practice Dealing with Patient Trauma

You currently know me as a nursing instructor but I am also a doctoral candidate in the Adult Education Program at Penn State Harrisburg. I am currently working on my research project for my dissertation in a thesis research course this semester under the advisement of Dr. Elizabeth Tisdell (ejt11@psu.edu). I am seeking research volunteers as participants for an investigation of embodied learning in nursing education and practice and its relationship to body trauma. This study proposes to examine the unfolding process of learning through the body, understood as an emergent property of neural systems, personal, and interpersonal patterns of connection as they are impacted by trauma. Learning as formation of patterned connections will occur in unique and unpredictable ways for each individual and the transfer of learning to personal and professional life will also be unique.

I am conducting in-depth interviews with up to 15 participants who have completed the courses N351 and N465 in which embodied learning practices were used. I am seeking volunteers who are at least 18 years of age interested in serving as voluntary participants who have an interest in attending to body awareness and are willing to talk about their experiences of learning through this approach. Participation or non-participation in this research will not have any effect on your student evaluation status. All arrangements to gather data for this research will be made based on participant convenience.

If you participate in this study, you may have a better understanding of how you create new knowledge through the body and how you access and apply this knowledge in your clinical practice. This may enhance the quality of other learning experiences in the future.

Your participation in this study would be deeply appreciated. If you decide to participate, you can choose to stop your participation at any time. You do not have to answer any questions you do not want to answer or participate in any activities that you do not want to experience. If you would like to volunteer as a participant for this study, please contact me, Ann Swartz, at 717-319-1144 or by email at als25@psu.edu by 12/15/2008. You will now receive a written copy of this information.

Also, I am now distributing an informed consent form with a postage paid envelope at this time for your review and as a measure of confidentiality. Please take TWO blank copies of the consent form, review it, and if you choose to participate, sign both copies and return one copy to me by 12/19/2008. Again, please notify me of your interest as a participant by 12/15/2008. Since this study involves a specific number of participants, I will notify you by email to confirm your participation. Effort will be made to select participants who are both male and female and of varied cultural groups. I will send you an email to confirm your participation and then ask that you complete and mail the informed consent form by 12/19/2008. Are there any questions? Thank you for your time and consideration with this research request.
Appendix B: INFORMED CONSENT FORM FOR RESEARCH

Title of Project: Nurses’ Embodied Learning in the Classroom and in Nursing Practice Dealing with Patient Trauma

Principal Investigator: Ann L. Swartz, ADTED Doctoral Student  
Penn State University  
W341 Olmsted 777 W. Harrisburg Pike  
Middletown, PA 17057-44898  
E-mail ash25@psu.edu  
Phone 717-948-6514

Advisor: Dr. Elizabeth Tisdell  
W. 331 Olmsted 777 W. Harrisburg Pike  
Middletown, PA 17057-44898  
E-mail ejt11@psu.edu  
Phone 717-948-6640

1. **Purpose of the Study:** The purpose of this research is to examine how practicing nurses (who are also RN-BS clinical students who have taken two classes that deal with health assessment and patients with complex problems) form patterns of connections, or create knowledge at different systems levels including through embodiment, as they learn to assess the body, and how these patterns relate to their understanding of trauma in the bodies of their patients and themselves.

2. **Procedures to be followed:** You will be asked to participate in a semi-structured audio tape-recorded interview lasting approximately one hour. Only the principal investigator and a professional transcriptionist, if needed, will have access to the interview audio tapes. You will be asked to share written remarks, drawings, or other reflections of your choice or copies of these from the course materials you produced in Nursing courses on health assessment and complex problems in adult patients. Drawings will be recorded with digital photography. You may also be asked to review preliminary findings to confirm the accuracy of findings.

3. **Discomforts and Risks:** There are no risks in participating in this research beyond those experienced in everyday life. Some of the questions are personal and might cause discomfort. Participation or non-participation will not have any effect on your student or employee evaluation status. You may consider some of the interview questions to be of a more personal nature.

4. **Benefits:** The benefits to you include having a better understanding of how you create new knowledge through the body and how you access and apply this knowledge in your clinical practice. This may enhance the quality of other learning experiences in the future. The benefits to society include added knowledge of embodied learning creating significant learning experiences that arise from and impact clinical care.

5. **Duration/Time:** The interview will take approximately 60 minutes. Any needed follow-up to review preliminary findings would be expected to take no more than 30 minutes. Documents will be collected at the time of the interview.
6. **Statement of Confidentiality:** Your participation in this research is confidential. Pseudonyms will be used on data to protect confidentiality. Pseudonym will be assigned at the time of interview when you share all other materials you are willing to share. There will be no master list linking real names with pseudonyms. The data, including audio tapes and digital photos of drawings, will be stored and secured at the home of the principal investigator in a locked file and only the PI will have access to this data. All data, audio recordings and digital photos will be destroyed after three years. The interview does not ask for any information that would identify to whom responses belong. For group data drawn from self-assessment completed using Angel surveys designed with the ‘anonymous’ setting, and any e-mails exchanged regarding your interest in participating, your confidentiality will be kept to the degree permitted by the technology used. No guarantees can be made regarding the interception of data sent via the Internet by any third parties. Penn State’s Office for Research Protections, the Social Science Institutional Review Board and the Office for Human Research Protections in the Department of Health and Human Services may review records related to this research study. In the event of a publication or presentation (for research or education/training) resulting from the research, no personally identifiable information will be shared.

7. **Right to Ask Questions:** You can ask questions about this research. Please contact Ann Swartz at (717) 948-6514/e-mail als25@psu.edu or Dr. Elizabeth Tisdell (717) 948-6640/ e-mail ejt11@psu.edu with questions, complaints or concerns about this research. You can also call this number if you feel this study has harmed you. Questions about your rights as a research participant may be directed to Penn State University’s Office for Research Protections at (814) 865-1775. If you are interested in the final results of this research please contact Ann Swartz.

8. **Voluntary Participation:** Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer or share any materials you do not wish to share. Refusal to take part in or withdrawing from this study will involve no penalty or loss of benefits you would receive otherwise. Course grades awarded by the principal investigator in the role of instructor will not be affected by the decision to participate in this study.

**May the researcher use existing coursework for research purposes?** *Circle one response for each type*

1. Learning Journals  
   - No  
   - Yes
2. Course Assignments  
   - No  
   - Yes
3. Health Measures  
   - No  
   - Yes

**May the researcher use audio devices during the interview portion of the research?** *Circle one*

1. No
2. Yes

**IF YES, May the researcher use these audio records for future research?** *(Circle two options below)*

1. I do not give permission for my recordings to be archived for future research projects. The records will be destroyed by __________.
2. I do not give permission for my recordings to be archived for educational and training purposes. The records will be destroyed by __________.
3. I give permission for my recordings to be archived for use in future research reports and publications.
4. I give permission for my recordings to be archived for educational and training purposes.
You must be 18 years of age or older to consent to take part in this research study. If you agree to take part in this research study and the information outlined above, please complete and sign both copies of the consent form, and return one form to the investigator.

You will be given a copy of this signed and dated consent form for your records.

______________________________________________  _____________________  
Participant Signature       Date

______________________________________________  _____________________
Person Obtaining Consent       Date
Appendix C: INTERVIEW GUIDE

What were your reactions to trying to bring attention to your sense of embodiment through the “Body Stories” exercises? Do any particular exercises stand out?

Comment on your experience of putting words to your own body story when we began the body stories work.

What was your experience of yoga dance and yoga mindfulness?

What, if anything, intrigues you about the body map you created?

What connections can you make between your body map and your body story?

Finish the following sentences:
   I listen to my body when or by …..

   I feel most connected to my body …..

   I experience the most disconnect from my body …..

   I learn through or in my body …..

How would you describe your own sense of embodiment at this point?

What is your concept of embodiment at this point? Can you give me an example of what you consider to be a significant embodied way of knowing and a time when you made use of this way of knowing?

What have been some of your most valuable insights or key learning point from the experiences of embodiment?

In what way have these experiences changed your understanding of the body and its connectedness to trauma?

To make the connection with trauma, can you remember examples from your life … including your life as a student and as a nurse … when you experienced “fear learning” … Something you learned in an instance of fear, you learned it in that one experience and never had to repeat it, and that you will never forget? What were the body components of that learning?

What about examples of trauma learning? Again, this can include personal, student, nursing experiences. These would be things that you learned in an atmosphere of control where you had few choices, were perhaps denigrated or humiliated, perhaps felt fear or anxiety. What were the body components of that learning?
Are there instances in which this fear or trauma learning resurfaces today, and what are the body components?

Tell a story about a complex clinical situation in which you were aware of knowing and/or learning through your body.

How did you feel that your ability to relate to and engage with embodied learning changed as the courses progressed?

What were you most comfortable with and least comfortable with regarding these experiences?

What assumptions did you hold about bodies, health, yourself, nursing education – that were challenged in some way by learning through your body? How have these changed, or what are your new beliefs?

How have these embodied learning experiences affected your personal life?

How have these experiences of embodied learning carried over into your professional practice?
### Appendix D: Evolving Definitions of Trauma and Traumatic Stress

<table>
<thead>
<tr>
<th>Historical Perspective</th>
<th>PERSON</th>
<th>EVENT</th>
<th>OUTCOME</th>
</tr>
</thead>
</table>
| **Wound**
  (Greek; 17th century in medical literature) | Bodily wounds, damage to tissue, repair may leave scars | Physical trauma exceeds body’s natural capacity for repair | Can lead to state of cardiovascular collapse, or “shock” May be lasting damage or death |
| **“Memory Crisis” resulting from stress of modernity**
  (Charcot, Janet, Breuer, Freud)
  The first psychological turn, when previous focus had been on the physiology of shock | Blows to the psyche registered by the traumatized psyche, existing outside ordinary awareness | Sudden, unexpected, emotional shock | Wounded Mind – memories unconsciously repressed and dissociated; recoverable with hypnosis and catharsis |
| Aftermath of Vietnam and concern with sexual abuse of children led to formal recognition of Post-Traumatic Stress Disorder (PTSD) in 1980 | The person experiences extreme terror or fright; ego functioning overwhelmed | Sexual exploitation (Freud later replaced this with repressed erotic infantile wishes) | Hysterical shattering of personality; disequilibrium of steady state |
|  | **Key:** “psychical reality of memory” (Freud) Shift of focus from nature of the stressor event and its social – historical context to premorbid determinants WITHIN the INDIVIDUAL | WWI and WWII, Holocaust, Korea and Vietnam | “Malingering” Forms of memory loss: Shell-shock, combat fatigue, concentration camp syndrome, survivor syndrome |
**Medical / Psychiatric Perspective**

<table>
<thead>
<tr>
<th>Post-Traumatic Stress Disorder</th>
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</thead>
<tbody>
<tr>
<td><strong>Disorder</strong></td>
</tr>
<tr>
<td><strong>DSM III</strong></td>
</tr>
</tbody>
</table>

- DSM I (1952) reflected a Freudian concern with traumatic neuroses of the individual. DSMII (1968) detailed lists of qualifying events and called it a transient adjustment occurring in some adults.
- Required: “an event that is outside the range of usual human experience and that would be markedly distressing to almost anyone”
- Only these situations have the potential to create PTSD, an anxiety disorder, which may or may not result.

<table>
<thead>
<tr>
<th>Post-Traumatic Stress Disorder</th>
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</thead>
<tbody>
<tr>
<td><strong>Definition became bi-fold:</strong> an interaction between person and event</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1. Person’s response involved intense fear, helplessness or horror</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Continuing emphasis on predisposing factors that make some people vulnerable using the Stress Model of PTSD, now incorporating neuroendocrine research</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Shift from list of qualifying events to key elements of the event</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>2. Must have experienced, witnessed, or been confronted with an event or events that involve actual or threatened death or serious injury, or a threat to the physical integrity of oneself or another. Death is key.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>PTSD, an anxiety disorder, is possible with these events. Now recognizing importance of contextualizing stressful experience; events are not isolated from the person who experiences them</td>
</tr>
</tbody>
</table>

**Humanities Perspective**

<table>
<thead>
<tr>
<th>The Politics of Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>A problem of hypnotic imitation: unresolvable tension between two paradigms</td>
</tr>
</tbody>
</table>

- **Mimesis:** Experience of hypnotic imitation or identification; trauma is located within the particular individual; memory of traumatic origin is retrievable, treatment with hypnosis or catharsis achieves this (Freud)
- **Anti-mimesis:** (Anti-representational) Trauma as purely external event coming to a passive victim (Lends itself to scientific interpretations, i.e. neurobiological; treatment may support forgetting or erasing the traumatic origin as per Janet)
- Linked with literary – critical, postmodern trend recognizing trauma as unspeakable and unrepresentable (Caruth)
- Shatters the victim’s cognitive – perceptual capacities; profound immersion in the traumatic scene; can’t achieve specular distance necessary for cognitive knowledge of the trauma; victim just a series of dissociated roles (Dissociative, multiple selves diagnoses)
Holocaust was *THE central trauma of the 20th Century* PTSD is a unified theory, integrating knowledge of the Holocaust survivors for application to victims of natural disasters, combat, and sexual abuse

### Popular Perspective

| Trauma is Ubiquitous  
Kirmayer, 2007 | The experience of violence and its aftermath | Severe stressors: Sociopolitical events Psychological process Physical and emotional experiences Changing Social Narrative theme is individual and social suffering | Rupture, break or shatter both Bodies and Minds |

### Psychological / Learning Theory Perspective

| Traumatic Stress Reaction  
Figley, 1985 | An event that induces the demand for reorganization of one’s belief system | The demand for change is so high that the person’s psychosocial resources are sufficiently challenged to create pathology |

| Constructivist Self-Development Theory  
McCann & Pearlman, 1990 | Self consists of:  
1. Frame of Reference  
2. Self-capacities  
3. Ego resources (Cognitive schemas operate to integrate experiences) | A “Traumatic Event” is any event that disrupts frames of reference, self-capacities, or ego resources | Restructuring of these aspects of self |
<table>
<thead>
<tr>
<th>Social Cognitive Theory: Shattered Assumptions (Janoff – Bulman, 1992)</th>
<th>3 Fundamental Assumptions: 1. The world is benevolent 2. The world is meaningful 3. The self is worthy</th>
<th>Traumatic events are those that hasten and accentuate the natural life process of realizing that these assumptions are naïve</th>
<th>It is necessary to either deny these experiences or restructure one’s fundamental assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traumatic Stress and Secondary Traumatic Stress Building on Figley’s work (Stamm, 1995)</td>
<td>One’s beliefs – faith in life, in others, and in self – are disorganized by events</td>
<td>Traumatically stressful events demand reorientation and reorganization of belief system, and the experience is stress producing. Traumatic stress may be a categorically different experience, not just an extreme form of stress.</td>
<td>Degree of unbalancing relative to magnitude of the event in relation to the person. It may or may not cause traumatic stress disorder. Stress can be evoked at primary level through witnessing or secondary level by hearing about the event.</td>
</tr>
<tr>
<td>Neurobiological Perspective (Fear Conditioning Model)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neuroethology of Fear &amp; Anxiety (Bolles, 1970; Bolles &amp; Fanselow 1980; Bouton &amp; Molles, 1979)</td>
<td>Fear evolved as set of anti-predator strategies to evaluate and respond to threat and these dominate behavior under threat. Able to recognize a stimulus that is predictive of threat. Learn to associate environmental stimuli with a frightening event.</td>
<td>Unlearned innate behavior patterns having phylogenetic history of species specific protection from threat. Predatory imminence continuum: Geographic – temporal and psychological distance from threat determine response.</td>
<td>Protection from danger Stress-induced enhancement of fear learning. Range of behavior becomes restricted to a limited repertoire. Fear conditioning links defensive freezing with other stimuli co-occurring with threat stimulus.</td>
</tr>
</tbody>
</table>
Trauma involves specific form of ‘body memory’ (Body as circuits involving the brain acquires associations as conditioned emotional responses)
One’s biology, conception of the world, and personality inextricably intertwined with experience.
All people initially experience intrusive thoughts which help them learn, plan, accept, and readjust expectations.
People organize experiences over time, assigning meaning to them, with new organization arising from reflective learning patterns. Trauma kindles related memories which are etched in brain by repetitive experience.
All people can be stressed beyond endurance. | The neurobiological self interacts with: ………………..
One’s biology, conception of the world, and personality inextricably intertwined with experience.
All people initially experience intrusive thoughts which help them learn, plan, accept, and readjust expectations.
“Traumatic Event” is a subjective assessment by victims or how threatened and helpless they feel in a particular interpersonal or societal context.

Overwhelming life experience is human suffering. It effects soma and psyche. | Trauma Responses

The normal ability to transform memory is disrupted so the experience does not fade. Biological changes create hyper-arousal with continuing reaction to stimuli as if threatening. Own physiology becomes source of fear.

PTSD results when people start organizing their lives around the trauma.

Core issue is inability to integrate the reality of particular experiences, resulting in repetitive replaying of images, feeling states, etc. What started out as an interpersonal or societal event becomes entrenched secondary biological consequences.
| Affliction of the Powerless (Herman, 1992) | Victim is rendered helpless by overwhelming force  
Natural force = Disaster  
Human force = Atrocity  
Feeling intense fear, helplessness, loss of control, and threat of annihilation.  
Body and mind involved in response to danger: changes in arousal, attention, perception and emotion (fear and anger).  
Sympathetic nervous system mobilizes for strenuous action. | Power to inspire helplessness and terror.  
Generally involve threats to bodily integrity, or a close personal encounter with violence and death (rape, battery, sexual and domestic violence, war).  
They confront one with the extremities of helplessness and terror, and overwhelm ordinary adaptations to life | Ordinary systems of care that give people a sense of control, connection, and meaning are overwhelmed.  
Likelihood of harm increased with physical violation or injury, exposure to extreme violence, witnessing grotesque death  
Traumatic reactions occur when neither resistance nor escape are possible.  
The complex system of self-protection, normally integrated, becomes disorganized. |
|---|---|---|---|
| Interpersonal Neurobiology of Developing Mind as context for trauma (Siegel, 1999) | The brain creates here and now experience of self. Living in the moment is experience of Core Self.  
The child uses the state of mind of the parent to help organize their own mental processes. | Trauma and stress have their source in the environment, in situations that cause fear.  
Disorganized attachment results when the caregiver is actually the source of alarm, fear and terror. | Trauma and stress affect the core self and its sense of agency, coherence, affectivity, continuity / memory of self in interaction with others are seriously impaired.  
Transgenerational transmission of traumatic stress |
Transactions with the environment involved cognitive process and physical change.

Emotions are created in the socially influenced value appraising processes of the brain.

Violent and terrifying events cause fear.

Emotion is integrative. It connects other processes with each other.

Fear activates body systems for survival and can also cause destructive body changes.

| **Novelty, Incongruity & Loss PTSD as Disorder of Recovery**  
(Shalev, 2007) | Normal reaction is initial preference to attend to fearsome pictures before learning to avoid them (Hebb, 1946); also normal initial attention to traumatic recollections after traumatic loss (Lindemann, 1944). Expressing & communicating these symptoms is necessary for recovery from acute grief; 'stress response syndrome' (Horowitz, 1976) being the normal response to acute loss. | Events that present a threat and evoke fear is a necessary but no sufficient condition. Threatening events must also be horrible and grotesque: strange, disturbing, or distorted; violations of norms for wholeness, bodily integrity, and specie-specific survival schemata. | Fear driven learning AND mechanisms that process novel, grotesque experiences are responsible for PTSD. Normal initial attentions may not extinguish. Persistent symptoms modify the nervous system toward preferential and indiscriminate misinterpretations of threat. |

| **Education Perspective** | The person feels little or no control and makes meaning over time in order to feel in control. | Traumatic event is any unwanted violation of one’s body, mind, and/or spirit. | These violations result in fear conditioning and building of new associations, made up either by the learner or the perpetrator. |

| **Traumatic Learning**  
(Janik, 2005) |  |  |  |
Appendix E: Sleep Deprivation Measure

Am I Sleep-deprived?

From *Power Sleep: The Revolutionary Program that Prepares Your Mind for Peak Performance*

By James Maas

Indicate true or false for the following statements:

-- I need an alarm clock in order to wake up at the appropriate time.

-- It's a struggle for me to get out of bed in the morning.

-- Weekday mornings I hit the snooze button several times to get more sleep.

-- I feel tired, irritable and stressed out during the week.

-- I have trouble concentrating and remembering.

-- I feel slow with critical thinking, problem-solving and being creative.

-- I often fall asleep watching TV.

-- I often fall asleep after heavy meals or after a low dose of alcohol.

-- I often fall asleep while relaxing after dinner.

-- I often fall asleep within five minutes of getting into bed.

-- I often feel drowsy while driving.

-- I often sleep extra hours on weekend mornings.

-- I often need a nap to get through the day.

-- I have dark circles around my eyes.

Results: Two or more "true" statements may be signs of a sleep problem. *Power Sleep* discusses the remedies for sleep deprivation and how to prepare your mind for peak daytime performance by following proper sleep strategies.
Appendix F: Stamm Stressful Life Experiences Scale

<table>
<thead>
<tr>
<th>Stressful Life Experiences Screening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please fill in the number that best represents how much the following statements describe your experiences. You will need to use two scales, one for how well the statement describes your experiences and one for how stressful you found this experience. The two scales are below.</td>
</tr>
<tr>
<td>Describes your Experience:</td>
</tr>
<tr>
<td>Did not experience this</td>
</tr>
<tr>
<td>Stressfulness of Experience:</td>
</tr>
<tr>
<td>Not at all stressful</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Describes your Experience</th>
<th>Life Experience</th>
<th>Stressfulness Then</th>
<th>Stressfulness Now</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have witnessed or experienced a natural disaster; like a hurricane or earthquake.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have witnessed or experienced a human made disaster like a plane crash or industrial disaster.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have witnessed or experienced a serious accident or injury.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have witnessed or experienced chemical or radiation exposure happening to me, a close friend or a family member.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have witnessed or experienced a life threatening illness happening to me, a close friend or a family member.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have witnessed or experienced the death of my spouse or child.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have witnessed or experienced the death of a close friend or family member (other than my spouse or child).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I or a close friend or family member has been kidnapped or taken hostage.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I or a close friend or family member has been the victim of a terrorist attack or torture.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>I have been involved in combat or a war or lived in a war affected area.</td>
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<tr>
<td>I have seen or handled dead bodies other than at a funeral.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have felt responsible for the serious injury or death of another person.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have witnessed or been attacked with a weapon other than in combat or family setting.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As a child/teen I was hit, spanked, choked or pushed hard enough to cause injury.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As an adult, I was hit, choked or pushed hard enough to cause injury.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As an adult or child, I have witnessed someone else being choked, hit, spanked, or pushed hard enough to cause injury.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As a child/teen I was forced to have unwanted sexual contact.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As an adult I was forced to have unwanted sexual contact.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As a child or adult I have witnessed someone else being forced to have unwanted sexual contact.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have witnessed or experienced an extremely stressful event not already mentioned. Please Explain:</td>
<td></td>
<td></td>
<td></td>
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© B. Hudnall Stamm Traumatic Stress Research Group, 1996, 1997 [www.isu.edu/~bhstammt/index.htm] This form may be freely copied as long as (a) authors are credited, (b) no changes are made, & (c) it is not sold.
Appendix G: Hanley Adrenal Burnout Scale

As you reach a goal, how often do you find that you cannot enjoy your success because another, even larger goal is demanding your immediate attention?

How often do you feel attached to your phone, pager, cell phone, or email?

How often do you work late hours and/or on weekends?

How often do you work all night?

How often do you feel impatient or irritated when your children, spouse, or others interfere with your work time?

Do you get sick when you take a vacation?

Do you take two weeks of vacation every year?

Are you unable to take vacations because you feel guilty about taking time off and/or just will not let yourself stop working?

How often do you experience any of the following symptoms: acute anxiety - with no immediate cause; shortness of breath; chest pains that could be mistaken for a heart attack; vertigo; palpations; nausea; blurred vision; dread; the feeling that you will lose mental control; and/or feelings of impending death?

How often do you feel like you are never enough, never doing enough, never good enough?

How often do you peter out around 3 P.M. and reach for a stimulant - even just sugar - for energy?

How often when you bend down and when standing up, do you feel lightheaded or see stars?

How often do you feel dizzy, faint, or momentarily weak?

How often do you awaken in the morning exhausted?

How often do you experience sudden shifts in temper?

If you are a woman, how often do you suffer from PMS, perimenopause, or menopausal symptoms such as craving, fatigue, edema, irritability?

How often do you get colds and flu?

How often do you get infections such as herpes, shingles, sinusitis, colitis, yeast, or boils?

How often do you get constipated?

How often do you get diarrhea?
How often do you feel exhausted after exercise instead of exhilarated?

How often do you suffer from insomnia?

How often do you feel uncomfortably cold, especially your hands and feet?

How often do you suffer from poor digestion, allergies, asthma, headaches, migraines, or musculoskeletal pains?

How often do you have a short fuse with co-workers, family, and people in the service industries - such as waiters, hotel clerks, store clerks, and airline representatives - and shout in the telephone, cut people off in traffic, behave rudely and/or insensitively, and/or have a crying jag?

How often do you suffer from short-term memory loss or confusion?

How often does exercise take more from you than it gives you?

How often do you resolve to exercise and then give up without much effort?

How often, when you have free time, are you too tired to do anything else but vegetate?

How often do you snap at innocent people - even when you feel your temper is justified?

How often do you feel anxious?

How often do you feel depressed, helpless, and/or hopeless?

Do you trek to the bathroom two, three, four, five, or more times a night?

Do you have dark circles under your eyes? Ask a friend to tell you and to be honest.
Appendix H: Stamm Professional Quality of Life Scale

ProQOL R-IV
PROFESSIONAL QUALITY OF LIFE SCALE
Compassion Satisfaction and Fatigue Subscales—Revision IV

[Helping] people puts you in direct contact with their lives. As you probably have experienced, your compassion for those you [help] has both positive and negative aspects. We would like to ask you questions about your experiences, both positive and negative, as a [helper]. Consider each of the following questions about you and your current situation. Select the number that honestly reflects how frequently you experienced these characteristics in the last 30 days.

<table>
<thead>
<tr>
<th></th>
<th>0=Never</th>
<th>1=Rarely</th>
<th>2=A Few Times</th>
<th>3=Somewhat Often</th>
<th>4=Often</th>
<th>5=Very Often</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>I am happy.</td>
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<tr>
<td>2.</td>
<td>I am preoccupied with more than one person I [help].</td>
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<td>3.</td>
<td>I get satisfaction from being able to [help] people.</td>
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<td>4.</td>
<td>I feel connected to others.</td>
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<td>5.</td>
<td>I jump or am startled by unexpected sounds.</td>
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<td>6.</td>
<td>I feel invigorated after working with those I [help].</td>
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<td>7.</td>
<td>I find it difficult to separate my personal life from my life as a [helper].</td>
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<td>8.</td>
<td>I am losing sleep over traumatic experiences of a person I [help].</td>
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<td>9.</td>
<td>I think that I might have been “infected” by the traumatic stress of those I [help].</td>
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<td>10.</td>
<td>I feel trapped by my work as a [helper].</td>
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<td>11.</td>
<td>Because of my [helping], I have felt “on edge” about various things.</td>
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<td>12.</td>
<td>I like my work as a [helper].</td>
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<td>13.</td>
<td>I feel depressed as a result of my work as a [helper].</td>
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<td>14.</td>
<td>I feel as though I am experiencing the trauma of someone I have [helped].</td>
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<td>15.</td>
<td>I have beliefs that sustain me.</td>
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<td>16.</td>
<td>I am pleased with how I am able to keep up with [helping] techniques and protocols.</td>
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<td>17.</td>
<td>I am the person I always wanted to be.</td>
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<td>18.</td>
<td>My work makes me feel satisfied.</td>
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<td>19.</td>
<td>Because of my work as a [helper], I feel exhausted.</td>
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<td>20.</td>
<td>I have happy thoughts and feelings about those I [help] and how I could help them.</td>
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<td>21.</td>
<td>I feel overwhelmed by the amount of work or the size of my case work load I have to deal with.</td>
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<td>22.</td>
<td>I believe I can make a difference through my work.</td>
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<td>23.</td>
<td>I avoid certain activities or situations because they remind me of frightening experiences of the people I [help].</td>
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<td>24.</td>
<td>I am proud of what I can do to [help].</td>
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<td>25.</td>
<td>As a result of my [helping], I have intrusive, frightening thoughts.</td>
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<td>26.</td>
<td>I feel “bogged down” by the system.</td>
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<td>27.</td>
<td>I have thoughts that I am a “success” as a [helper].</td>
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<td>28.</td>
<td>I can’t recall important parts of my work with trauma victims.</td>
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<td>29.</td>
<td>I am a very sensitive person.</td>
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<td>30.</td>
<td>I am happy that I chose to do this work.</td>
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</table>

© B. Hudnall Stamm, 1997-2005. Professional Quality of Life: Compassion Satisfaction and Fatigue Subscales, R-IV (ProQOL). http://www.isu.edu/~hhstamm. This test may be freely copied as long as (a) author is credited, (b) no changes are made, and (c) it is not sold.
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© B. Hudnall Stamm, 1997-2005. Professional Quality of Life: Compassion Satisfaction and Fatigue Subscales, R-IV (ProQOL). http://www.isu.edu/~bhstamm. This test may be freely copied as long as (a) author is credited, (b) no changes are made other than those authorized below, and (c) it is not sold. You may substitute the appropriate target group for [helper] if that is not the best term. For example, if you are working with teachers, replace [helper] with teacher. Word changes may be made to any word in italicized square brackets to make the measure read more smoothly for a particular target group.

Disclaimer

This information is presented for educational purposes only. It is not a substitute for informed medical advice or training. Do not use this information to diagnose or treat a health problem without consulting a qualified health or mental health care provider. If you have concerns, contact your health care provider, mental health professional, or your community health center.

Self-scoring directions, if used as self-test

1. Be certain you respond to all items.

2. On some items the scores need to be reversed. Next to your response write the reverse of that score (i.e. 0=0, 1=5, 2=4, 3=3). Reverse the scores on these 5 items: 1, 4, 15, 17 and 29. Please note that the value 0 is not reversed, as its value is always null.

3. Mark the items for scoring:
   a. Put an X by the 10 items that form the Compassion Satisfaction Scale: 3, 6, 12, 16, 18, 20, 22, 24, 27, 30.
   b. Put a check by the 10 items on the Burnout Scale: 1, 4, 8, 10, 15, 17, 19, 21, 26, 29.
   c. Circle the 10 items on the Trauma/Compassion Fatigue Scale: 2, 5, 7, 9, 11, 13, 14, 23, 25, 28.

4. Add the numbers you wrote next to the items for each set of items and compare with the theoretical scores.
Appendix I: Kolb Learning Style Inventory

There are nine sets of four words listed below. Rank order the words in each set by assigning a 4 to the word which best characterizes your learning style, a 3 to the word which next best characterizes your learning style, a 2 to the next most characteristic word, and a 1 to the word which is least characteristic of you as a learner.

You may find it hard to choose the words that best characterize your learning style. Nevertheless, keep in mind that there are no right or wrong answers – all the choices are equally acceptable. The aim of the inventory is to describe how you learn, not to evaluate your learning ability.

Assign a different rank number to each of the four words in each set; do not make ties.

<table>
<thead>
<tr>
<th></th>
<th>discriminating</th>
<th>tentative</th>
<th>involved</th>
<th>practical</th>
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<tr>
<td>1</td>
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<tr>
<th></th>
<th>receptive</th>
<th>relevant</th>
<th>analytical</th>
<th>impartial</th>
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<td>2</td>
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<tr>
<th></th>
<th>feeling</th>
<th>watching</th>
<th>thinking</th>
<th>doing</th>
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<tr>
<td>3</td>
<td></td>
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<tr>
<th></th>
<th>accepting</th>
<th>risk-taker</th>
<th>evaluative</th>
<th>aware</th>
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<tr>
<td>4</td>
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<th></th>
<th>intuitive</th>
<th>productive</th>
<th>logical</th>
<th>questioning</th>
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<th></th>
<th>abstract</th>
<th>observing</th>
<th>concrete</th>
<th>active</th>
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<tr>
<th></th>
<th>present-oriented</th>
<th>reflecting</th>
<th>future-oriented</th>
<th>pragmatic</th>
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<td>7</td>
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<tr>
<th></th>
<th>experience</th>
<th>observation</th>
<th>conceptualization</th>
<th>experimentation</th>
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<td>8</td>
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<th></th>
<th>intense</th>
<th>reserved</th>
<th>rational</th>
<th>responsible</th>
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<tr>
<th>CE</th>
<th>RO</th>
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</table>

Scoring

The four columns of words above correspond to the four learning style scales: CE, RO, AC and AE. To compute your scale scores, write your rank numbers in spaces below only for the designated items. For example, in the third column (AC), you would fill in the rank numbers you have assigned to items 2, 3, 4, 5, 8, and 9. Compute your scale scores by adding the rank numbers for each set.

Score items:  

| 2 | 3 | 4 | 5 | 7 | 8 | 1 | 3 | 6 | 7 | 8 | 9 | 2 | 3 | 4 | 5 | 8 | 9 | 1 | 3 | 6 | 7 | 8 | 9 |

CE = _____  
RO = _____  
AC = _____  
AE = _____  

To compute the two combination scores, subtract CE from AC and subtract RO from AE. Preserve negative signs if they appear.

AC – CE: \[
\frac{AC}{CE} - \frac{CE}{AC} = ____
\]

AE – RO: \[
\frac{AE}{RO} - \frac{RO}{AE} = ____
\]
Appendix J: Connection to Trauma Theory Through Story - The Case of Marie

In making the connection to this study, participants as students came to class with established patterns of preferred, secure activities. They developed these over a lifetime, carrying some patterns from childhood and developing others along the way, in the course of re-forming as they matured and changed. These preferred, secure activities cut across contexts, including home, work, school, the outdoors and leisure time, etc. Any of these contexts can also become disordered and threatening. When they do, behavior and activity patterns change as necessary, and can break down and become chaotic, with all the attendant emotions, relative to the causes of the disruption. In time, there’s a settling into new patterns. As the disruptions recur, a growing awareness of pattern in recurrence of chaos in a particular context accompanies the learning of the natural games, the patterns of intentional actions that allow the agent to survive in the changing environment. The body and its physiology are present and integral at every step.

**Natural State and Safety**

This interplay and cascading of threats and disruptions is exemplified in Marie’s interview story about being a working mother who cares for children’s bodies at work, and must also care for her family’s bodies, and her own. These are often competing demands. She describes pre-conscious knowing through her body as she faced a recent disorganizing event with her own health. She responded to this interoceptive or interior awareness as a threat alert and made preparations for a more imminent danger. Later, the repercussions of revelations within the family led to unanticipated self-organization with some new patterns of responding:

Well most recently was the nose bleeds. I woke up Wednesday morning, and I blew my nose and it was bleeding, and it took 20 minutes to stop. And I'm
thinking "That's never happened before." And the rest of that day, I could feel the circulation in my head. I was very mindful of that. My daughter was home sick from school, and she and I watched movies. Later on that night I had to drive to work for sexual harassment training. When I drove home I was afraid to turn my head to look ... in changing lanes. So I was really kind of concerned about that.

When I got home and settled to watch TV I just never could really relax. I knew something was wrong. That night I woke up and I was bleeding again. I felt all day that something was going to happen and I thought about what I would do if the worst case scenario popped up. When I ran to the bathroom and told my husband to call an ambulance [blood] was just literally pouring out of the nares of my head. It was pumping out of my head and I was coughing up too. That whole day I felt I shouldn’t go too far from home. Just stay close by and don't shut yourself out of anything. Don't worry about it. The only thing I worried about was trying to get to that silly thing at work. I had chicken soup for dinner. No stress ... I wasn't stressed.

Because of the unusual incident that morning, I was prepared for that night. I was able to be more calm when it was happening and say, “OK. Call an ambulance, because this isn't supposed to be happening.” Getting in the ambulance the guy said, "You're the calmest person I've seen considering how much blood is coming out.” I'm like ... OK, that's fine ... I was more calm than I probably would have been had that been the initial nosebleed. So I think I had been aware throughout the whole day that something bad was going to happen.

On her own, Marie recognized an impending threat that morning and adjusted her behavior. She imagined a worst case and prepared her responses mentally. She anticipated that her family would be affected by what happened, but she was surprised by the way this evolved.

Our eldest son made a comment which really struck me because whenever anything bad happens, I laugh. That's how I deal with it. If he falls, I'll laugh. It's not because I'm laughing because of the fall. It’s because I have to regroup and figure out how to help. But I didn't laugh at the whole thing [her own hypertensive bleeding episode]. And he said, "Well if it had been me, you would have been laughing." I apologized. He said he understood that’s how I expend energy when I’m nervous. But I don't do it at work. When I'm at work, and something bad happens, I get a little more flushed and nervous. I don't laugh. But at home I do. So I'll be mindful not to laugh.

Marie described a situation with her husband, also, in which he perceived that she was not as available to him as he would have liked when he experienced loss of body integrity.
He dislocated his shoulder a couple times years ago. Then one morning he woke up at 4 o’clock in the morning and his shoulder had rolled out of the socket again. He called me while I was working night shift, and he said "You have to come home!" I said that I couldn’t, I had these really sick kids that night. I told him if he could get an ambulance I would meet him downstairs. So instead he got a neighbor to drive him to Holy Cross. They reinserted his shoulder really quickly and then he came home with a pack. He was so upset that I didn't come home for him. I told him, “You got there quicker and you were home faster than I would have driven home to get you.”

He's usually a very laid back person when it comes to stuff like that. But apparently he’s not. I definitely think when he rolled over and his shoulder wasn't with him (starts laughing) I think it wigged him out a little bit. And then when he had his surgery I was just as scared. I KNOW all the bad stuff that can happen.

There are significant aspects of Marie’s story that highlight how some of the theory discussed above plays out in the lives of real people, in this case Marie, and some of the other adult learners in my class. In the subsections here, I highlight relevant aspects of these theoretical pieces.

*Heightened Potential for Threat*

Marie’s story can be used to understand the following principles of our species specific responses to threat to survival or fear in general. When the potential for threat is perceived, the interior experience of worry is the signal to prepare and get ready, ‘just in case.’ The limbic system of the brain, the emotion center, achieves ascendancy and the higher order thinking of the neo-cortex shuts down. The sub-cortex and limbic system in dynamic tandem allow us to achieve mental arousal and concrete thinking is the norm as we prepare to possibly act (Perry et al, 1995). Marie asked herself what she would do if the worst case happened. She planned actions. She did not engage in philosophical pondering.

At this point, an animal would reorganize behavior to change its observable patterns, reducing its risk of predation. It scans the environment more vigorously before venturing out and
takes different paths to and from its nest. It eats larger and less frequent meals. It does protective maintenance on its nest by burying unusual and harmful objects (Fanselow, 1994). An interesting human correlate might be considered in the folk medical practice of burying in the yard a variety of unusual items in order to counteract a negative ‘spell’ (Kriebel, 2008). Marie stayed around home; ate chicken soup, a comfort and healing food; watched TV and spent time with her children; and chose to relax. She scanned her interior landscape being acutely attentive to signs, like her hyperawareness of the circulation of blood in her head.

People incorporate the imaginative use of worry in order to blunt the surprise effect of a potential adverse event. In a formal way, this mechanism has been harnessed for the purposeful teaching of stress inoculation techniques (Matthews, 1990; Meichenbaum, 1985, 2003). Basic security education includes instructions on how to vary one’s daily schedule and routine, particularly when operating outside the home. All of these behaviors occur in response to the increased likelihood of a predatory encounter. This would perhaps be like threat levels “Yellow” and “Orange” on the Department of Homeland Security National Threat Advisory System (Larson, & Peters, 2001). This is a difficult comparison to make because individuals aren’t aware of all the actual threats to a nation that are detected. So the behaviors exhibited by people are always in response to their own sphere of awareness of environmental threats.

Detection of Present Threat/Imminent Danger

When an actual threat is detected, anticipatory fear, mobilization and vigilance kick in according to the following processes explained by Rau and Fanselow (2007). The predator is present AND detected by the prey. Now the self-organization of behavior becomes defensive with the aim of avoiding contact with the detected predator. These patterns are highly variable across species and individuals. Rats are most likely to automatically freeze, but will run if a safe
route is readily available. With freezing, all movement except respiratory is eliminated. If freezing fails to prevent contact with the predator, there can be a reactive burst of activity, including movements, noise, intimidation, attacks, all facilitated by the freezing and still aimed at terminating contact with the predator. Freezing is not useful in healthcare, so it is not surprising that the study did not uncover stories of freezing. In Marie’s story we can make the connection between her laughter in the face threats, understanding this as a reactive burst of activity. It is noise, and she identifies that it allows her to organize herself to act. It fends off panic and helps diffuse the possibility of increased chaos. The fact that she did not laugh in response to her own hemorrhage, did not faint or freeze, and remained unusually calm, may suggest that she was under the influence of her body’s protective chemistry.

[Endogenous opioid-like peptides provide a sort of analgesia so that attacks can be carried out while withstanding injury. Only afterward in the period of recuperation are the damages and pain noticed and experienced (Fanselow, 1986). The neuroendocrine stress response and limbic brain (especially the amygdala) are at play throughout this process (Fanselow & LeDoux, 1999; Sapolsky, 2005c). When hearing Monica’s interview story of injuries she receives at work, we have a new way of understanding her responses.

I feel most disconnected from my body when I'm at work. You know … lifting patients just running around on your feet all day, not really paying attention to what I'm doing, getting bruised up. (laughing) My legs sometimes get bruised. When you're lifting patients, your legs hit the side of the bed while you're lifting. I work night shift most of the time, so it'll be dark in the rooms and I'll like bump into something. I bruise easily. I don't really notice … pay attention … because the main focus is the patient. So I'm not really focusing on myself. I'm focusing on getting the patient where they need to be or getting them situated. That's my first focus at work.
I notice that I’m bruised] the next day. I notice something on my legs after my bath, after I take a shower, I'll at least put lotion all over, and I always notice bruises here and there (little laugh). I don't feel them, unless I get hit at the same spot or I touch it.

**Individual Differences**

In people, the *interior experiencing* connected with the increasing levels of threat presence (from no threat, to increased possibility of threat, to present threat) moves from anticipatory worry, which can enhance coping skills, to anticipatory fear which stimulates and reorganizes the behaviors toward movement, until panic ensues with the identified presence of the predator, when the threat is imminent (Rau & Fanselow, 2007). Significantly, individual appraisal of danger and perception of risk are what define threat imminence, so we must expect these definitions to span the diverse range of possibility (Craske,1999). With progression to perception of actual threat presence, the limbic brain of our emotions (which we share with all mammals (Sapolsky, 2004b, 2005c) stops communicating with the sub-cortex and its basic rationality, and begins instead to communicate with the more primitive midbrain, which we share with all other animals possessing a nervous system (Sapolsky, 2004b, 2005a). The neuroscience research of psychiatrist Perry and his research group (Perry et al, 1995) clarifies the interconnection of neural process and behavior in the face of threat, and indentifies the diversity of individual patterning, always expressed as some combination of hyperarousal and dissociation. The following is a summary of the process et al (1995) identified that offers an interpretation to aspects of Marie’s story from the scientific perspective of the neurobiological fear conditioning model of trauma.
When the threat becomes a real and present danger, our thinking becomes emotional as our mental state is one of fear, and we may freeze. Marie’s husband was frozen to a degree, when he discovered his misshapen body due to dislocated shoulder. He felt unable to act, and felt reactive anger, which is linked with aggression, because Marie could not act to help him as he imagined was necessary. His thinking was not rational, but rather emotional.

When we progress beyond freezing, into forms of movement that allow us to flee and to fight, it is because our limbic brain of emotions has relinquished its power to the midbrain, and ultimately the brainstem and autonomic nervous system. The mental state of fear is replaced by terror and then a sort of move past awareness. Our thinking passes out of emotion and into pure reaction and then reflexive action. When the ‘freeze’ behaviors of resistance (hyperarousal) and compliance (dissociation) fail, we move into either flight and fight mode, the hyperaroused form of which is expressed as posturing and then physical aggression; the dissociative form as numbing, then fainting, and perhaps brief psychosis. Marie was able to ward off this progression in her husband, calming him from a distance and suggesting a plan. He was then able to direct his adrenalin charged fight/flight reaction into calling someone and getting himself to the hospital. His memory of horror at his body, helplessness and anger were coupled to this experience of fear as context.
Appendix K: Group Learning as Patterns of Connection

When learning is understood as a process of self-organization, then it is noted as emerging within the patterns of connections formed at multiple levels. This study focuses on patterns of group learning across time in the context of two nursing courses, and then individual participants’ patterns of connection between early life and past professional embodied learning and the various embodied learning experiences presented in these courses. Patterns of self-organization are always dependent on the intrinsic dynamics present at the outset.

*Health Assessment Course: Patterns of Connection at the Level of the Group*

Group learning patterns were identified through summary of the researcher’s journal. The health assessment course met on five weekends for full day sessions, and three evenings to hear speakers and experience two yoga trance dances. A total of 18 students began the course on Health Assessment / Physical Examination. At the first night of class they were oriented to the course, introduced themselves and spoke about their nursing experience and current practice, identified their assessment strengths and learning desires for the course, and took a physical examination pre-test. The final activity was as 75 minutes session of yoga trance dance to introduce the embodied learning thread of the course. Overall, students were initially surprised and skeptical, but open to the experience and very positive about it afterward. It was perceived as a good workout, which challenged their assumptions from the start. The stress of feeling foolish and fear of being watched, shared by many, was overcome easily because the lights were out. The very well chosen music and deft leadership of the yoga instructor were noted as facilitative. One student (overweight and ambivalent about having to do lab and clinical course...
work) dropped the course and left the program the following day. Remaining students decided to prepare themselves for a different kind of semester.

“Shake those coconuts!”

At the first weekend session there was an extended discussion of ‘hippies’ …. One student’s label for the yoga instructor. This discussion served the purpose of allowing students to express some of their skepticism about the body learning assignments. More importantly, they identified their values around bodies, self expression, self-awareness and self-care by telling stories from clinical practice and a few from their personal lives. There were also many questions about expectations for the ‘body stories’ journal they would be keeping.

“My patients don’t choose their bodies.”

By the second time the class met together, they had written their personal body story, drawn their skeleton, and begun doing movement exercises on their own and keeping a journal about their activity. All of them felt very challenged. Retrieving body memories was difficult, but they found that once begun, the process was pleasurable, as one memory soon began generating others, often fragmented and unconnected. The fragmentation was disturbing to some, ignored by others, and sometimes conducive to creative, imaginative elaborations on the memories. None of them had yet found a satisfactory way of completing the movement exercises, which were often designed for partners and almost always benefitted from narration by an outside observer. Various discomforts arose in doing exercises together in class (lying on carpet which might be dirty, being in full view of pedestrians - although the isolated building is essentially empty on weekends, being close to each other and able to be observed by other students. Nevertheless, they experienced the exercises as relaxing, and after completing these as a group
had a clearer understanding of what they were to be accomplishing on their own between class meetings.

The primary topic of discussion related to their body stories reading was some strong reaction to the concept of choice in relation to bodies. Some were genuinely angry with the text, pointing out that their patients (especially children) could not choose and had to live with their deformed bodies. This reaction, coupled with their frustration with this new sort of ‘homework’ felt like a threatened derailment. As previously, by sharing clinical stories from their work, validating each other's feelings, and with some tricky reframing by the instructor, there arose a new commitment to explore the body stories work, if only to prove it wrong and confirm the generally held assumption that this body learning had nothing to offer.

*A Case of “the Vines”*

There was a marked difference in attitude with palpably less anxiety by the third weekend class. It had become clear that the body stories book really was about anatomy and followed a head to toe sequence, just as their physical exam book did. Everyone had found their own way to complete the assignments and have something to write in their weekly journal entries. Here their individuality really began to take hold and define their learning processes. Amazingly, only one student opted to tape the exercise narrations and listen to them, while also listening to her favorite music recordings. One combined the study with her home yoga practice. A few enlisted a family member (usually spouse) to read the exercises while they relaxed into them. Others found various ways to break down the exercises into easier to remember segments. Identifying a specific place and time for practice was important for some: in bed at bedtime worked for a few, others used a favorite chair or even their office. One student simply decided what she wanted from the entire experience …. which was to achieve relaxation, and she
“switched around” all the exercises to achieve that purpose. At this class meeting, the group ‘body story’ exercise time was much more relaxed. Concerns about floor germs, windows, air temperature, being observed by each other had been handled. Each one modified their participation, in terms of assuming positions, according to their own level of comfort. A friendly sense of humor prevailed. They had created a ritual of sharing lunch time in the classroom, which had never happened before with this course. Only one student consistently retreated to take a nap during lunch. The meal time discussion this week was a very hearty ‘can you top this?’ sharing of clinical stories related to reproduction and genitalia.

*War and Amputations*

Class weekend four was a surprise as students made connections between the body stories, most of which had dealt with lower extremities, and much deeper and negative emotions. Discussion found its way into the challenges of their work that make them tired (often experienced through their feet and legs) then on to clinical stories about patients with extremity complications, then amputations, and finally the war in Iraq. One student was preparing for her husband’s first deployment. Shared stories of their talks about amputations led to a deeply emotional discussion in which students engaged their classmate through their own emotions and ultimately found ways to validate each other for what they do each day as nurses. The topic did not spiral into negative emotion, such as a sense of depression, but it did push the group toward public recognition of the darker side of their work.

*The Past We Carry With Us*

At the final weekend class, when the body stories work had made connections among body structure, senses and emotions, the focus of discussion was on the satisfactions and challenges of work, how these were being expressed through their bodies, and how these expressions
overlapped with traumatic stress reactions. Using class as a problem solving session, they embraced the opportunity to exchange stories about challenging situations in their own work settings, and approaches to change that had succeeded ... or failed. They approached the in class body stories as an anticipated opportunity to relax at the end of class. Given the option of finishing the course with another trance dance, they made a unanimous choice to do so. Four students found themselves choosing to negotiate job changes.

*Complex Problems in Adults Course: Patterns of Connection at the Level of the Group*

In the following semester, thirteen of these students continued together in a second course, this time a clinical course, Complex Problems in Adults. A few students were out of sequence and had already completed this course, without the embodiment exercises. Six other students joined the group, either without completing Health Assessment or having taken it earlier or elsewhere, again, without embodied learning content. The mood of this class was decidedly more informal, typical of students during summer session in this program. While the group engaged well in all activities, cohesion had to be rebuilt and the students with no embodied learning experience presented a challenge, as it was much more difficult for them to see that movement and interoceptive awareness had anything to do with what they were ‘supposed to learn.’ Occasionally they were disruptive. Despite an orientation at the start of the course, it was impossible to convey in a brief period, and passively, the patterns of connections that were formed during the previous semester. The learning journal requirement for this course was less structured than during Health Assessment. Students were instructed to record their reflections on the course elements as they drew upon them to make connections for learning each week. They could draw from in class experiences and discussion, readings, clinical experiences that were part of their course work, and on the job experiences. Rather than require specific reflection on
all body activities, it was a purposeful decision to allow students to choose what they understood as the sources of their learning by making connections.

*Body Map*

Although creating a life size body map was one of the independent exercises late in the body stories text, during Health Assessment, most students claimed they didn’t understand the assignment and did not make one. So this was a group activity early in the Complex Problems course. The activity made more sense in doing it together, and most students appreciated this social aspect and the ability to ‘look at what other people were doing’ in order to know better how to carry out the process. Having to negotiate the intimacy of drawing around each other’s bodies, most of their forms were a bit bloated. Most felt very challenged when confronted with a box of crayons and the freedom to choose any color and write or draw whatever they wished. Despite the written description from the text, written on a white board, and given as oral instruction at the start of the activity, students made their own interpretations of what was to be done and the drawings were quite different. These changes are viewed as reflections of the difficulty in creating a body map, beginning with focusing on interoception, connecting with emotions, and turning this into a graphic representation. The task was very, very challenging. But students engaged when it became fun. Months later, during interviews, many said they finally thought they understood the intent of the body map exercise within the context of the body stories learning, and that their map would be very different if done again. One student, new to embodiment, had a map consisting only of a body outline. A few created greatly detailed drawings focused on superficial aspects like make-up, jewelry, etc. Among the other students, they noticed, with sad amusement, the overwhelming presence of references to pain and hunger.

*Chaos / Self-Organization Activity*
The second body activity involved movement and related directly to course content. Students were being introduced, through reading, to concepts from complexity science. To demonstrate chaos and self-organization they moved into a large open area and successively moved according to instructions: 1) Start moving and keep moving, and choose a person to always keep in view. 2) Keep moving and now choose a second person, always keeping both in view and staying at least six feet away. 3) Add a third person to keep in view and stay apart from, and avoid eye contact. If eye contact is made, change directions and resume the activity. The group response was as with previous groups of students in this course: they asked no questions, began moving in a big circle going the same direction and continued in that way, evolving into two nested circles going opposite directions. They made comments, laughed and moaned as the instructions increased, but maintained their order and direction.

In the group discussion afterward, they identified two primary approaches taken by almost every student. They either chose to follow the person who was standing closest to them at the outset of the exercise, or they fixated their gaze on one of the two students wearing bright yellow T-shirts that night and followed them. One student purposely tried to challenge the process surreptitiously, and playfully, by purposely making eye contact with other students in order to force them to make a change. Another student found herself becoming very anxious when the third person and eye contact requirements were added. She began feeling the way she felt at the park, trying to keep track of her three children. Following the instructions would have forced her to override her own well-ingrained safety rules and her mind, led by her body and emotions, just set a limit and she stopped incorporating new information. A few other students experienced some degree of attending less specifically to the new details but they couldn’t be specific and felt that they still continued to try to follow instructions. They were able to
recognize their unique responses and differences from each other, but they did not make a connection to the illustrated concepts until after the course was completed.

*Yoga Mindfulness*

During the next four weeks class began with a yoga mindfulness exercise, narrated by the instructor from a script, building progressively each week from first a focus on breathing at different sites in the body, to feeling body connection at its boundaries, and finally touching the solar plexus and connecting to self and one’s own body. Students received a copy of the script so they could practice at home or use with someone else or at work. After the first two weeks a Body Awareness scale was added, for student use only. It was a Likert scale that allowed them to rate body awareness before and after doing the mindfulness exercise. Again, they were encouraged to explore use of the scale with themselves outside of class. In the fourth week, students were paired and they practice leading each other through the exercise. It was surprising during the interviews to find how much a few students enjoyed this exercise and used it later at home and at work to calm themselves. During the course, it was clear that the group relaxed through mindfulness, but they had little to say about the experience. During the interviews, most of them remembered the mindfulness as relaxing but less enjoyable than the body stories because it didn’t include movement. Their strongest memory was of the paired practice and how noisy the room became and some students’ not taking the exercise seriously and adding more distractions. Months later, two students noted the connection between that exercise and the challenge of focusing within chaos that is required during critical clinical situations, and to some degree of all of us in our everyday lives.

*Viewing of the Film “Wit”*
For the next experience the class watched a feature film, “Wit,” about a woman’s experience of being treated for ovarian cancer under a research protocol, and ultimately dying. Use of the body awareness scale was incorporated before and after viewing the film. Students were very attentive to a difficult to hear film. Most were struck into silence, shared a mood of depression, and later expressed their dismay at how much of the story resonated with their own experiences with technology, research and ‘care.’ They found the film very disturbing but were glad they watched it.

*Clinical Stories with a Body Component*

Finally there was a sharing of stories of complex clinical situations in which they were aware of knowing or learning through their body. All had contributed written clinical vignettes early in the class for use as case studies during class discussion. For these stories, the instructor told a story from her own practice as an example and then led a discussion about students’ responses. They used the following week to choose a story from their own experience that could be told in 3 minutes and then exchanged these stories in pairs. Only the experience of telling and listening was discussed in class. This was a very popular activity, experienced as a relief and very validating. Many talked about how wonderful it was to be able to tell a detailed story to someone who would listen and could understand and identify, since families don’t tend to want to hear these stories.

*Learning Journals*

The collections of references to learning experiences in students’ learning journals were quite interesting. Almost all wrote about what they learned from readings about complexity science and leadership, and their readings about transcultural health care. Pathophysiology readings received much less attention, and almost no one mentioned readings about quality
improvement and risk management, even though these were directly related to a clinical hours requirement. Most students chose a few concepts from the complexity science book and attempted to explore and explain these in relation to experiences at work. Students who had participated in ‘body stories’ in health assessment were more likely to include references to the self-organization exercise, the body map, viewing ‘Wit.’ All of these students wrote about the film and most about the body map. Both groups of students included references to the yoga mindfulness activity at a 50% rate, suggesting this experience was more meaningful as an introduction to embodiment than as a follow-on for students who were accustomed to movement in the ‘body stories.’ In analyzing interviews for participants’ perceived results of embodied learning, the possibility of connections to all of these activities are present, although most participants didn’t select them from the list as standing out or being specifically significant. And yet awareness of connections often emerged in the course of interviewing, as a tangent, raising the possibility that much of the embodied learning occurs outside of conscious awareness, only heightening the already present difficulty of putting into words exactly how this embodied learning works.
Appendix L: Individual Uniqueness in Most Memorable Exercises

To identify the most memorable and valued embodiment activities the data analysis examined course Critical Incident Questionnaires or “CIQ’s “ (Brookfield, 1995) and the interviews, then looked back to the journal recordings about these activities. The analysis is compiled below in Table 10.

Table 10.  
**Particular Embodiment Activities That Stood Out**

<table>
<thead>
<tr>
<th>Name</th>
<th>Activity</th>
<th>Key Descriptions</th>
<th>Integration</th>
<th>Trauma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angela</td>
<td>#2 Body Memory story</td>
<td>We were taking a walk and we had to go through a basement. The words were supposed to jar a certain feeling .... It created a little sensation of how much you can feel emotion by just picturing it. It was amazing how this translates once you let yourself get into it.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>#25 Nervous System</td>
<td></td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Body Listening:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Imaginative journey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased interoceptive awareness and openness to embodiment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cadence</td>
<td>#19 Iliopsoas</td>
<td>That one, working on a muscle, From the quadriceps to the obliques. (supports pelvis and organs inside) I forgot about that one?? I didn’t realize that I use it. Now I work particularly on that muscle, since I’m pregnant.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Eugene</td>
<td>Epilogue: Body Tracing</td>
<td>Describing in our own terms all over our recently drawn picture of ourselves showed the problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
| #7 Body Measuring | #8 3 Body Weights & Postural Alignment | we deal with and physical problems we perceive.  
The plumb line. That is an easier visual for me than some others, because I’m trying to be more cognizant of my posture.  
*Self – Awareness and connection with others; Body awareness and self care* |
|---|---|---|
| Fred | #18 Pelvis | I remember noticing the way I rotated my hip up, how that changed my posture and made me taller. I was losing weight and becoming more aware of my body. It was interconnectedness. That’s why I remember it.  
*Increased body awareness, self awareness and evolving concept of embodiment* |
| Gabriella | Quite a few stand out that I still try to engage today  
#7 and #8  
#11 Axial Skeleton  
#18 Pelvis  
#19 Iliopsoas | Talking about the vertebrae, the alignment; envision the vertebrae and feel them stacking; it made me appreciate bone as living tissue and become more aware of my posture. This is really how you strengthen Your core .... Bring flexibility back To the pelvis ... primal moves in Trance dance ... fluidity, freedom, Movement, opened up, relief, Release, energy!  
*Body and self awareness, sense of embodiment, self-care practice* |
| John | #3 Sensory Awareness / Body Painting  
#25 Body Listening | You could actually feel yourself going into this color red ... it was fascinating  
You were imagining going down these |
<p>| Yes | No |</p>
<table>
<thead>
<tr>
<th>Yoga Trance Dance</th>
<th>Stairs, and whatever was narrated, you FELT! It was very relaxing. Running around in circles was freeing. I do it with my kids now.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>Increased interoceptive awareness, sense of embodiment, and new practice sharing embodiment in relationships</em></td>
</tr>
<tr>
<td>Kathy</td>
<td>That was a little difficult for me to do. It didn’t feel right. I didn’t want to get into it too much.</td>
</tr>
<tr>
<td></td>
<td>Deep breathing, I keep up with that. I do that ten times a day. Some of the ones that needed a partner. The skull massage. My husband and I did that with each other and found it very relaxing. He enjoyed it more than I did so we did it more often.</td>
</tr>
<tr>
<td></td>
<td><em>Increased self-awareness, new self-care practice, embodiment shared in close relationship</em></td>
</tr>
<tr>
<td>#5 Evolution</td>
<td>Yes  No</td>
</tr>
<tr>
<td>In the water</td>
<td></td>
</tr>
<tr>
<td>#6 Evolution</td>
<td></td>
</tr>
<tr>
<td>On land</td>
<td></td>
</tr>
<tr>
<td>#4 The Cell</td>
<td></td>
</tr>
<tr>
<td>#10 Skull</td>
<td></td>
</tr>
<tr>
<td>Maria</td>
<td>The one that required just sort of lying there, and moving your hips ... Whenever I think of lying relaxation I thing of lying down or sleeping. It’s my incentive to get through the day. While I was going through this class I was exhausted. I feel 80% better than I did.</td>
</tr>
<tr>
<td></td>
<td><em>Increased sense of embodiment and evolving concept or embodiment</em></td>
</tr>
<tr>
<td>#20 Femur</td>
<td>No  No</td>
</tr>
<tr>
<td>(hip circles)</td>
<td></td>
</tr>
<tr>
<td>Marie</td>
<td>#14 Shoulder Girdle</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------------</td>
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<tr>
<td></td>
<td>I didn’t realize how much movement and thought process was involved in that simple but very poignant movement of giving someone a hug. It was really helpful. I’m opening up more to my husband and children. I’m becoming more in tune with what my body’s going through. Having relived the things that make me who I am, writing my early memories and realizing there’s so much history to each person.</td>
</tr>
</tbody>
</table>

*Increased body and self-awareness, evolving concept of embodiment, sharing embodiment in close relationships*

<table>
<thead>
<tr>
<th>Mary Beth</th>
<th>#5 Evolution</th>
<th>In the water</th>
<th>#2 Attitudes about the body (constructive Rest)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>When you’re imagining being a fish and no arms or legs, you think about how incredible it is to do what you do. Feeling the weight of your brain, and head, and joints falling to the floor. I never took time to focus. Everyone takes their body and movement for granted. When you really feel ... in a sense you are awakened. It’s very open.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Increased body awareness and sense of embodiment*

| Monica         | #20 - #23 Legs and feet | When I was at work, standing on my feet all the time, and when working out, I wouldn’t focus on my knees or lower legs. I started focusing stretching and using proper alignment so my knees |
|----------------|-------------------------|--------------------|-----------------------------------------------|
|                |                         |                    |                                               |

<p>| Yes | Yes |
| No  | No  |
| No  | No  |</p>
<table>
<thead>
<tr>
<th>Name</th>
<th>Task/Description</th>
<th>Experience</th>
<th>Reality Check</th>
<th>Awareness Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rachel</td>
<td>The ones we did in class together</td>
<td>It was hard for me to concentrate and it took a lot for me to concentrate in doing the body stories. Even in class it was hard due to everyone else around me.</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>No awareness of learning, looking back</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Robert</td>
<td>#2 Attitudes About the Body (constructive Rest)</td>
<td>Especially the first one, constructive rest. Made me aware I could control my body in ways I never knew; made me more in tune of my body. You feel yourself letting go. I still use it today. Like when I’m having trouble going to sleep.</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I tried the sensory one in the library and Noticed how with my eyes closed I could Pick up all these things through other Sense that I don’t usually notice.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Evolving concept and sense of embodiment; increased body awareness; new self-care practice</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trudy</td>
<td>The ones that focused more</td>
<td>You don’t focus a lot of attention on your Body because you’re too busy.</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
on skeleton and joints found these just relaxing, my own time. No one was going to talk. With the skeleton & joints, because we come from work, aching and stiff, I found I could focus on these parts because they hurt.

*Evolving concept and sense of embodiment*

| Table 1 reveals several things. Experiences of body alignment, sensory and affective awareness, and relaxation or release were named frequently, but these arose from different activities for each person. The pelvis and legs were the most referenced body regions. In most cases the stories, journal entries or interview, did not represent integration. Emotion or imaginative connection with interpersonal relationship could have been present but were not included as part of the story. When integration appeared it was in situations where the participant was sharing their learning process with family members. Connection to past trauma only appeared once.

Two things were consistent. First, the majority of exercises named were those done in class together, and some participants even noted this as important. This could generally be construed as interpersonal relationship. In the same general way standing out in one’s memory could imply attached positive emotion, but I applied the criteria for integration more strictly. Second, in most cases an intrapersonal relationship was inferred. Participants remembered these exercises because they brought them in touch with their own bodies in some new way, so they served as marker events or connection nodes. Most frequently what occurred was emerging connection with self through body awareness (of what one’s own body is able to do and experience) or self-awareness (understanding one’s own perceptions and actions). Occasionally
this connection appeared as increased interoceptive awareness (knowing internal body perceptions and feelings). The next most frequent occurrence was an evolving sense of embodiment (experiencing the body as relaxed, free, energized); and then an evolving concept of embodiment (noticing ways that the body knows, expresses stress, is whole and interconnected). Several participants reported a new embodied practice, usually in the form of self-care and a few times as sharing embodiment in a close relationship.

While only a few of these stories mentioned stress directly, as a group participants identified that they are most disconnected from their bodies at work. Heightened awareness of this came to them after completing the body stories and health assessment, when they created body tracings together. The activity itself was boisterous and fun, but they were sobered by the realization that their body maps all labeled hunger, pain, or both of these. The high-stress group was not distinct. All of these new forms of awareness and especially new behaviors take on added meaning in light of participants’ bodily expressions of stress, discussed in the next section.
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1979 – 1982  Head Nurse, Psychiatry; Walter Reed Army Medical Center
1976 – 1979  Staff Nurse, Medicine; Head Nurse, Psychiatry; Assistant Chief Nurse Evenings & Nights; Womack Army Hospital, Ft. Bragg
1974 – 1976  Assistant Nurse, Plastic Surgery, Burns, Psychiatry; University of Virginia

Affiliations
1973 – Present  Phi Pi Theta, Jefferson Literary and Debate Society, University of Virginia
1974 – 2008  American Nurses’ Association
1984 – Present  Sigma Theta Tau, Nursing Honor Society
1984 – Present  Military Officers Association
1995 - Present  Army Nurse Corps Association
2008 - Present  American Holistic Nurses Association