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The Accidental Experts: A Demonstration of the Existence, Utility, and Emergence of Implicitly Learned Tacit Knowledge in Assistive-Augmentative Technology Users.

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The Accidental Experts: A Demonstration of the Existence, Utility,
and Emergence of Implicitly Learned Tacit Knowledge in
Assistive-Augmentative Technology Users.

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Doctor of Education

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by

Douglas Eugene Masini

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ABSTRACT

The Accidental Experts: A Demonstration of the Existence, Utility,
and Emergence of Implicitly Learned Tacit Knowledge in
Assistive-Augmentative Technology Users.
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I investigated the presence, utility, and emergence of tacit knowledge in 9 study participants who used assistive-augmentative technology. I conducted phenomenologic interviews, audio-taping, and transcribed the interview with the written consent of the participants. Sixteen highly trained experts critiqued the final product of the interviews and answered a 25-question survey instrument. Non-parametric statistical processes were chosen to conduct inferential hypotheses testing. Wilcoxon - Mann Whitney U tests and Kruskal - Wallis One-Way ANOVA (alpha level of 0.05) were used for questions 1-10, and a 2 x R (R = 3 or 4) contingency table and Fisher's Exact Chi-Square were used for questions 11- 25. The responses to survey questions showed no statistically significant differences or interaction for the variables gender, expertise, and service ($p < 0.0017$). Qualitative analysis found discernable heuristics and ideation that was indicative of the presence of implicitly learned tacit knowledge in study participants; the utility of tacit knowledge emerged during direct observation or when participant's engaged in analogy, storytelling, and metaphor. The participants in this study used introspeculation, a learning style framed by reflection and introspection on the validity of one's own knowledge and the value of what is learned from life experience and in the classroom. The introspeculative examined the presence and utility of tacit knowledge in decision-making, and questioned the veracity of sources and resources that guide them on the path of life. The study suggested that tacit knowledge not only informs the practice of therapists and technology users but may assist classroom teachers facing student involvement in individual education plans (IEPs), Individuals with Disabilities Education Act (IDEA), or section 504 of the Americans with Disabilities Act (ADA).

2

DEDICATION

This work is dedicated to the love of my life, my wife, and my greatest supporter, Shirley D. Masini. Thank you for putting your life on hold and helping me to accomplish this dream.

To my children, Anne Michelle Masini and Joseph Douglas Masini for their love and support through the many years of school.

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TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

The mission of the self-directing educator philosopher:
"To shew the fly the way out of the fly bottle" (Ludwig
Wittgenstein, 1910, cited in Gudmunsen, 1977, pp. 69-70).

The intent of this study was to investigate the presence and utility of implicitly learned tacit knowledge in persons who have learned to use complex medical technology while in the process of gaining mobility and coping with catastrophic neuromusculoskeletal injury or disease.

Survivors of catastrophic illness abound in our community, and their ability to thrive in society is dependent on their ability to simultaneously cope with an injury or illness while implementing new ways of thinking, knowing, and doing. They are a unique cohort of learners considering that, prior to the injury or illness, they enjoyed sound bodies, had families, careers, occupations, in most cases exceptional brain function and intelligence, with proficiency and physical skills acquired from years of training and experience culminating in knowledge from implicit and explicit learning. Their illness or injury has radically changed their life, for study participants were unable to control necessary bodily functions and were trapped in a paralyzed body with altered cognition of the world around them: they are capable of receptivity but cannot effect responsiveness to the stimulus.

In an attempt to escape this nearly inescapable situation, they used their native intelligence to cope with and overcome the life-changing problems incurred by the complex assistive-augmentative medical technology (upon which they are literally dependent for life and breath) and the debilitating and often painful sequelae of the physical insult itself.

I chose this group of people not only because they were interesting from a scientific perspective. In reflection, I now see that my ignorance about their use of technology immediately juxtaposed our roles, with me taking on the role of the listener and learner while they became the teacher. They held my rapt attention with their tales of trial and error, success, failure, and the physical

and spiritual challenges they faced along the way. My experience with these strong, independent people convinced me they were learning unusual things about complex medical equipment in unorthodox ways, using techniques that did not appear in the lesson plans or in a text book. It seemed that almost all of their learning occurred out on the fringe of traditional pedagogy and didacticism. In fact, hearing their stories about learning and knowing made me question my own beliefs about teaching and caused me to re-examine that which I define as knowledge.

This study explores historical, philosophical, and epistemological foundations of knowledge, and uses the findings and conclusions of the research to propose a novel technique for measuring the effectiveness of training programs in this unique group of learners by mapping the utility, presence, and emergence of their implicit and explicit learning. The clients tell their story in a phenomenological interview; then these observations are analyzed by the experts in the allied health fields who rescue them, rehabilitate them, nurture them back to health, and then train them to use complex medical technology to survive.

Knowledge is a shy and wary chameleon that changes its form and color to suit the habitat and environment of the knowledge-seeker. Throughout recorded history, traditional explicitly learned knowledge was analyzed and evaluated using a format of written tests or extemporaneous, verbal tests or examinations. Performance on these examinations revealed the presence of facts, formulae, and figures in the cognitive consciousness of individuals who broadened this base of knowledge through laboratory experience, discussion, performance appraisal, and further testing. Those who fare well on a standardized test are certified by the academy to have displayed knowledge, although this "paper-and-pencil" knowledge may or may not represent practical experience or have application in the real world.

The owners of traditional knowledge may or may not have a complete understanding of why an event took place or how a process is performed. They

draw from an information base gained from lectures, through reading and rote memorization, and have done countless calculations and achieved correct answers to problems, possibly never having had the opportunity to actually apply the findings in the solution of a physical problem. In contrast, there are others who are the owners of practical knowledge who exhibit craftsmanship and tactile/psychomotor skills learned from years of hands-on experience or from observing a master craftsman during the trial-and-error process of apprenticeship.

The majority of work on tacit knowledge and implicit learning is "new" in that it arose in the early 1960s; my earliest inquiries caused doubt in my mind that tacit knowledge gained through implicit learning was conceptually new; hence, included in this study is an exhaustive review of the classic literature seeking postulations and observations concerning different types of knowledge. This exercise is an appeal to the academy to consider the possibility of the existence of several forms of learning, both conscious (explicit) and unconscious (implicit) that collectively lead us to being knowledgeable.

The tradition of explicit learning tells us that true knowledge is initiated by reading from books, attending organized classes with didactic lessons, and listening to wise people discuss problems and offer solutions. The literature on the tacit dimension of knowledge suggests that field experiences in the classroom of life provide a sound curriculum and that lessons are learned implicitly, absorbed, and then stored subconsciously. When these routines are practiced again and again in reoccurring, similar situations (in the present and the future), they are vicariously reinforced, increasing the intuitive 'gut' feeling (in the owner and in those who observe them) that the owner has proficiency and skill in their job, duty, calling, or vocation.

Synonymous terms that are used by observers to describe overt manifestations of tacit knowledge in an individual are having clinical acumen, where-with-all, intuition, a gut-feeling, common sense, clairvoyance, instinct, being in the zone, playing a hunch, having the touch, élan, and charisma.

Sternberg and Horvath (1999) take this one step further, stating that the observations are focused on behaviors that are the true architectural foundation of the nebulous term leader, particularly in the case of a leader in business or "...as applied to (leaders in) military organizational levels" (p. 42).

In this study I spend much of the narrative arguing the likeness and difference between implicit and explicit knowledge. In fact, I created this artificial duality in order to confront a dialectic for the purpose of this study, as well as to better differentiate and measure different species of knowledge. In reality, knowledge is a conjoined stream consisting of explicitly learned, conscious knowledge that is inseparably blended with implicitly learned, unconscious or tacit knowledge. William James (1904) best described this conjoined stream in his claim:

> If you ask what any one bit of pure experience is made of, the answer is always the same: "It is made of *that*, of just what appears, of space, of intensity, of flatness, brownness, heaviness, or what not..." Experience is only a collective name, for all these sensible natures, and save for time and space (and, if you like, for 'being') there appears no universal element of which all things are made. But a last cry of *non possumus* will probably go up from many readers. "All very pretty as a piece of ingenuity," they will say, "but our consciousness itself intuitively contradicts you. We, for our part, *know* that we are conscious. We *feel* our thought, flowing as a life within us, in absolute contrast with the objects which it so unremittingly escorts. ...I am as confident as I am of anything that, in myself, the stream of thinking (which I recognize emphatically as a phenomenon) is only a careless name for what, when scrutinized, reveals itself to consist chiefly of the stream of my breathing...the essence out of which philosophers have constructed the entity known to them as consciousness (original emphasis)(James, 1904, in Solomon, 1992, p. 352).

James' work on the conjoined stream of conscious and unconscious knowing evoked in me a new view of the architecture of knowledge. This view suggested that if an individual reflects on what is and what will be, it can lead

one to new and higher levels of knowledge acquisition. The individual must recognize what is known *in an effort to know that they know it* (my emphasis); this radical and dynamic move towards knowing occurs when:

Introspection + Speculation = Introspeculation

The "conjoined stream of knowledge" (James, in Solomon, 1992, pp. 348-353) resides quietly in the human psyche and is available to one who engages in introspeculation. The introspeculative is one who is willing to participate in a radical epistemological process; to be simultaneously introspective and speculative and engage in the exploration of the validity of knowledge and to prepare them to enumerate the magnitude of conscious (explicit) and unconscious (implicit) knowledge.

Introspection and speculation are defining features of human knowledge, in that the human beings' sentient essence is what separates us from other life-forms as we acquire knowing and recognize its presence and importance through reflection after action. In theory, human beings consciously and unconsciously categorize knowledge into cerebral pigeon-holes and draw upon it as needed. It follows that frequent visitation to that knowledge, and the speculation as to its correctness or error, would logically follow. Brown, Collins and Duguid (1989) suggested that students were rarely allowed to engage in real-life speculation; rather, their troubleshooting skills were lacking because their "...everyday intentiveness is constrained by prescribing and proscribing ways in which (someone else's idea of a) solution must be found" (p. 41). Self-visitation to one's own fountain of knowledge should be encouraged and not stifled.

The dissection and exploration of the definition and theory of knowing is not enough; the literature on knowing and doing suggests that any breakthrough in the understanding of human knowledge and learning must be followed by new techniques that teach people new ways to use these skills for the betterment of the community, and ultimately, the world.

The acquisition of new teaching skills will also demand new ideas on pedagogy and androgogy (Knowles, cited in Vella, 1994) and changes in the teacher-training curriculum. Freire and Macedo (1987) encouraged educators to train themselves and their students to "read the word and their world" (pp. 34-36), while Green (1999) suggested that teachers should hold self-audits, listening to one's "internal voice of criticism" (p. 59) to increase the efficacy and value of introspection. Vella (1994) suggested that listening and conducting meaningful dialogue with learners are the most important skills needed to design adult education activities. The educator is then prepared to walk side-by-side with adult learners on what (Hull, 1993) termed as the journey to "critical literacy" (p. 395).

<u>Statement of the Problem</u>

People using complex medical technology appeared to learn implicitly and use tacit knowledge, complementing both existing and new explicit learning. This study examined and documented the feelings and reactions of clients who were in the process of learning to use complex medical equipment and seeks to answer the following research questions:

1. Does implicitly learned tacit knowledge emerge during dialogue with clients?
2. Does implicit or unconscious knowledge have utility to the clients as their lives change with adaptation to diseases or injuries requiring the use of assistive-augmentative technology?
3. Does richness and thick description in the client's dialogue indicate the ownership of implicitly learned tacit knowledge?
4. Is implicitly learned tacit knowledge distinguishable from explicit learning when viewed by trained experts?

Each subject or participant had suffered a diagnosed illness or injury to the neuromusculoskeletal system. An expert panel of healthcare workers analyzed the findings of the study and compared it to the existing body of explicit knowledge (on assistive-augmentative technology) in an attempt to

differentiate implicitly learned tacit knowledge from concrete, explicit knowledge.

I chose trained users of complex medical technology specifically because they are forced to learn differently; they must study and master a discipline that they did not choose to learn, and they must simultaneously cope with chronic pain and a variety of neuromusculoskeletal injuries, functional deficits, and coexisting motor and somatosensory impairments.

A cursory survey of the classic literature indicated that authors considered to be the pillars of the academy and philosophical founders of modern education were preoccupied with alternative pathways to knowing.

Traditional learning, where learning occurs explicitly (consciously), is thought to increase knowledge through rote memorization and repetitive student experience with the instructor-led pedagogical model. Implicit (unconscious) learning occurs through experiences such as a craft apprenticeship, repetition of a procedure, clinical internship and experience, vicariously reinforced modeling, or the afferent neurons from the senses acting as somatosensory conduits, transporting learning to the brain.

While categorizing different types of knowledge, one must recognize that implicit learning, while responsible for tacit knowledge, is complementary to explicit knowledge. The theories of Dewey (cited in Gouinlock, 1994) and Polanyi (1966) posited that implicit knowing, while not apparent to the owner, is highly visible to other individuals who are evaluating the owner's display of expertise, leadership, or craftsmanship. In these owners of tacit knowledge, this knowledge is visible, respected and understood by those around them. However, it is a quality in people that is difficult to put one's finger on and is inexplicable in regard to traditional terminology; in short, it defies a rational definition.

The presence of tacit knowledge, the result of implicit learning, was exhibited in the experimental laboratory using word strands and artificial languages (Berry, 1997; Reber, 1993). The presence of tacit knowledge is

16

believed to be unknown to those who possess it. Brooks (1994) and Guthrie (1996) theorized that specific demands or situations evoke feelings related to confidence in one's ability, a path of direction that is guided by tactile or psychomotor skill, acumen, intuition or gut-feeling that may make a case for human instinct.

A cursory survey of the current physical rehabilitation literature found a minimal amount of research on measuring implicit learning, explicit learning and tacit knowledge in clients learning to use complex medical equipment. Although explicit learning forges an important link in the client's success in learning complex medical life-support equipment, researchers have not explored the measurement of implicitly learned tacit knowledge's use in regard to the performance of the client operating the medical equipment while dealing with a catastrophic disease or injury.

<u>Purpose of the Study</u>

The purpose of this study was to examine the skills and to document the feelings and reactions of clients in regard to the learning process they experienced while learning to use complex medical equipment after a serious illness or injury to the neuromusculoskeletal systems. The use of an expert panel to analyze the findings of the study and compare it to the results of the client is also a new approach in attempting to differentiate implicit from explicit knowledge.

My review of the rehabilitation literature did not provide any books, journal articles, or research that was based upon empirical studies that examined modalities or procedures that tested the implicitly learned tacit knowledge of clients enrolled in rehabilitation or assistive-augmentative technology training programs.

The participants of the study were recruited through the Appalachian Independence Center (AIC) in Abingdon, Virginia. Participants were asked to participate in a face-to-face phenomenological interview. Marshall and

Rossman (1999) noted that phenomenological interviewing is a "type of in-depth interviewing grounded in the tradition of phenomenology" (p. 112).

Phenomenological studies focused on descriptions of how people experience and how they perceive their experience of the phenomena under study (Glesne, 1999). A phenomenological approach was selected because it examined the lived experiences and the ways people understood those experiences to develop their world-view; the procedure rested upon an assumption that there is a structure and essence to shared experiences that can be narrated (Glesne, 1999).

Likewise, I believed that experts trained and experienced in the rehabilitative therapy fields of respiratory, physical and occupational therapy were capable of "reading [the clients] words and their world" (Freire & Macedo, 1987, pp. 30-32) in the narrative of the interview and evaluated the client's responses and assessed and differentiated explicitly learned knowledge from implicitly learned tacit knowledge.

<u>Significance of the Problem</u>

Tacit knowledge and implicit learning are seldom discussed in the context of knowledge acquisition. The lack of reference to these alternative learning methods in textbooks is in sharp contrast to the writings of Aristotle, Berkeley, Descartes, Dewey, Hume, Piaget, Plato, and others considered to be the philosophical founders of modern education. A review of the writings of the aforementioned masters revealed evidence suggesting that a preponderance of their work explored alternative ways of learning and knowing through sense experience and sense data acquired through experience and sensory input. These theorists suggested that use of the five senses of the body facilitated learning from the somatosensory conduits, the genesis of implicitly learned tacit knowledge.

The focused review of the literature on somatosensory conduits, sense data and sense experience is contained in Chapter Two. This chapter is presented to establish thematic credibility in regard to an alternate way of

knowing, and ostensibly, complement the naturalistic research method. I sought to provide definition and clarity on the difficult subject of implicitly learned tacit knowledge while directing the reader's attention to my theory that implicitly learned tacit knowledge emerges in dialogue when the right questions are answered by the subjects or participants in a sample of a population.

The works of Brooks (1994) and Guthrie (1996) suggested that implicitly learned tacit knowledge is critical in the development of leaders. The literature review citations frequently noted that character traits or skills can only be acquired experientially; therefore, it would be difficult for the owner to describe where these skills were learned or how they were acquired (Koivunen, 1998; Sternberg & Horvath, 1999).

The increased utility of these skills and their emergence in the behavior of leaders could be more predictable if the core curriculum and the instructor's pedagogical style included reflection after action (Vella, 1994) and the inclusion of special teacher and student training courses in popular education, self-enlightenment through learning (Anderson, 1994) and the notion that praxis is the desired outcome of critical literacy (Hull, 1993).

This study contributes to the body of knowledge on implicit and explicit knowledge, particularly in regard to measurement of the presence and utility of different types of knowledge in a small group of clients who are using complex medical equipment. I attempted to provide data and evidence for future research and inform new teaching methodologies for those who teach users of complex medical equipment. It is my supposition that enhanced teaching methods, such as the alteration of the pedagogical style as noted above and in the narrative, will assist technology users, facilitating earlier discharge of the client to assisted living centers or to their homes. It is also assumed that a better understanding of how people learn to use complex medical equipment could lead to earlier mastery of the technology by the clients, the important end-users of assistive-augmentative technology.

This study, although focused on adult clients, is important to secondary and post-secondary teachers whose practice deals with inclusion and mainstreaming, now considered standard practice in many school districts. Classroom teachers now deal with students who require non-traditional pedagogy to meet the child's educational needs, and the teacher will be challenged by the statutory requirements and paperwork involved with individual education plans (IEPs), Individuals with Disabilities Education Act (IDEA), and the rights of people as discussed in section 504 of the Americans with Disabilities Act (ADA).

This study is informed by these statutes because it deals exclusively with participants or respondents who are users (and/or teachers) of complex assistive-augmentative medical technology, and all of the clients truly meet the criteria of disabled as established by the Americans with Disabilities Act.

<u>Limits of the Study</u>

The study is limited to subjects or participants in selected towns, cities and counties in Southwest Virginia and Northeast Tennessee. This study, while seeking gender equity in the mix of male and female participants, yields results that reflect the vision, values and cultural beliefs of the region; therefore, no inference is made concerning persons from this area who are not users of assistive-augmentative technology, nor does it apply to assistive-augmentative technology users from other geographic areas.

The phenomenological interview is naturalistic, and time and context bound; therefore, it represents the individual experience of clients in the realities of the past and the present, with speculation regarding future experiences. It may not be applicable to other complex medical technology.

The quantitative analysis represented the opinions of people who train and care for clients who are reliant upon complex assistive-augmentative technology.

<u>Definitions</u>

<u>Explicit Learning</u>: An orchestrated learning experience that leads to formally acquired knowledge. Explicit learning arises from "well-constrained laboratory tasks that have some relationship with real world tasks" (Sternberg & Horvath, 1999, p.76). A demonstration of explicitly learned knowledge is the application of principles "in an axiomatic or deductive fashion to answer a specific problem, yielding a precise diagnostic approach to a solution" (p. 76).

<u>Heuristics</u>: Rules of thumb used by experts, generally acquired through implicit learning and vicarious reinforcement. Experts tend to use heuristics instead of rule-based behaviors because they have had multiple successes using them in their past life experiences; these successes tend to reinforce future behavior.

<u>Implicit Learning</u>: An unconscious abstraction process that yields abstract knowledge. Reber (1989) noted that "...knowledge acquired from implicit learning processes...is knowledge that, in some raw fashion, is always ahead of the capability of its possessor to explain it" (cited in Berry, 1997, p. 5). The non-conscious nature of implicit learning processes has been explored by many researchers. Observers note that observed skills come "not from laboratory research but from life itself. They argue that many skills, such as deciding how old or attractive a person is or interpreting X-ray pictures, develop through (and rely on) knowledge structures that are acquired outside of conscious awareness" (Berry, 1997, p. 7). Reber (1993) noted that "...it is not misleading to argue that implicitly acquired epistemic contents of mind are always richer and more sophisticated than that which can be explicated" (p. 64).

<u>Phenomenological Interviewing</u>: A naturalistic study in the philosophy of experience (Edie, 1965). The Husserlian ideal of a pure phenomenology "is that in contradistinction to positivism, in making all of the experience relevant to the philosophical enterprise, and it might be added, *only* experience the point of departure for it's investigations" (original emphasis) (cited in Edie, 1965, p. 161). The research style uses the separate realities of individuals experiencing

a common phenomena to establish a narrative and the focus of inductive analysis.

Tacit Knowledge: Polanyi (1966) noted that people can, "Know more than we can tell" (p. 4). Tacit knowledge is knowledge that is not easily articulated, generally involving knowledge of how to do things. We can infer its existence only by observing behavior and determining that this knowledge is a precondition for effective performance. Tacit knowledge can be identified in assumptions, biases, ways of looking at the world, and forms of behavior that take advantage of situational factors.

<div align="center">Summary of the Chapter</div>

The introductory chapter of this study discussed the concept of implicit and explicit knowledge. This study offered me the opportunity to be immersed in the tacit dimension of knowing and the daily life of the complex assistive-augmentative technology client who is coping with neuromusculoskeletal injury or disease.

The chapter suggested that implicitly learned tacit knowledge can be monitored, and that participation in reflection after action and introspeculation can better bring this unconscious, tacit knowledge to the foreground to increase its utility in our daily life.

A modified pedagogy, or androgogy in adult learners, facilitated reflection after action and encouraged the individual to pursue a path to praxis, the state where the organism consciously realized that it is capable of effecting change upon its environment. This realization, in itself, defined critical literacy, a state in which the learner is capable of recognizing oppressive forces in that environment. The skills and keywords are dramatic but are imperative for the user of assistive-augmentative technology.

CHAPTER 2

REVIEW OF THE LITERATURE

We let loose our thoughts in the vast ocean of Being as if
all that boundless extent were the natural and undoubted
possession of our understandings, wherein there was
nothing exempt from its decisions, or that escaped its
comprehension (Locke, cited in Maund, 1972, p. 9)

<u>Knowledge and Other Ways of Knowing.</u>

In the above quotation, John Locke succinctly describes the potential

totality of human knowing in the context of the somatosensory conduit of

information leading to knowledge. The human being receives visual, auditory,

olfactory, gustatory, spoken, and afferent neuronal input directly to the central

nervous system and the brain, and the human organism may store the

information, act upon it, or ruminate upon the implications of action in regards

to the present or a future situation.

The most vigilant person, ever watchful and wary for a learning

opportunity, still learned some lessons by accident through casual observation,

behavior modeling and social learning (Bandura, cited in Goleman, 1995), rote

repetition or vicarious reinforcement of a modification of a successful behavior.

Thomas Aquinas (cited in Ozmon & Craver, 1999) believed that "the path

to the soul lies through the physical senses" (p. 56) that is, knowledge could be

gained from sense data, "...a study of the world using observation and reason"

(p. 56). This 'accidental knowledge' or implicitly learned knowledge becomes

more troublesome when we attempt to define its presence or utility to the

learner.

When an observer (scrutinizing a learner) noted that a learner exhibited

predictable skills that are outside of their training and the exhibitor of the skill

was not aware of the uniqueness of their skill, nor how or where they learned

it, this roughly defined the presentation of knowledge as implicitly learned tacit

knowledge.

Tacit Knowledge

Polanyi (1966) stated, "Perception…now appears as the most impoverished form of tacit knowledge. (Tacit knowing)…forms a bridge between the higher creative powers of man and the bodily processes which are prominent in the operations of perception" (p. 7). The importance of perception in educational philosophy becomes more apparent as we progress with this review of the classic literature on learning and knowing.

Tacit knowledge was not readily recognized by educators or scientists, and it required me to seek a definition of the root word. Webster's New Collegiate Dictionary (1961) defined tacit thus:

> **tacit** (tăs' ĭt), *adj.* [F. or L.; F. *tacite*, fr. L. *tacitus*, past part. of *tacere* to be silent, pass over in silence] 1. Unspoken; silent; also not speaking. 2. Implied or indicated, but not actually expressed, as *tacit* consent. 3. Law. Arising without express contract or agreement; arising by operation of law. – **tac' it-ly**, *adv.* – **tac' it-ness**, *n.*(Webster's New Collegiate Dictionary, 1961, p. 864).

Tacit knowledge, then, is a silent knowledge, unknown and unspoken by it's possessor and historically shrouded in intrigue. The definition, or better, the meaning of the word tacit may arise from the work of the Roman writer and historian, Tacitus. Tacitus wrote in a style that Mattingly and Handford (1970) said "…implied a promise of more historical detail in future editions, however, the volumes were handed down unfinished, incomplete, a literary promise never fulfilled" (Mattingly & Handford, pp. 11-12). In my opinion, Tacitus wrote around the subject, and in the Agricola, Tacitus focused on many historically important aspects of that time; unfortunately, he failed to expound on the important details of the subject itself.

We pass over tacit knowledge in silence; tacit knowledge is not traditionally discussed in coursework or acknowledged in our reading. Furthermore, Polanyi (1966) noted that "People can know more than they can tell" (p. 4). Tacit knowledge is knowledge that is not easily articulated,

generally involving knowledge of how to do things. We can infer its existence only by observing behavior and determining that this knowledge is a precondition for effective performance. Tacit knowledge is identified in assumptions, biases, ways of looking at the world, and forms of behavior that take advantage of situational factors.

How do we measure a species of knowledge that is outside the boundary of traditional learning and knowing? An example of this knowledge is seen in brazing, a form of welding. The welder must have the ability to interpret the color of the glow of the molten rod and the 'feel' of it as it melts. The expert welder 'senses' the molten flow of braze as it seals a joint or juncture of pipe or tubing; the smooth seamless finish represents the creation of a powerful new air-tight connection between like or unlike metals.

The master welder spends hours of shop and classroom time in didactic learning and teaching but cannot impress the 'feel' of this craft into the learner; one must lay hands upon the torch and rod to obtain the knowledge. The construction of a building depends on steel beams whose strength is reinforced by the bonding of two beams together using a welded joint. The experienced welder can evaluate the work of another welder when they 'see' and 'hear' another skilled welder at work. These sights and sounds assist the expert in their ability to decipher the strength and weakness in the weld by a rudimentary visual examination, or sense the strength or weakness of a joint by the tone emitted by the 'sound of the weld' when the weld is struck with a slag hammer (a welder's tool that breaks the spoil and debris from the weld).

Yet, when asked to "…define the skills and enterprise needed to create the perfect weld, expert welders frequently cite techniques that are not listed in welding textbooks" (Evans & Butler, 1992, cited in Tennant & Pogson, 1995, p. 59).

Perception, Self-Examination, and Introspection

The use of the senses to uptake information is an effortless task that one replicates hundreds of times in a single day. The use of the six most influential

afferent neuronal somatosensory conduits of information (hearing, smell, sight, touch or feel, taste, and speech) enable one to have the initial experience that one can be thoughtful, reflective, or introspective about.

The signals received may elicit responses varying from comfort to pain, joy to sadness, hot to cold, and a wide-range of emotions and physical responses to the signal received. In reflection or introspection, one asks oneself 'What just happened?' and a lucid description with rich detail of the experience can be extracted from the recipient who experienced the experience, stimulus or signal.

The use of introspection, the conscious retrieval of both the stimuli and response and the feelings elicited in the recipient organism, may seem a distant process from the modern learning environment. The utility of self-examination, reflection, self-analysis, and introspection has been just below the surface of the deep pool of literature concerning learning and knowing.

Piaget (1971) refutes the primacy of the "...sensorial origin of scientific knowledge" (pp. 63-88), in his observation:

> On one hand, knowledge is never derived exclusively from sensation or perception but also from schemes of action from operatory schemes of various levels, both irreducible to perception alone. On the other hand, perception itself does not consist in a mere recording of sensorial data but includes an active organization in which decisions and preinferences intervene and which is due to the influence on perception as such of this schematism of actions or of operations...the progress of knowledge is the work of an indissoluble union between experiment and deduction, in other words, a necessary collaboration between the data offered by the object and the actions or operations of the subject – these actions and operations themselves constituting the logico-mathematical limit beyond which the subject is never able to assimilate the objects intellectually (Piaget, 1970, pp. 86-87).

Piaget said that important scientific knowledge and human intelligence primarily arose from explicit learning. Piagetian theories seem to disagree with the sensorial component of knowledge. Piaget's writings reveal his opinion that

the human being is a systematician, and a purely sensorial approach could "...never have formed the *Systema naturae* of Carolus Linnaeus" (original emphasis)(Piaget, 1970, p. 87).

My research led me to doubt that Linnaeus would be in complete concord and agreement with Piaget on this critically important issue. I examined some of Linnaeus' work, noting that he appealed to the senses and to commonsense when he used analogy and metaphor to clarify the information he presented and thus better informed the human intellect. Linnaeus metaphorically compared plant reproduction to human sexuality and love:

> The flowers' leaves...serve as the bridal beds which the
> Creator has so gloriously arranged, adorned with such
> noble bed curtains and perfumed with so many soft scents
> that the bridegroom and his bride might there celebrate
> the nuptials with so much greater solemnity (Linnaeus,
> 1729, cited in Waggoner, 2000, p. 1).

Linnaeus presented a non-empirical view of the reproductive cycle of plants while using an easily understood metaphorical definition; he departs from the positivist approach to purposefully to evoke introspection and encourage clarity and understanding in the reader.

Jayatilleke (1974) explained that introspection is an analytical tool. He noted that the effective use of observation and introspection are important in that Buddhists believe in the mutual interaction between the physical basis and the mental activity:

> The ...nature of the causal relations that hold among
> mental phenomenon and their relation to the body, the
> physical, the social and ideological environment are also
> analyzed and the correlation is explained in terms of the
> interaction. The Buddhist search for causality, then, is
> the earliest historical account of a naturalistic view of
> the mind (Jayatilleke, 1974, p. 80).

Jayatilleke's argument is a cornerstone of Western educational psychology; the emphasis on analyzing human behavior arises from the fact that behavior can be observed and experience cannot. Despite the advances in psychology and education, the modern tempo and the "...philosophies of life

give no room for intelligent self-restraint, relaxation, self-analysis and meditation as a means of achieving a healthier mind" (p. 81).

The use of introspection is not an often used or recommended skill. However, Horney (1968) saw the utility of introspection and the efficacy of questioning oneself during her practice of Western psychiatry and psychology. Horney suggested that self-analysis was effective, and that traditional psychoanalysis is not the only way to resolve inner conflicts because "…life itself is a very effective therapist" (cited in Friedman & Schustack, 1999, p. 127).

A literary example of introspection is drawn from Hermann Hesse's (1951) <u>Siddhartha</u>, where the 'voices in the river' are voices that speak knowledgeably to people about life through recollection of past events, reflections on the precious present, and dreams and visions of the future. I strain to hear the voices in the river, for in that river flows both conscious and unconscious knowledge; conscious or explicit learning from lessons we have learned, classes, schools, books, etc., and a stream of unconsciousness or implicit learning flows quietly, imperceptibly like a river through all of us. In Hesse's classic novel we hear the river metaphorically speaking to the prophet; Siddhartha is engaged, for listening is his chosen method of learning and knowing:

> He had heard all this before, these numerous voices in
> the river, but today they sounded different. He could
> no longer distinguish the different voices – the merry
> voice from the weeping voice, the childish voice from
> the manly voice. They all belonged to each other: the
> lament of those who yearn, the laughter of the wise, the
> cry of indignation and the groan of the dying…And all
> the voices, all the goals, all the yearnings, all the sorrows,
> all the pleasures, all the good and evil, all of them
> together was the world, all of them together was the stream
> of events, the music of life (Hesse, 1951, pp. 135-136).

Siddhartha heeds the voices in the river and, seeking enlightenment, he "…ceased to fight against his destiny. There shone in his face the serenity of

knowledge, of one who is no longer confronted with conflict of desires, who has found salvation, who is in harmony with the stream of events, with the stream of life, full of sympathy and compassion, surrendering himself to the stream, belonging to the unity of all things" (Hesse, 1951, p. 136).

James (1904) took the metaphor of the stream one step further in his arguments for a natural automaticity of action and reflection; this results from the inseparable mental events and feelings that exist within the stream of consciousness and unconsciousness in a human being, noting that "...the stream of thinking...is only a careless name for what, when scrutinized, reveals itself to consist chiefly of the stream of my breathing..." (James, cited in Solomon, 1992, p. 352).

The human psyche first looks to what *a person knows that they know* (my emphasis)(the definition of consciously learned, concrete explicit knowledge) or to what their intuition or gut-feeling tells them they know (unconscious, implicitly learned tacit knowledge) when thinking and making decisions. For the purposes of this research and for the sake of clarity, I dissected knowledge into these two primary components, with an emphasis on implicitly learned tacit knowledge, what Reber (1993) called the cognitive unconscious.

Reber, citing Erdelyi (1986) notes that "...the point to be developed here is that questions of the epistemic status of implicit and unconscious knowledge will be dependent on a simple inequality:

$$\alpha \ > \ \beta$$

where α is information available to the unconscious processing system and β is that available to the conscious system" (Erdelyi, cited in Reber, 1993, p. 8). Reber goes on to say, in regard to uncovering the cognitive unconscious, that "...how the measures are made and what kind of psychometric defenses of them are provided will prove to be extremely difficult yet critical areas of investigation" (p. 9). One can take Polanyi's concept and Erdelyi's theme (that

being that the unconscious pool of knowledge is always greater than the conscious) a step further.

If $\alpha > \beta$, then what fraction of total knowledge is tacit or implicit, and what fraction is explicit? In this paper I explore the possibility that much of what defines us as learned and knowing arises from the cognitive unconscious (Reber, 1993)

The review of the literature revealed the seduction of the cognitive unconscious as it was literally felt and described by the philosophers who embraced it or refuted it. The theory is so attractive, in my opinion, that theorists were compelled to describe it and make inference about its utility in both their theory and composition, whether in agreement with it or not. The passion of one's refutation, in my mind, provides a compelling argument for the existence of a philosophy or phenomena as the exhortations of a fervent believer in the theory.

Alternate Pathways to Knowledge

Postulations concerning new ways of learning, alternate pathways to knowledge, and the existence, architecture and variants of knowledge in the human mind were discussed and theorized before 1966, the year that a book titled The Tacit Dimension was published. In this book, the chemist-turned-philosopher Michael Polanyi issued a challenged to the existing schools and paradigms of learning and knowing. The evidence showed that, centuries before Polanyi had glimpsed alternative pathways to knowledge, other theorists and philosophers espoused the use of the lessons learned from experiential learning in the maintenance of a strong community and a civilized world.

Plato (Grube, 1974) defined knowledge in this statement which took syllogism to new poetic heights:

So too understand the eye of the soul; whenever it is
fixed upon that upon which truth and reality shine,
it understands and knows and seems to have intelligence,
but whenever it is fixed upon what is mixed with darkness –
that which is subject to birth and destruction – it opines

and is dimmed, changes its opinions this way and that, and seems to have no intelligence (508 c. – d., Plato, in Grube, 1974, p. 163).

Plato emphasized the difference between knowing ("upon which truth and reality shine in…", p. 163) and ignorance ("…mixed with darkness…it opines and is dimmed…and seems to have no intelligence", p. 163) in a construction of reality where there seems to be no middle ground. In truth, seldom in these writings of Socratic Idealism is there a deviation away from the duality of right and wrong. This viewpoint is consistent, noting that "…the mind that knows is good…(and) must be honoured…if it provides knowledge and truth and is itself superior to them in beauty" (Plato, in Grube, 1974, p. 163).

Speaking for Socrates in the <u>Republic</u> (translated by Grube, 1974), Plato discussed a view of the conquest of that which is 'knowable', expressed in four categories: *eikasia,* image-making or imagination such as reflection or works of art; *pistis*, opinion or objects of sense; *dianoia*, reasoning on mathematical realities or sciences; and the highest level attainable, *noêsis* (all original emphasis, p. 185) the achievement of a high level of understanding and intelligence through action and endeavors of form or dialectic:

> This is what I call the intelligible class, and said that the soul is forced to use hypotheses in its search for it, not traveling up to a first principles, since it cannot reach beyond its hypotheses, but it uses as images those very things which at a lower level were models and which, in comparison with their images, were thought to be clear and honoured as such…Understand also that by the other section of the intelligible I mean that which reason itself grasps by the power of the dialectic. It does not consider it's hypotheses as first principles, but as hypotheses in the true sense of stepping stones and starting points, in order to reach that which is beyond hypothesis, the first principle of all that exists (511 b.– c., Plato, in Grube, 1974, p. 165).

Plato's statements in the <u>Republic</u> speak to his belief (and ostensibly the belief of his mentor Socrates) in the positivist methodology of science; they revel in the hard science of mathematics and "geometry" (pp. 178-179). Yet,

the narrative reveals the open-mindedness of these scholars and suggested their interest in somatosensory perception and knowledge gained through hard work and experience. There is also a clear indicator of the cognizance of knowing related to experiential learning, apprenticeship, gut-instinct, intuitive knowing, and tacit knowledge when Plato wrote:

> Men and women will campaign together; moreover they
> will take the sturdy among their children with them, in
> order that, like the children of other craftsmen, they may
> observe the actions which they will perform when they
> grow up (467 b. - c, Plato, in Grube, 1974, p. 127).

Socrates noted that in the absence of the desired experience and training, civilizations failed to acquire the skills needed to survive in dangerous times. More importantly, the skill needed to lead a civilization from darkness to enlightenment requires knowledge that cannot be learned from books. This statement exemplified Plato's understanding that experience, decision-making, and academics are best learned in the classroom of real life (Grube, pp. 126-128).

Gandhi (cited in Kundu, 1975) seemed to agree with Plato in his educational philosophy of "education for peace and non-violent social order" (p. 5). To Gandhi, who explained the criticality of the "Culture of the 3H's" (Head, Hands, and Heart, in Kundu, pp. 14-22), sees the loss of craft-centered labor exemplified "...a tragedy of the first magnitude that millions have ceased to use their hands as hands..." for without the use of the hands "...the brain would be atrophied" (pp. 20-21).

Gandhi indicated that a lack of intellectual training through *skilled physical labor* (my emphasis) failed society just as it failed "...to develop the moral, rational and physical capabilities of the child" (p. 21). Gandhi spoke of a new social order when:

> Gandhi wanted the village handicrafts or agriculture as
> the pivot and center of education. The principle idea is to
> train the pupils in one occupation or another, and also
> to teach through handwork of all the subjects like
> history, geography, mathematics, science, language,

painting and music. He said "You have to draw out
all that is in the child through teaching all of the
processes of the handicraft, and all of your lessons in
history, geography, arithmetic will be related to the
craft" (Gandhi, cited in Kundu, 1975, p. 24).

Gandhi wrote that didacticism in an agrarian society (India of that day

was an agriculture-intensive society) was irresponsible. Likewise,

Gandhi noted that his goal was not only to produce workers for the villages by

stating:

…craft centered education is not primarily the production
of craftsmen able to practice some craft mechanically,
but rather the exploitation for educative purposes of the
resources implicit in craft work (Kundu, 1975, p. 25).

At this point, Gandhi established a physical and psychological approach

in regards to his Basic Education scheme, noting that:

The educator must be concerned with how the rate and
quality of learning are affected by environments, how
individuals vary in their capacity to learn, through what
activities the mind best acquires and retains knowledge,
and how feelings can find expression in graceful movements,
refined appreciations and healthy activities…Learning is
primarily the literacy of the whole personality, that is,
it is the disciplined purposing activity of the whole man
in the satisfaction of his needs – aesthetic, social, economic,
etc. (Kundu, 1975, pp. 38-39).

Jiddu Krishnamurti (1895-1986) questioned the utility of traditional

pedagogy when he asked students and teachers:

What is the point of passing examinations and getting
degrees? Is it to get married, get a job, settle down in
life as millions and millions of people do? Is that what
you are going to do? …We see what education has been
used for. Human beings throughout the world – whether
in Russia or in China or in America or in Europe or in
this country (India) – are being educated to conform, to
fit into society or into their culture, to fit into the stream
of social and economic activity, to be sucked into that
vast stream of social and economic activity that has

been flowing for thousands of years. Is that education
or is education something entirely different?
(Krishnamurti, 1974, pp. 16-17).

Krishnamurti challenged students and teachers to reconsider their
role in his version of the metaphorical stream of society:

> Can education see to it that the human mind is not
> drawn into that vast stream and so destroyed; see that
> the mind is never sucked into that stream; so that with
> such a mind, you can be an entirely different human
> being with a different quality of life? ...are you going to
> allow your parents, society to dictate to you so that you
> become part of the stream of society? Real education
> means that a human mind, your mind, not only is capable
> of being excellent in mathematics, geography and history,
> but also can never, under any circumstances, be drawn
> into the stream of society. Because that stream which we
> call living is very corrupt, is immoral, is violent, is greedy.
> That stream is our culture (Krishnamurti, 1974, pp. 18-19).

Krishnamurti, like many writers and philosophers, used the metaphor
of the stream in a way that is antithetical to the meaning and use of the stream
in Hesse's Siddhartha. Whereas the voices in the stream guide Hesse's
protagonist Siddhartha, Krishnamurti suggested we flee from the stream in
order to save ourselves from societal woes. The voices of Krishnamurti's
stream advised us to keep our distance from a rigid and conformist culture.

The writings of Thomas Aquinas (1225-1274) looked at knowledge gained
through a higher order, a divine intellect, a law not known to all, "...the things
that are of God no man knoweth...the eternal law is a type existing in the
divine mind. Therefore it is unknown to all save God alone" (Aquinas, in Adler,
1947, p. 34). Aquinas defended Aristotelian Realism, and sense experience
resulting from sense datum, in his Treatise on Law where he explains that:

> We cannot know the things that are of God as they are
> in themselves but they are made known to us in their
> effects, according to Romans 1:20: "The invisible things
> of God...are clearly seen, being understood by the things
> that are made" (Aquinas, in Adler, 1947, pp. 34-35).

Aquinas argued in Summa Theologica for a "...possible intellect" (Aquinas, cited in Adler, 1963, p. 97). The possible intellect was an inner knowledge that resides in the soul, and "...the path to the soul lies through the physical senses..." leading "...to true being by progressing from a lower to a higher form" (Ozmon & Craver, 1999, p. 56). The moving from a lower to higher form illustrates Aquinas' Aristotelianism (no doubt in part of the influence of his mentor, Albertus Magnus, a renowned scholar of Aristotelian philosophy) illustrating "...the developmental cosmology of progressing from the lower to the higher, or movement to perfection" (Ozmon & Craver, 1999, p. 56).

Aquinas' chapter in Summa Theologica, *Treatise on Habits* (original emphasis) (Adler, 1963, p. 86), illuminated the genera of the sensitive powers of man, particularly the grouping of the cognitive powers, where the interior and exterior senses reside. The exterior powers dealt with tactual, olfactory, gustatory, auditory, and visual senses (touching, tasting, hearing, seeing) and the interior senses, consisting of common sense, mnemonic, imaginative power, estimative power (perceiving, remembering, imagining, estimating). The sensitive powers of man are the aforementioned somatosensory conduits that brought sensory information to the brain and informed our brain about the environment that surrounded us.

It is noteworthy that common sense was included by Aquinas in the list of interior senses. Adler, who commented on Aquinas' view of the utility of common sense, instructed us that:

> The common sense enables animals and men to make
> some judgment about the sensible qualities received
> and distinguish them from one another... (Adler, 1963,
> p. 90).

Perhaps most telling is Aquinas' view of memory and imagination "...which permits the animal to apprehend a thing not only at the actual time of sensation, but when it is absent" (Aquinas, in Adler, 1963, p. 90). Aquinas clearly believed that knowledge could be gained from sense data, progress to a

higher level of intellect, and this improvement "...could lead to God, provided the learner views it in the proper perspective" (Ozmon & Craver, 1999, p. 56).

Benedictus Spinoza (also cited as Baruch Spinoza) (in Parkinson, 1954) describes a method by which the mind is to be directed "...towards a true knowledge of things". To acquire knowledge he says that, "...a method is said to be necessary, i.e. one must first know how to look. But the method in question is in itself an item of knowledge (pre-existing knowledge), so that a method is needed for finding further knowledge" (p. 9).

What is required, therefore, "...is a method for finding the method, and so on *ad infinitum"* (original emphasis, p. 9). Spinoza reported "that the learner does not start from a condition of absolute ignorance, but rather it (a question or true idea) presupposes some knowledge" (pp. 9-10), and he told us how human beings acquire increasing amounts of knowledge:

> Men...proceeded from the simplest tasks to the
> construction of natural tools, *innatis instrumentis*,
> and from these tools they proceeded to other tasks
> and other tools, and so finally arrived at the ability
> to perform many extremely difficult tasks with slight
> labor. In the same way the intellect, by its own native
> strength, makes for itself intellectual tools, by which
> it acquires other strength for other intellectual tasks,
> and from these tasks it acquires other tools and so
> proceeds until it reaches the summit of wisdom.
> (original emphasis)(Spinoza, cited in Parkinson,
> 1954, pp. 9-10).

Spinoza wrote that one must use 'innate tools' or a given true idea that the person already has in mind. Spinoza made the observation "...that the mere possession of a true idea is itself a sufficient sign, for a man does not have to know that he knows before he can know something" (p. 10). *Innatis instrumentis,* representing a person's basic intellectual tools, are purified in the forge of implicit and explicit knowledge co-mingled with experience over time.

What Spinoza described is a simple method for explicit knowledge acquisition "...through reflexive knowledge or *cognitio reflexiva*; it consisted of thinking about what is known, rather than trying to prove that a given

proposition is known" (Parkinson, 1954, p. 11); he does not endeavor to further explain the "...native strength of the intellect that presupposes one's ability to know, that unconscious predisposition that makes us initially knowledgeable" (original emphasis)(Spinoza, cited in Parkinson, 1954, p. 11) suggesting that Spinoza was cognizant of an implicit component to learning and knowing.

Pears (1971) lingered on the relative simplicity of defining knowledge. However, just as quickly, he retorts that it is "...difficult to do justice to the *reflexiveness of knowledge* without extravagance" (p. 4). (Pears) worried that "simplification (of a definition of knowledge) causes complication...and that complication causes difficulty. If I know something, ought I to know that I know it, and *know* that I know that I know it? Can knowledge really be like a system of mirrors, the first one reflecting the object, and the second one the first with it's reflection of the object, and so on?" (original emphasis)(Pears, 1971, p. 4).

John Dewey observed that "...a person knows many things that he cannot express" (cited Ozmon & Craver, 1999, p. 7). "Such knowledge remains purely personal and cannot be shared unless it is abstracted, or expressed in some public language; then it can be shared and critically analyzed for improvement. Prior to a person sharing her thoughts and experiences, she must first consider the experience of others and then put his ideas in language that others can understand" (p. 8). Experiences should be shared and taken into practice for testing, for "...practice, then, expands theory and directs it into new possibilities" (Dewey, in Ozmon & Craver, 1999, p. 8.)

Clearly, Aristotle, Aquinas, Plato, Polanyi, and other scholars believe that book learning and explicitly learned lessons are not the only manner in which human beings learn life's lessons.

Liberation: Wittgenstein's Attack on Philosophical Elitism

Ludwig Wittgenstein, whose major works were published between 1953 and 1971, posited that all people had the intrinsic ability to receive sensory input and knowledge from somatosensory sources, such as mental models,

grammar, language, visual images and "…a certain obsession with pictures of how things must be" (cited in Gudmunsen, 1977, p. 69). Analogous to the Buddha's rejection of the current philosophical thought of that day, Wittgenstein participated in the "curing of theories" (p. 67), that is, his critiques stood in opposition to what had gone before, philosophically speaking. Wittgenstein wrote that all people were capable of important philosophical thought and learning through alternate pathways; he had deeply rooted convictions that philosophers should attend to the problems of the people:

> He (Wittgenstein) wished to "…free people from a view
> of the world in which what had looked like information
> turns out to be nothing but grammar treated as science"
> (cited in Gudmunsen, 1977, p. 68).

Wittgenstein's writing revealed that he thought philosophers of the day falsely pictured sense datum that led to emotions and feelings. Philosophy enslaved people to "pseudo problems" (p. 70), so as to make "…foolish, untaught common people…settle down to accept the (difficulties)…so, too, in the <u>Investigations</u>: the difficulties are unreal ones which we have created for ourselves, and when we see things aright, (by removing the obsessive pictures) the problems vanish as if by magic" (Wittgenstein, cited in Gudmunsen, 1977, p. 70).

Wittgenstein was critical of 'elitism', believing that philosophy dictated that "…only people calling themselves philosophers could assume the existence of private sensations, pains, hopes, etc. which can be internally pointed to and named…"(p. 68). Wittgenstein's soothing answer to those who felt plagued by " …a certain obsession with pictures of how things must be" (p. 70) was:

> What is the use of studying philosophy if all that it does
> For you is to enable you to talk with some plausibility
> about some abstruse questions of logic, etc. and it does
> not improve your thinking about the important questions
> of every day life? (Wittgenstein, cited in Gudmunsen,
> 1977, p. 70).

Wittgenstein offered liberation when he pointedly responded: "If...a picture held us captive...(then the individual must decide for themselves) what is your aim in philosophy – To shew the fly the way out of the fly bottle" (pp. 69-70).

The liberation of the person lies not only in defining the way they attain knowledge, but in identifying the real-life problems encountered when one regards knowledge only as a mental act or as a theoretical relationship between subject and object, as "...the answer truly lies between a mind and what it knows" (Wittgenstein, cited in Gudmunsen, 1977, pp. 90-91).

This statement is one of the most transparent epistemic views of self-directed learning, where the philosopher directed the educator to act as a guide and "...shews the way" (Wittgenstein, cited in Gudmunsen, 1977, pp. 69-70), allowing the learner to find their way the best they can, accomplishing the mission of learning on ones own.

<u>Knowledge Validation: An Epistemologic Primer</u>

To learn about knowledge, there must be scrutiny of the existing information about learning; for example, the prudent evaluator of knowledge must assume that different learners store knowledge in different conscious and unconscious compartments of the psyche. Exactly where knowledge resides after it is acquired remains a mystery. To achieve further growth in the study of knowledge, one must examine the work of scholars who questioned the correctness or value of what is known. That inquiry led to epistemology, a study of the validity of what is known.

Pringle-Pattison (cited in Maund, 1972) wrote that the epistemologist must seek to answer the question "What is knowledge, and where does it begin and end?" (p. 4). Dawes Hicks (1935) defined epistemology as "...that branch of philosophy which has for its province the investigation of the nature and structure of knowledge...(the) possibility, and the significance, worth and validity of its contents as representing the nature and relations of the real" (cited in Maund, 1972, p. 4).

Hicks explained that the word epistemology was first used in Ferrier's Institutes of Metaphysics, published in 1854. Ferrier made a sharp distinction between epistemology, the doctrine or theory of knowing, and ontology, the science of that which truly is, and contends that although psychologically the latter is prior, logically the former is, since we cannot know what is until we have answered the question, "What is the meaning of 'to know?' " (Ferrier, 1854, cited in Maund, 1972, pp. 4-5).

Maund cited Hicks explanation of knowledge; the popular definition of knowledge (seems to) "...imply a distinction between an inner or mental process of knowing and an outer world of fact to which the act refers, and that it is in the knowing that the two distinguishable aspects are brought together in a certain unity" (p. 5).

Hicks clarifies and differentiates related disciplines with the statement "Psychology is concerned with the act of mind as a psychical event and has no special interest in what is apprehended...epistemology is primarily concerned with the problem how an act of mind can give knowledge of the external world and under what conditions such an act truly represents the world" (Hicks, cited in Maund, 1972, p. 5).

The possession of, or lack of, intelligence, an externalization of knowledge, may serve to create social and demographic boundaries in otherwise sophisticated societies (Herrnstein & Murray, 1994). In the history of mankind, no more elusive goal exists than capturing and confining knowledge, and perhaps, more elusive is the working definition of what knowledge is and how it works in human beings.

The study of ontology, what is, and the outcomes after validation of knowledge (epistemology) are often blurred, and for many people, may be synonymous when implicit learning clashes with what others explicitly know. The individual, then, must make their choice as to which course of action is the best to follow in a given situation. When others observe that decision (or

are directly affected by it), they assign labels related to that person's intelligence and the foundations of their decision-making.

Cognition and Knowledge

Cleeremans (1997), compared human cognition and knowing to the computer model of cognition, and discussed a 'classical metaphor of cognition', the classical symbolic framework:

> There is a central processor that fetches or stores information in knowledge bases and processes it. The processor interacts with the world through input/output systems. These subsystems are modular, that is, autonomous and informationally encapsulated. Knowledge (either programs or data) is represented symbolically (Cleeremans, in Berry, 1997, p. 198).

Cleeremans noted that the difference between a computer model of cognition, a connectionist framework, and the symbolic framework of human cognition are:

1. In human cognition, discrete representations, allowing the process of partial or degraded information (unclear, blotted characters or strange foreign accents) with remarkable ease.

2. Flexible interpretation of processing rules in human cognition versus absolutism in most computer-based situations.

3. Learning in the classical human cognition framework is programming or memorizing, while connectionist models learn continuously through software and experience, and

4. Human cognition is functionalist, that is, there is a difference between who you are and what you know, "whereas in connectionist frameworks, like computers, the machine and what it knows are one and the same" (in Berry, 1997, p. 199).

Cleeremans indicated that a dichotomy of human cognition existed and is explained by two architecturally similar cognitive systems: "…the cognitive conscious' rule-based system using symbolic, abstract knowledge, and the cognitive unconscious' rule-based system using symbolic, abstract knowledge" (in Berry, 1997, p. 202). Cleeremans rejected Shanks and St. John's (1994) argument that "…learning is always explicit or conscious, and better explained by rule-based and instance-based knowledge" (in Berry, 1997, p. 203) than by a "cognitive unconscious" (Reber, 1993, p. 80).

Evers and Lakomski (2000), in their defense of a naturalistic representation of practical knowledge, refuted the mechanical world-view implicit in Cleereman's analogy. Citing Simon's (1995) view of the "multiple realizability argument" (p. 25):

> Neurons and chips have little in common beyond the
> fact that they can both think, and the latter can be
> programmed to think in humanoid fashion. This fact
> demonstrates the existence of a symbolic (software)
> level of theory above the hardware or neuronal level.
> (Simons, cited in Evers & Lakomski, 2000, pp. 24-25).

Evers and Lakomski suggested that the above argument "…abstracts too severely from the physical context in which rational thought and action occur" (p. 25) and minimized the significance of the neuronal and physiological in regards to somatosensory learning. The authors cited Cussins' (1992) commentary regarding the drivers experience in the United Kingdom:

> Everytime you venture on to the road and obey the
> convention to drive on the left, think to yourselves: Isn't
> it a miracle that the events in the nervous system which
> control your arm on the steering wheel cause the wheel
> to be in just the place required to satisfy your intention
> to drive on the left? (Cussins, cited in Evers & Lakomski,
> 2000, pp. 24-25).

<div align="center">Somatosensory Perception and the Search for Self</div>

The Eastern View of Learning and Knowing

I am interested in the connection between Western educational philosophy and Eastern spirituality and philosophy. The connection between

West and East clearly emerged when I looked at the transcendence of sensuousness over positivism in the popular education movement and in modern trends towards critical thinking and leadership. However, I think the predilection with the sensuous goes back to the very foundations of educational philosophy.

In my review of the classic literature on knowledge, I sought other scholar's questions on the derivation, the acquisition, and the utility of knowledge arising from sources other than traditional Western pedagogy. In the Western tradition, talking is a learning art. A learning environment exists when learning is in a properly appointed classroom complete with a 'sage-on-the-stage' who executes didactic lecture with very little dialogue or interaction between student and teacher.

In the classic Eastern tradition, dialogue, interaction, and fieldwork are the preferred appointments of the learning environs; listening is a teaching art. Early views of wisdom, learning, and knowing are contained in the philosophical and spiritual beliefs arising in the Arab countries, and in both Southeast and Southwest Asia.

Jayatilleke (1963, 1974) examined the components of the mind in the context of the classic Buddhist literature, noting that "sense-impressions consisting of images, ideas and concepts (sañãã), were related to intellectual activity (viññāna) but in a separate branch of the mind" (p. 83). Ideational activity that we are not aware of is citta-saṅkhārā (p. 86). Viññāna covers knowledge and belief, "…and denoted the whole of our mental activity, conscious or unconscious" (p. 86). "Man's stream of consciousness (viññāna-sota) has a conscious and an unconscious component…the conscious mental activity gets into this unconscious and accumulates in it, continuing to influence our conscious behavior" (Jayatilleke, 1974, pp. 86-87).

Frank (1978) explored the demonstration of learning and knowing in the Sunnî Muslim culture, particularly seeking definitions to the Attributes. The Koran is the revelation to the Arabs – through language: "…the discourse of

God" (kallâm Allâh, p. 9). Common Islamic dogma, founded in the Koran itself, has it that "the miracle of Moses - the signs and wonders worked through him by God to confirm his mission - had the form and character of magic, and that Jesus the form and character of medicine and healing, that of Muhammad was *of language"* (original emphasis, p. 9). The Koran was presented in "…clear Arabian speech as a scripture for recitation in Arabic" (p.10). Knowing, then, arose from language and discourse and was a modality or form of conviction, differentiated by a secondary or accidental quality:

> What our masters say concerning knowing (*'ilm*) is that
> it is of the *gins* [the virtue of being specifically what it is]
> of conviction; when it is related to the thing as it really is
> (*'alà mâ huwa bihî*) and occurs (*waqa'a*) in a way that
> entails authentic confidence *(sukûnu n-nafs)*, it is
> knowing; when it is related to the thing as the thing is
> not, it is ignorance; when it is related to it as it really is
> but does not entail authentic confidence, it is neither
> knowing nor ignorance [but is simply conviction]
> (original emphasis)(Frank, 1978, p. 75).

Frank found that the Sunni defined 'necessary knowledge' as "…that gained in direct sense perception ('idrâk), including all knowledge, whether gained through experience, study, practice, perception or whatever, that, since it is not based upon inference and reasoning, cannot be challenged or called into question on theoretical grounds" (Frank, 1978, p. 84).

This knowing arose from the "…distinction of things as different from one another or the same as one another and similar in terms of the attributes and characteristics (that have been discussed); i.e., similarity and dissimilarity, sameness and difference, are determined through the Attribute of the Essence ('the atom is an atom', Frank, 1978, p. 67) or through the essential attributes that flow directly from it " (p. 65).

Thus, "…being a knowing person may be described or defined as constituting the actual possibility of the realization of a well wrought act (by)…one who is knowing" (p. 63). You cannot define the act unless you have the knowledge or experience (necessary to achieve the attribute) to have

realization of it, the power to realize acts unlimited either in kind or in number...leading to the realization of God's being *qâdir* or capable of autonomous thought and action" (original emphasis)(Frank, 1978, p. 63).

Heidegger (1959) proposed a similar definition of practical knowing and laid the philosophical foundation when he said:

> But to know means: to be able to stand in the truth. Merely to have information, however abundant, is not to know. Even if curricula and examination requirements concentrate this information into what is of the greatest practical importance, it still does not amount to knowledge. The man who possesses such information...will still be perplexed in the presence of real reality, which is always different from what the philistine means by down-to-earth; he will always be a bungler. Why? Because he has no knowledge, for to know means *to be able to learn* (original emphasis)(Heidegger, 1959, pp. 20-21).

The search for enlightenment and the release from suffering through the attainment of nirvana, Siddhartha Gotama (563-483 B.C.E), the Buddha, was an ascetic who eschewed worship and never prayed: "ironically, he is now a god, worshipped in prayer by millions" (Ozmon & Craver, 1999, pp. 99-101).

Nhat Hanh (1990) wrote that the Buddha's teachings on enlightenment "...begin with the five elements that combine together to complete a self; form (the body), feelings, perception, mental factors and consciousness. All five elements are constantly transforming; they are never born and never die. The learner is not bound or limited by the five elements, and since we are not born or destroyed, we need no longer be oppressed by death" (p. 49). This occupation on living life in the present lends itself to the attainment of enlightenment as "...the sage calls a person who knows how to dwell in mindfulness night and day...one who knows the better way to live alone" (p.18).

People who are ignorant of the key quality characteristics of Buddhism may not understand their impact and significance on Western civilization. Jayatilleke (1974) noted that "...the (Buddhist) practices recommended are of relevance to any civilized society", citing a stanza in a Buddhist chant "...a good

education, acquiring a technical skill, a well-cultivated sense of discipline and cultured speech - these are the auspicious things" (p. 260).

Wittgenstein (1968) explored the use of sense data in regard to Western philosophy, pedagogy and Buddhism. Wittgenstein was troubled by "…man's philosophical captivity" (p. 69), and he searched for a state of "…complete clarity…a state of enlightenment in which the mind is free from philosophical questions" (p. 69):

> K.T. Fann, for instance, compares Wittgenstein with a
> Zen master. One has to be led to dissatisfaction and
> perplexity about a philosophical problem before one
> can be liberated (and) the obvious remark is that one
> must have a problem before it can be solved. Wittgenstein
> offers liberation…this liberation is from a spell cast
> by an obsession of certain pictures of how things
> must be as suggested by grammar: 'Philosophy is a
> battle against the bewitchment of our intelligence
> by means of language; Philosophy, as we use the word,
> is a fight against the fascination which forms of
> expression exert upon us' (Gudmunsen, 1977, p. 69).

This "bewitchment", according to Wittgenstein, is "…only brought to a head in philosophical puzzlement" (p. 69). Gudmunsen (1977) cited Wittgenstein's criticism of the traditional Western versus the Eastern way of getting people to:

> …understand what they need to understand. This can
> be most easily explained if we go back for a moment to
> the discussion of what the analysts and the critics took
> understanding to be. For some, understanding is the
> confrontation of the mind with whatever is to be understood.
> To get someone to understand something, present him
> with the facts. What the philosopher should be doing…
> is making the attempt, however difficult in practice, to
> present the reader with indubitable knowledge, such
> as that of our sense-data. The reader either sees the
> truth and accepts it…or else he doesn't see it" (Wittgenstein,
> cited in Gudmunsen, 1977, p. 71).

The exposition of the truth according to Hīnayāna Buddhism "…is the task, centrally, of the Buddha. In the Sutras he sets out his teachings, the

truth of which has to be 'seen'. Arguments are put forward, certainly, but in the final analysis the Buddha's doctrine is a 'come-and-see-thing'…the act of understanding being rooted in a basic act of seeing. Either one sees or one does not" (Wittgenstein, cited in Gudmunsen, 1977, p. 71).

Jayatilleke (1974) recommended that we consider the 'centrality of the whole' where the disciple is guided toward self-direction in learning and the steering of oneself to 'the middle path', as implied in the Buddhist concept of Pacceka Buddha (Jayatilleke, 1974). This allowed one to attain salvation and a high degree of enlightenment by one's own efforts "…without necessarily depending on the teaching of the Buddha" (p. 15). Jayatilleke further commented that the teaching of the Buddha is only a guide to understanding, "…for one has to put forth effort oneself, *for the Transcendent Ones are only guides*" (original emphasis)(Jayatilleke, 1974, p. 15).

The Buddha, trained by Āḷāra Kālāma and Uddaka Rāmaputta, both teachers of the Brahmanical school, found that the existing schools of philosophical thought were dominated by a search for ultimate objectivity in philosophical explanation. This search, however, was flawed by one or a combination of "…the attitudes and perspectives of (a). faith and confidence, (b). likes or preferences, (c). tradition, (d). reflection on form, and (e). delighting in the contemplation of views" (Kalupahana, 1992, pp. 30-31). The Buddha was unwilling to abandon all human perspectives when formulating a view, perhaps realizing from the outset the impossibility of doing so; then…"He began to analyze the nature of sense experience, the means by which we come to have yogic intuition, and the process of rational reflection" (p. 31).

Kalupahana's (1992) life work has been to thoroughly explain the roots of the Buddhist epistemology. He examined "…four major schools of Eastern philosophical thought concerning knowledge and the life experience that preceded the teaching of the Buddha: Brahmanism, Materialism, Ājīvikism and Jainism" (p.30). Brahmanism (pp. 5-12) "…sought to explain the significant

role of experience of one individual in the world order. Materialism, particularly the second school of Materialism, opposed the orthodox Brahmanical system and emphasized sense experience as a valid source of knowledge" (p. 13).

Materialists focused attention on the human's personality, for them the identity of a person was based on the physical body, which enjoyed the status of ultimate reality. Materialists were the first no-soul theorists of India, which Kalupahana posited "sped them in their journey toward the limit of objectivity in human knowledge and understanding" (p. 14). Ājīvikas (p. 14) "were the first Indian philosophers to face squarely the challenge of determinism and free will (they accept determinism and reject free will), believing that no difference was made by effort on the part of the individual" (Kalupahana, 1992, p. 14).

In Jainism…"the conception of action or kiriya, which can be bodily, verbal or mental, dictates what the mind is, rather than the mind determining what action is. Any bodily action has consequences for which the agent of action is responsible" (p. 16). Jainism holds that " all actions result in responsibility whether the action is performed with or without attention, with or without knowledge…the relationship between action and consequence is never conditional, always absolute" (p. 17). The "eventual return to atman (self) by Jainas and all other schools suggests that "…investigation of the essential Brahman views of knowledge acquisition and Buddhist enlightenment through sense experience is paramount when arguing Eastern philosophy and epistemology" (Kalupahana, 1992, p. 19).

Brahmanism sought to explain the significant role of experience of one individual in the world order. In the contemplative writings of the Brahman sages, specifically the Brhadarāṇyaka Upaniṣad (written at the Vedanta, or "end of the Vedic tradition", near 600 B.C.E), the concept of atman, is prominent regarding the metaphysics of the self and the world. This concept of 'I' (aham) as the primordial 'self' (atman) (pp. 10-11) explains the trials of the human being attempting to reach the ultimate objectivity in explaining the

subject of experience. This stance combined Eastern philosophy with the philosophical perspectives suggested by the Cartesian cogito as well as the Kantian "transcendental unity of apperception" (Kalupahana, 1992, p.11).

In my reflections on the work of Kalupahana, I note that he is both a student and critic of Jayatilleke. My reading of his 1975 work Causality: The Central Philosophy of Buddhism exposes Kalupahana's belief that "…the dualism of Western philosophy" (pp. 25-28), symbolic of the battle between dark and light, right and wrong, good and evil, life and death, purportedly results in the epistemological erosion of Jayatilleke's writing on Buddhist philosophy (Kalupahana, 1975). Kalupahana's interpretation of the teachings of the Buddha discounted any such dualism, for the attainment of the self as one in nature needed no outside influence, nor is it measurable by any parameter that requires a true or false type of dualistic scale or monitor. The value of faith lies, in the musings of Kalupahana, in the discovery of self, enlightenment, and peace

In a similar vein, Kalupahana's reference to Rene Descartes "cogito ergo sum" ("I think, therefore, I am") is written with the intent of rejecting the import of the Brahman emphasis on 'I' (aham) and the 'self' (atman) as a narcissistic focus of the life force. In spite of his criticism of Jayatilleke's work and rare occasional inscrutability, Kalupahana's insight forges a powerful link between Western and Eastern philosophies in the important epistemological context of the cognitive unconscious and learning and knowing.

Philosophical Arguments for Sensory Learning

At this point in the discussion, I remembered the lessons I learned in an excellent philosophical and historical foundations of education course, where the student learned the different schools of thought such as Idealism, Realism, Existentialism, Pragmatism, Behaviorism, Eastern Philosophy, Secular Humanism, Progressivism, and others schools of epistemological and philosophical importance, the importance of each depending upon the author or theorist and the person teaching the class.

The impact of Eastern thought and philosophy on the American education system is often minimized; yet there is no doubt that the Eastern point of view regarding learning and knowing crosses the boundaries of all of these otherwise different schools of thought. For example, the writers representing the ideologies of Existentialism, Secular Humanism, Idealism, and Realism argued that sense data led to knowing, that perception is feeling what is right and good, and that people know more than they can tell. The similarities are so numerous that it would be more economical to establish a minimalist argument concerning the dissimilarities that exist. I found that a large body of evidence existed that supported sensory learning when one performed a thorough review of the philosophical viewpoints of the classic writers and theorists of both Eastern and Western pedagogy.

The Cartesian cogito supported the tradition of Idealism because it reaffirmed the centrality of mind in relation to an individual human being to the world. Objects outside the cogito are grasped by the senses, although we know with certainty that the senses are notoriously subject to error when used as the sole criterion for decision-making (Ozmon & Craver, 1999).

In this context, the Buddhist's experience with sense data reveals that there is an awakening, and:

> ...from contact (with an object) arises feelings. What
> one feels, one perceives. What one perceives, one reflects
> about. What one reflects about, one is obsessed with.
> What one is obsessed with, due to that, concepts
> characterized by such obsessed perceptions assail him
> in regard to visual objects recognizable by the visual
> organ, belonging to the past, present and future
> (Kalupahana, 1992, p. 32).

Contact, then, leads us to the emotive element, feelings, and "What one feels, one perceives" (Kalupahana, 1992, p. 33) and Berkeley's esse est percipi, "to be is to be perceived" (Ozmon & Craver, 1999, p. 22). The Cartesian method, stated in the terms of Platonic thought (where Herodotus stated "You

cannot step into the same river once", cited in Kitto, 1951, p.182), accepted that the finite human mind contemplated the ultimate reality of ideas, the cogito defined, "I think, therefore, I am" (Ozmon & Craver, 1999, pp. 20-21).

Introspeculation encouraged these and similar epistemic musings. The introspeculative is conscious, lucid, and aware of their thoughts, and their whole is transfixed upon mindfulness and knowing. The premise of thinking and reflecting (prior to action or forming a plan to act) is in itself an action plan, clearly linked and definitive to the operationalization and deployment of many of these useful philosophies.

These conjoined philosophies refuted David Hume's <u>Treatise on Human Nature</u> (1739) accenting his moral skepticism and doubt concerning human morality and knowledge. Hume's greatest question on morality and knowing was, thus: "Can we ever prove that our ideas corresponded to reality?" (Solomon, 1992, p. 199). The importance of sense experience and cogito, ostensibly refuted by Hume's positivism, are reinforced by Immanuel Kant's response to Hume, stating "We know reality precisely because we constitute reality through the concepts of our understanding" (Solomon, 1992, p. 247).

Similarly, Immanuel Kant's (1704-1824) view of education was not dissimilar to that embraced by the Buddhist tradition: in education, the important thing is "enlightenment or teaching a child to think according to principles as opposed to random behavior", and "the performance of duties towards oneself and others" (Ozmon & Craver, 1999, p. 24). In Solomon (1992), Kant noted that "...morality is a deontological (acting for the sake of duty instead of acting in conformity with duty) theory" (p. 247), but to test morality it must be autonomous, that is, "...those responsible to the moral code have the ability and right to act in accord with the precepts or disobey the code. Only then can reason or knowledge be evaluated" (Solomon, 1992, p. 247).

James (1842-1910) opined that the autonomous self, then, could not serve Sartre's (1972) "backward cast shadow" (cited in Hart, Nelson, and

Puhakka, 1997, p. 82), for the shadow deals with a future implied by the experiences of the past, what has happened. James taught us that "…a consciousness that is the result of contiguity of the series of connected present moments. Each moment becomes a past but, when the whole chain is remembered as a collective in the moment of the present, it seems to imply an ongoing experiential entity or being we identify as the 'thing' or 'container' we call consciousness" (p. 82).

James insisted that pure experience is the 'stuff' of which the human world is made. From this stance, he argued for a radical empiricism that "placed 'subjective' events on an equal ontological footing with 'objective' ones which, in his system, appear to vary more in degree than in any absolute kind from each other" (cited in Hart et al, p. 82).

James' radical empiricism (cited in Hart et al) is established when he states that "…knowing can be easily explained as a particular sort of relation towards one another into which portions of pure experience may enter" (p. 83).

Further, James went on to clarify the apparent dichotomy we all intuitively sense between inner and outer, subject and object as being the result of the relationship between these qualities becoming "…part of this pure experience in which one of (the) terms becomes the subject or knower, and the other the object, or the known" (p. 83).

Starting with James' pure experience, we can imagine reality as being operationally defined as "…the type and style of the attentional and awareness processes used in the act of knowing. Thus, scientific observation and method, which is a cognitive and behavioral approach employing a particular set of experiential operations, is the *style* (original emphasis) of scientific knowing which generates scientific knowledge. Likewise, religio-mystical practices (experiences) are styles of knowing which lead to spiritual knowledge" (James, cited in Hart, Nelson, and Puhakka, 1997, p. 83).

Jürgen Habermas (1971) quipped that we must be certain of the validity of our own judgments before we are certain of our knowledge:

What is demanded is thus the following: we should know the cognitive faculty before we know. It is like wanting to swim before going in the water. The investigation of the faculty of knowledge is itself knowledge, and cannot arrive at its goal because it is this goal already (in Habermas, 1971, p. 7).

In the <u>Radicalization or Abolition of the Theory of Knowledge</u>, Habermas (1971) further explores the relationship between consciousness and the theory of knowledge. Habermas (in his interpretation of Hegel's critique of Kant) notes that sense-certainty is the name of the natural consciousness of a world of everyday life which we always find ourselves already inside: "Sense certainty is objective in the sense that the recollecting power of reflection itself originates in this stratum of experience, whose dogmatic character it unmasks" (p. 8).

Habermas notes the utility of reflection and the presence of tacit knowledge when he states "…consciousness cannot make anything transparent except the context of its own genesis …phenomenological experience is a form of reflection itself. It pertains to the structure of self-knowledge that one must have known in order to know explicitly. Only something already known can be remembered as a result and comprehended in its genesis, and this movement is the experience of reflection. The goal is…knowledge which the critical philosophy asserted as an immediate possession [referring to Reinhold's circular character of epistemology]" (Habermas, 1971, p. 9).

Hegel's metaphorical description of a relationship between knowing and being, states that "…if the examination of knowing, which we represent to ourselves as a medium, makes us acquainted with the law of refraction…For knowing is not the refraction of the ray, but the ray itself through which the truth reaches us" (1971, p. 11).

Habermas posited that Hegel's statement is an important philosophical departure from the duality of traditional writing on knowledge, where students and knowing are separate entities "…the absolute relation of subject and object" (p. 12). By defining sense certainty as a mode of reflection and

consciousness, Hegel, in my view, acquiesced to the existence of conscious and unconscious knowledge.

The path of determinate negation guarded against empty skepticism and the reversal of consciousness. This is clarified by Hegel when he states that:

> ...the result obtained from a non-veridical instance of
> knowledge cannot shrink to an empty nothingness
> but must be apprehended necessarily as the nothingness
> *of that of which it is the result*: a result that contains that
> which was true in the preceding instance of knowledge
> (original emphasis)(Hegel, cited in Habermas, 1971, p. 18).

This is a mechanism of the progress of a mode of reflection in which theoretical and practical reason become one. Habermas defines the phenomena simply, stating that "in this affirmative moment...categories of apprehending the world and norms of action are connected" (1971, p. 18).

Maund (1972) discussed David Hume's (1711-1776) views on perception, intuitive knowledge and "the accusation of knowing" (p. 254). Hume's essential solution to the question 'What is knowledge?' is succinct in that we have ideas in relation to objects: If a person knows something, they have propositions that they are able to express, and "...these expressions are precise and accurate" (cited in Maund, 1972, pp. 254-255). Maund painstakingly identified the confusion and ambiguity expressed in Hume's work, particularly regarding perceptions of sensory input, which Hume framed as "intuitive knowledge" (p. 252).

In Maund's analysis of Hume's <u>Treatise</u> (1739), she expounds on Hume's theory of intuitive knowledge, "...a type of knowledge he thinks is different from various other kinds of knowledge" (1972, p. 255), a knowing which "...is purely practical and arises from the fact that our practical activities are such that we do make this kind of use of our intuitive knowledge" (p. 253). Hume's intuitive knowledge dealt more with perceptions, according to Maund, and Hume used the perceptions of intuitive knowledge to account for variance and errors in belief "...where the particular type of error we have been

considering cannot arise, we proceed in a more *artificial* manner" (Hume's emphasis, cited in Maund, 1972, p. 253).

If Hume wished to proceed in an artificial manner, according to Maund, he "...called for comparative testing of two objects' relationship. This test would show distinctions in what one believed they knew versus what was true about the size, the shape or the relationship between objects" (1972, p. 253). Hume wrote that "...the test would show the relationship between perception or intuitive knowledge and original knowledge, that is to say give stronger grounds for the belief that there is a relationship and that there was truth to the original object belief...However, this could in no way inform the validity or incorrectness of the original perception, or the original knowledge, but only about the original object belief" (1972, p. 253).

Maund attacked the philosophical ambiguity that Hume expressed regarding intuitive knowledge, and believed that the learning gained from perception is flawed "...because beliefs and statements...make perceptual assertions which go beyond what is perceptually given. We go even further and sometimes assume that intuitive certainty gives us knowledge of external object relations" (1972, p. 256).

If David Hume's research uncovered further sources of data on the effects of perception and intuitive knowledge, no evidence exists. His remarks on intuitive knowledge appeared only in the <u>Treatise</u> and there is no mention of intuitive knowledge in <u>Enquiry Concerning the Human Understanding</u>; however, Hume wrote about reason from experience which he related to learning from sociology and customs [Maund, 1972]. Maund postulated that Hume, realizing the difficulty he would have in substituting perception for objects, and wanting his work to have popular appeal, moved away from perception and intuition (what Maund called "ideas", p. 259) and back towards "concepts" (p. 259) in his publication of the <u>Enquiry</u> paper and in later works.

Maund's critical hubris must be overlooked when objectively examining the import of Hume's writings; specifically, Hume's assertion "...that relations

of ideas are intuitively or demonstratively certain merely assumes what we are trying to find out...", noting that "...we must admit that if we do recognize an example of a relation of ideas we can also see that it is certain in a sense in which no matter of fact is certain" (Hume, in Maund, 1972, p. 259).

In such circumstances I admit that relations of ideas are not dependent, quoting Hume, "...on what is anywhere existent in the universe" (Maund, 1972, p. 261). Armstrong and Malcolm (1984) sought to establish a clearer picture of consciousness and unconsciousness in regards to the variants of learning and knowing. The authors cited John Locke's comment that:

> ...consciousness is the perception of what passes in a
> man's own mind. Can another man perceive that I am
> conscious of anything, when I perceive it not myself?
> (Locke, cited in Armstrong & Malcolm, 1984, p. 23).

Locke went on to say that it is "...impossible for anyone to perceive without *perceiving* that he does perceive. When we see, hear smell, taste, feel, meditate, or will anything, we know that we do so" (original emphasis)(Locke, cited in Armstrong & Malcolm, 1984, p. 23).

<u>Philosophical Cautions Concerning Sense Perception</u>

Sense data, however, is not perfect; in the causal theory of dispositions, Armstrong and Malcolm (1984) put forth their theory that all aspects of nature and the character and virtue of a person contributed to that which occurs around them and to them:

> Sense data is conceived of in the mind of the perceiver,
> and epistemological access (to light, dark, color, situation,
> shape and sound) is thought of as direct and infallible,
> giving the perceiver indirect knowledge of its external
> physical causes (Armstrong & Malcolm, 1984, p. 136).

Introspection, the ability to look inward, informed the perceiver and gave one a clearer perspective prior to making a decision. Brentano noted that "Even ordinary perception begins with an awareness of a mental object: the sense impression...'outer perception' is not really perception at all, and that

mental phenomena are the only ones of which perception in the proper sense of the word is possible" (Brentano, in Armstrong & Malcolm, 1984, p. 136).

Inner sense, therefore, is not infallible in it's apprehension of the physicality of the sense datum, because introspection might inform the perceiver differently. Spinoza, (cited in Parkinson, 1954) like most seventeenth-century rationalists, held that sense experience alone is not a sufficient criteria to explain how and why we know things.

Parkinson (1954) suggested that Spinoza's "...doubt surrounding sense experience" arises from his agreement with Descartes' methodological doubt, in that "...the senses sometimes deceive us and that it is wiser not to trust entirely to any thing by which we have been once deceived" (p. 45).

We begin to see the utility of sense experience as a 'sensory conduit', a primary source of implicit learning and tacit knowledge. Spinoza's aforesaid comment on sense experience fits neatly into the groove created by John Locke's view on perceiving: we interpret what we know from what we feel we know. Likewise, the perspective gained from introspection assists us when we make judgments and take action based upon instinct, a hunch, intuition or a gut-feeling. As stated, the validity of knowledge or the wisdom of a decision made upon the inputs of sense experience may not be in the best interest of the decision-maker; just as in life, the wise decision may still be the wrong one.

Locke's views on perceiving were echoed by Steenbergen (1970), who said that "...subjective experience (while important in knowledge acquisition) may not be superior to an objective examination of our knowledge" (p. 192). Steenbergen (1970) cited the existence of knowledge in three domains, "corporeal, spatial and temporal" (p. 201). Corporeal knowing is from physical senses and measures sense-datum, spatial knowing confronts the individual to define a personal role in time and space, and temporal knowing relates to thought and reflection. Steenbergen tagged sensory input (hearing, seeing, smelling, feeling and speech) "corporeal datum" (p. 199) because it arises from sense experience, and that:

...sense datum assists in the objective examination of
knowledge by making it more explicit...Sense datum
(are not only expressive, they)...are modalities of reality,
allowing the subject to have a lived experience in empirical
concepts (Steenbergen, 1970, p. 197).

Steenbergen sternly warned of the seduction of sense datum, saying that
sole reliance upon it "...could exaggerate reality" and serve to add unwarranted
"prejudice and ambiguity" (1970, p. 201). Mandelbaum (1964)
agreed with this comment, stating "Sense experience frequently offers
contradictory testimony concerning the nature of physical objects" (p. 123).

Sense experience, when edified by introspection, is a source of knowledge
that is frequently used in decision making, particularly when unusual or
unexpected circumstances arise. Baruch Spinoza (1632-1677) attributed the
machinations of imagination and memory to "...knowledge from the common
order of Nature" (Spinoza, cited in Parkinson, 1954, p. 142). He alludes to
sensory input from sense perception when he tells the following story:

...from thinking of the word *pomum* a Roman will
immediately fall to thinking of the fruit, which has no
likeness to that articulate sound, nor anything in
common with it, except that the body of one and the
same man was often affected by these two things.
(When)...two different men see hoof prints in the sand...
a soldier will think of a cavalryman, and from that will
think of war; a countryman, on the other hand, will
think of ploughs and fields. Neither of these has been
thinking in the strict sense of the word, for they have
undergone an automatic process of association, in which
the links are those of personal habit rather than those
of logic (original emphasis)(Spinoza, cited in Parkinson,
1954, p. 143).

It is clear that Spinoza considered knowledge obtained from the
"...common order of Nature" (cited in Parkinson, 1954, p.142) important
in regards to defining the presence or absence of knowledge. In the genesis of
phenomenological inquiry, the importance of the Husserlian perspective is
unquestioned. Husserl's view on implicit and explicit learning and sense
experience was investigated by Gurwitch (1965), who viewed this phenomenon

from a Husserlian, Noêtic, and Gestalt-theoretical perspective. Gurwitch was
skeptical about the possibility of "incompleteness" (p. 18), noted by critical
authors who had analyzed Husserl's views of perceptual experience in regard to
phenomenological analysis:

> Perceptual experience never exhausts itself in single acts,
> but can be understood only in terms that are open, i.e.,
> capable of indefinite continuation. It must be stressed
> that even a static phenomenological analysis – one which
> does not consider the perceptual process of it's unfolding
> and development, but rather confines itself to the study
> of a single perception – must discover the process character
> of perceptual experience, insofar as it's quality as a phase,
> hence it's references to further phases, belongs among the
> phenomenal features of every single perception (Gurwitch,
> cited in Edie, 1965, pp. 18-19).

Abram (1996) suggested that Husserl was increasingly frustrated with
"mathematized and mechanical universe - the impersonal objective dimension
of pure facts" (p. 35) that he encountered when trying to direct scientific
attention to "...the fluid region of direct experience" (p. 35). Husserl's
phenomenology would "seek not to explain the world, but to describe as closely
as possible the way the world makes itself evident to awareness" (Abram, 1996,
p. 35).

Gurwitch wrote that "...all of Husserl's writings dealing with
phenomenological problems of perceptions - <u>Ideas</u>, <u>Cartesian Meditations</u>,
<u>Erfahrung und Urteil</u>, <u>Dies Krisis der Europäischen Wissenschaften und die
transzdentale Phänomenologie</u>...(Husserl) almost invariably expresses in
noêtic terms the process character of perceptual experience as it is meant here,
that is, ascertainable by a static analysis" (p. 19). Gurwitch continued his
explanation on the noêmata (the highest Platonic level of knowing: a belief in
that which is believed to be present but is not seen) and used the terms
explicit and implicit in the proper context of this investigation, stating:

> To recall only a few of (Husserl's) formulations: through
> every act of perception more is intended than merely
> that which is given in direct sense-experience; every

act surpasses and over reaches itself in pointing to
further acts by which it is to be complemented...
(in reference to unseen things) prove to be implicit
noêmatic components, in contradistinction to the
explicit ones comprising whatever is given in direct
sense experience. In speaking of perceptual implications
we wish to indicate components and constituents
which, though essential to the noêmatic structure, are
not yet unfolded, unraveled and articulated, and which
contribute to that structure in, so to speak, a silent way
(Gurwitch, in Edie, 1965, pp. 19-20).

Gurwitch clarified this statement in Gestalt-theoretical terms, "...that
which is the reality-based outcome of direct sense experience (Gestalt-
contexture) is essentially determined and qualified, and made to be what it is
by the functional significance of that which is observed" (1965, pp. 22-23).
This outcome differed from the perceptual noêmata "...which are aspects that
may, but do not in the present moment, appear in perceptual experience"
(1965, p. 23). Sense experience, then, while not perfect in noêtic terms, is
available to all, is visible, commonly used, and ideal as a technique of learning
and eventually (through experience) knowing.

Summary of the Chapter

This chapter reviewed the classical literature for signs of a predilection
towards other ways of knowing; knowledge acquisition through implicitly
learned tacit knowledge, somatosensory pathways and sense experience, which
are complementary to and coexistent with explicit learning. I established the
connection between Western and Eastern philosophy, noting a parsimonious fit
between Eastern and Western ways of thinking and modern educational
philosophy. A caution is presented on sole reliance on the sensuous as a
source of learning and pathway to knowing. The utility and presence of
implicitly learned tacit knowledge, as well as a novel technique to measure it's
existence and utility in a sample of the population, are explored in ensuing
chapters. The major authors and their theories are captured in Table 1.

Table 1.

Theories Of Knowledge

Life/ (Work) Date	Theorist	Term for Knowing	Relation to Sense Perception/Somatosensorium
1937CE	Hicks	Knowledge of world	A personal act truly represents the world
1711-1776CE	Hume	Ideas and reality	Practical activity arises from intuitive knowing.
1225-1274CE	Aquinas	A divine intellect	Aristotelian Realism; "…unknown to all save God…"
3-67BCE (30CE)	St. Paul	Invisible things of God	Clearly seen…by the things that are made.
563-483BCE	Siddhartha	Perception	Hearing the voices in the river.
427-347BCE (380CE)	Plato	Cannot step in the river once	Ultimate reality of ideas.
1889-1951CE	Wittgenstein	Liberation of person	" Shew the fly the way out of the fly bottle…"
1632-1677CE	Spinoza	Cognitio reflexiva	Pre-supposed knowledge, initially knowledgeable.
1632-1677CE	Spinoza	Sense experience	Be wary, the senses can deceive us.
1596-1650CE	Descartes	Methodological doubts	What we perceive can deceive us.
1632-1677CE	Spinoza	Innatis instrumentis	Do not have to know that you know before you know.
1859-1952CE	Dewey	Personal knowing	Know things you cannot express.
1889-1976CE	Heidigger	Knowing; stand in truth	To know means to be able to learn.
1225-1274CE	Aquinas	Possible intellect	Inner knowledge resides in the soul.
1964CE	Mandelbaum	Sense experience	Contradictory testimony…nature of physical objects.
1859-1938CE	Husserl	Phenomenal features	Perceptual process "…of unfolding and developing"
1966CE	Polanyi	Perception	Bridge perception and creativity.
1889-1951CE	Wittgenstein	Complete clarity	Sense-data; free from philosophical captivity.
1889-1951CE	Wittgenstein	Come and see	The person 'sees' it or they don't – this is understanding.
1632-1704CE	Locke	Subjective experience	Objective examination of knowing.
1970CE	Piaget	Logomathematical limit	Preinferences intervene; schematicism of action.
1921CE	Pears	Reflexiveness of knowing	Reflection of object.
1770-1831CE	Hegel	Sense certainty	Natural consciousness of daily life.
1770-1831CE	Hegel	Examination of knowing	Absolute relationship subjective objective - A ray of truth
1920-1970CE	Jayatilleke	Introspection	Analytical tool.
1920-1970CE	Jayatilleke	Stream of consciousness	The unconscious influences conscious behavior.
563-483BCE	Siddhartha	Centrality of the whole	Transcendent Ones are guides – gain knowing on your own.
427-347BCE	Plato	The eye of the soul	Knowledge and ignorance (Light of reality and darkness).
1842-1910CE	James	Stream of knowledge	Conscious (explicit) + Unconscious (implicit) knowing.
1978- CE	Frank	Necessary knowledge	Knowledge of experience, study, practice, perception.
1978- CE	Frank	Essential attributes	Flow from direct perception.
1632-1704CE	Locke	Perceiving	Consciousness of what passes through the mind.
1984- CE	Armstrong & Malcolm	Sense data	Indirect knowledge of physical causes.
1990-CE	Nhat Hanh	Alone in enlightenment	Dwell in mindfulness amidst form, feelings, perception.
1992CE	Kalupahana	Rational reflection	Sense experience and life experience.
1933- CE (1992CE)	Kalupahana	Action consequence	Bodily action espoused in Jainism.
1933- CE (1992CE)	Kalupahana	Enlightenment	Think by principles, enlightenment by sense experience.
1711-1776CE	Hume	Ideas and reality	Do thoughts correspond to reality?
1724-1804CE	Kant	Transcendental unity of apperception	Human attempts to reach ultimate objectivity.
1905-1980CE	Sartre	Backward cast shadow	Consciousness of connected moments.
(1986CE)	Cleeremans	Rule + Instance-based knowledge	Knowing is always explicit or conscious.
(1986CE)	Cleeremans	Metaphor of cognition	Knowledge represented symbolically.
(1986CE)	Reber	Cognitive unconscious	Unconscious knowledge is available for use.
1842-1910CE	James	Pure experience	Are the subjective and objective reality real?
1685-1753CE	Berkeley	Esse est pricipi	To be is to be perceived.
1885-1952CE	Horney	Introspective self-analysis	Life is an effective therapist.
1596-1650CE	Descartes	Cogito ergo sum	Outside of the *cogito* is grasped by senses.
1225-1274CE	Aquinas	Study the world; Observation and reason	Path to the soul through the physical senses.
(1999- CE)	Sternberg & Horvath	Leader behavior	Intuitive knowing is the foundation of leadership.
1200-1280CE	Magnus	Cosmology	Knowledge moves from low to high towards perfection.

CHAPTER 3

REVIEW OF THE LITERATURE

<u>Building Bridges of Understanding</u>

In the epoch I detailed a planned meeting between a retired engineer and myself. I have been active with a support group of patients who used wheelchairs and other assistive-augmentative technology. The purpose of this day's meeting was to talk with him about my study and to evaluate the usefulness of a rather old portable, lightweight wheelchair used by his wife. The engineer had done an exquisite job of modifying the wheelchair by using a hacksaw to cut the tubular steel; he then extended and reinforced the new joints to allow the portable wheelchair to fold up neatly and fit in his trunk during long trips.

I cautioned the gentleman about the modification, noting the importance of strength and safety and that, in my opinion, the warranty was now voided by his modification. I was trying to inform and help in this situation. He smiled at me and said:

> In my day I was a bridge builder. I took raw steel in
> hand and created great structures, sound and strong.
> You drive over them every day in your car. I use steel
> to build and you use words…will your words support
> weight and the test of time? You build your bridges, son,
> and you leave me to build mine (personal communication,
> used with permission, 2000).

The engineer was right. I evaluated the strength and safety of his work through my knowledge of equipment, while he had made the modification from his heart, to support the weight of his most precious wife. He knew about the strength of metals and the stress on joints, but more importantly he knew the value and the power of an improvement that was properly researched and carried out by an experienced craftsman. In this work I attempted to build a bridge of words that connected the reader to a better understanding of the presence and utility of implicitly learned tacit knowledge.

<u>The Utility and Presence of Tacit Knowledge</u>

The investigation into tacit knowing is a search to better understand relatively unknown dimension of learning. The reader will also learn a new language about learning and knowing, whose words (tacit knowing, implicit and explicit learning and vicarious reinforcement) are contextually foreign to the modern educator. The research is compelling in its description of the presence of implicitly learned tacit knowledge, and I believe that it is important to uncover more information about this poorly understood pathway to learning and knowing.

The literature hints at a rising belief that implicitly learned tacit knowledge may be exploited in future educational applications of software and hardware. In Hanna's (2000) <u>Higher Education in an Era of Digital Competition: Choices and Challenges</u>, the author provided evidence and descriptors of futuristic technology and prognosticated their introduction and adoption time frames.

Students of learning and knowing will not be surprised to see that the descriptors of this technology wax towards the realm of somatosensory conduits of learning: "Artificial realities with immersive multisensory virtual worlds used to provide intensely motivating simulation and virtual experience…and consciousness sensors with the inputs of user biofeedback into computers to monitor mood and state of mind; the authors predict(ed) both within 7-10 years" (Hanna, 2000, pp. 1-20). In a similar study, Olsen (2000) used virtual reality therapy (VRT) and achieved stated diagnostic and therapeutic goals in Alzheimer's disease, traumatic brain injury, and in Post-Traumatic Stress Disorder (PTSD) in Viet-Nam veterans.

In the book <u>The Tacit Dimension</u>, Polanyi (1966) described the tacit as that which is implied but not expressed in words, silent or spoken. He commented, as one example, that we do not remember a certain set of facial muscle positions, yet we can describe tacitly the emotions they express.

Polanyi described the genesis of thought on implicitly learned tacit knowledge and his rumination on the seeds of literacy when he noted the following:

> The combination of organismic and mechanical
> principles is replaced in the mental field by the
> combination of tacit comprehension with a set of
> fixed, logical operations. A child starts off with
> a scanty repertoire of innate mental connections
> and enriches them rapidly by using his
> powers of comprehension for establishing further fixed
> relations of experience. Piaget has described how a
> child's powers of reasoning are improved by developing
> increasingly stable rules of logical procedure.
> Stimulated by the interiorization of language,
> this development eventually produces the adult mind.
> I described in my last lecture the tacit process of
> comprehension by which we take in the meaning of a
> communication addressed to us; the process of education
> by which the human mind is brought into existence is
> a major exercise of these powers of understanding.
> (1966, p. 45).

Polanyi's comment that "people know more than they can tell" (1966, p. 4) Unraveled the traditional thoughts and definitions of literacy, and challenged the concept that tests of literacy accurately compare, contrast, measure, or define knowledge across cultures or between different groups of people. Perhaps the least understood component of literacy is knowing, and the challenge to educators is to discern what theory or definition of knowledge is correct and appropriate in a particular setting or a particular audience with special needs.

Contextual Literacy and Tacit Knowledge

Guthrie (1996) explored contextual literacy and examinined tacit knowledge's role in leading and decision making during outdoor leadership activity. Tacit knowledge is a generally unarticulated, preconscious type of knowledge that formed a basis for human judgment and decision making. The author noted that tacit knowledge is acquired primarily through experience and practice, usually vicariously through hands-on exposure to crafts. Knowledge is reinforced through observing the technique of skilled mentors, experts,

teachers, and then the learners have multiple, repetitive, successful hands-on encounters with the same (or similar) craft or skill.

Simosko stated that "many skills are picked up accidentally" (cited in Pogson & Tennant, 1995, p. 60). This supported Guthrie's statement that tacit knowledge is practical knowledge usually taken-for-granted by the person who has it, but it is "observed and described by others as a skill (the ability to do something well)", or exists as a "...perceptual ability, that is, gaining knowledge by the use of senses that is not obvious to an inexperienced person" (Guthrie, 1996, p.10).

Brooks (1994) stated that tacit knowledge is particularly critical in woodcraft and is grossly underestimated by participants in environmental experiences. Brooks' supposition is that skilled leaders of outdoor experiences can socialize the participants into the outdoor environment and help them interpret their roles in the cultural dimension of the ecological crisis. The author argues that traditional models of judgment and decision-making assume that experienced leaders recognize a problem and then think through sequential steps to arrive at an appropriate decision.

Guthrie wrote that the "decisions" of experienced leaders are not consciously made "...but result from preconscious processes or habits that arise from the leader having been in similar condition in a past situation" (1996, p.12). Guthrie and Brooks' work is in concord with Ehrlich and Soloway (1979), who posited that the "computer literacy advantage that experienced computer programmers have over novice programmers is tacit knowledge" (cited in Tennant & Pogson, 1995, p. 60). Guthrie's work in particular suggested to me that tacit knowledge is not coincidental but plays a direct role in leadership and decision making.

Brooks (1994) commented on the "...excessive faith in rationalism and progress" as one of many "environmentally toxic beliefs" that devalue tacit knowledge in the wilderness, finding that these beliefs tend to suddenly erode when "one must depend on woods-craft and implicit knowing to survive in the

wilderness" (pp. 28-31). This begged me to ask the question "Are people who survived for centuries in the South American rainforest 'literate' in the ways of survival?" Guthrie (1996) scoffed at the concepts of literacy that are hallowed by business and the academy, and I pondered Brooks' notion of outdoor leadership when I paraphrased the question: "When you are lost in the forest, is the person who can survive by woodcraft the most critically literate leader of the group?"

Gardner discussed many issues that gave implicitly learned tacit knowledge utility in the young learner. In Artful Scribbles (1980), he noted that the child's maturational artistic level transitions "...from scribbling to genuine representational depiction" (p. 47) through experience, guidance, and repetition.. In Frames of Mind (1983), Gardner led us to reevaluate the somatosensory conduits in a discussion of human cognition, defining cognition as "...(consisting) of a number of "special purpose" information processing devices" (p. 55), and the theory that these devices lead to the previously unrecognized cognitive unconscious.

Gardner's work on multiple intelligences (1991, 1993) suggested that components of innate skill reformulate leadership in context. The cognitive unconscious is a composite of skills. For example, in Gardner's The Unschooled Mind (1991) it is written that application of these skills is important to many because "there is a significant...(portion of)...the population that lacks facility with formal examinations but can display relevant understanding when problems arise in natural contexts" (p. 13).

Is the basis of leadership contextually defined by happenstance; that is, when the expectation of the group is that a predesignated leader will help members of the group survive, does this support the groups acceptance of the implicitly learned tacit knowledge over explicitly learned models of leadership?

The phenomenon of accidental expertise is clearly described in Evans and Butler's (1992) expert model of welding where the expert welders describe the "feel of a tool as an extension of themselves and expert cues (the

appearance and viscosity of the weld pool, the sound and the feel of the arc) tacitly provide guidance during the performance of their work" (p. 59). The authors note that, interestingly, none of the listed "everyday expert cues" (cited in Tennant & Pogson, 1995, p.59) were found in the welding texts' syllabi.

These observations served to reinforce the findings of another research team (Sternberg & Caruso, 1985), whose research found that very little tacit knowledge is transferred during formal instruction by qualified teachers, but primarily by informal instruction, "…by the self after experience on the job" (p. 60).

Norman (1988) named this precise behavior from imprecise knowledge "knowledge-how", that is "…the *procedural* versus the *declarative*" (author's original emphasis) and observed that it may be difficult or impossible to teach, citing that "even the best teacher cannot usually describe what it is they are doing, and that most skill in teaching is learned vicariously during observation, demonstration, and practice" (p. 60).

Simosko (1991) noted that "…much of what we learn seems to be unconscious and many of the skills we possess are acquired seemingly accidentally" (cited in Tennant & Pogson, 1995, p.61). Much of the information on tacit knowledge in the literature dealt primarily with the most current definition of tacit knowledge in different trades and jobs of work.

The questions concerning the presence of tacit knowledge and evaluating its prudent use are discussed and presented in the work of Schraw and Bruning (1996). The authors examined the relationship between readers implicit models, the reading process (i.e. tacit, systematic assumptions about the role of the reader) and reader engagement. They defined two models or dimensions of readers involvement with the text: The transmission model, where belief is transmitted from the author to the reader, and the transactional model, where the meaning is constructed by a transaction between the reader, author, and text.

Their work provided clarification of a statement by Broudy (1970), who described a phenomenon in the learner's aesthetic response to poetry:

> A great deal of poetry written in English depends for its imagery on its Latin roots. These Latin images function tacitly in the aesthetic response to poetry, and if the poet has these in mind, the reader who has a good dictionary meaning of the term, but not the appropriate image is simply not responding as the poet anticipated he would. That is, meaning is displaced from the concrete English meaning of the word to its Latin imagery (Broudy, 1970, cited in Tennant & Pogson, 1995, p. 58).

Schraw and Bruning (1996) analyzed different models of reading instruction in young adult learners. Their analysis results found that the readers overwhelmingly endorsed a transactional model. Readers had higher recall of the expository text, as well as more critical evaluations of the text, a greater likelihood that they would relate the text information to prior knowledge, and more affective responses such as anger and empathy.

I compared Schraw, Bruning, and Brody's work and found that their findings correlated in at least two ways: One, engagement of the reader (connecting) with an author or story or text, particularly understanding the context, words, or meaning depends on explicit (learned from teachers) learning. Two, the understanding of the text and the ability of the story to elicit emotion has a very significant implicit learning component, most often cited as the primary source of tacit knowledge. I contend that with the continued emphasis on didactic education that there is a strong inequality between theory and practice.

Tacit Knowledge, Teaching, and Learning

Cervero (1989) discussed three related viewpoints on Continuing Professional Education (CPE): Functionalist, Conflict, and Critical. Cervero cited Schön's (1983) work on critical awareness of choices and implications. In this model, expertise is defined as "…instrumental problem solving made rigorous by the application of scientific theory and technique" (Cervero, in

Merriam & Cunningham (Eds.), 1989, p. 518). The functionalist viewpoint, per Schön, "put the educator in a position to help professionals by helping them keep up-to-date on the newest information in their fields and to correct existing deficiencies in their practices." In the conflict viewpoint, Schön believed that the educator "...works in an adversarial role with the professionals to reduce the power of the oppressive system of which the professionals are a part, creating a more equal relationship between them and their clients. The critical viewpoint, Schön argued, put the educator in a peculiar position as there is no consensus on quality in professions. The continuing educator should seek to help professionals critically analyze the technical and ethical choices they make in their practice" (Cervero, in Merriam & Cunningham (Eds.), 1989, p. 518)

These views all hinged on knowledge, both explicit and tacit, which would be approached based upon the perceived needs of the group or individual relative to real or imagined situations. It appeared to me that the continuing educator had a unique power to decide the relationship, and perhaps the outcome, of the adult continuing education learning experience.

Schön (1987) suggested that "professionals find themselves in a dialectical relationship with situations characterized by uniqueness, uncertainty and value conflict." Thus, "...problem setting rather than problem solving is the key to professional practice" (in Merriam & Cunningham, (Eds.), 1989, p. 519).

Kessels and Kothagen (1996) noted that scholarly thinking was dominated by a strong inequality between theory and practice. Abstract knowledge is considered to be of higher standing and of more value than concrete skills or the tacit knowledge of good performance. The educator, particularly in professional continuing education, must wrestle with bridging the gap between theory and practice and the existing value system regarding explicit and tacit knowledge. It has been my experience that adults are rewarded for divergent thinking, whereas their experience in K-12 has often

rewarded them for convergent thinking, and this philosophical obstacle must be considered regardless of the educational offering under consideration.

The educator also must deal with what Schön (1983) called "the crisis of confidence" which "arises in professions where the reliance on scholarship, hard data, and science versus artistry and unvarnished opinion creates more problems than it solves". Schön advocated "reflection-in-action" (p. 161), the process by which he sees professionals engaging with problems and learning experientially, reflecting on their experience in the midst of practice, and "...Learning takes place during reflecting in the process of experience which often happens at an intuitive or tacit level" (Schön, cited in Tennant & Pogson, 1995, p.161).

An awareness of the dimensions of planned continuing education, in consideration of Schön's advice, may help to bridge the gap between implicit and explicit learning while increasing the utility of that knowledge in the student's chosen field.

Koivunen (1998) discussed the importance of human creativity, and stated that it is the ability to break out of conventional meanings and to associate new things in novel, unexpected ways. Koivunen quoted Jean-Paul Sartre's statement:

> The human being is always a storyteller. He always lives surrounded by his own tales and surrounded by other peoples tales. He always sees everything he encounters through these tales and tries to live his life as if he were retelling it (Sartre, cited in Koivunen, 1998, p. 1).

In the past, the concept of the 'information society' emphasized that knowledge is external to the human being. In the modern information society, "knowledge has been defined in the vein of the scientific-technological tradition as external data, facts, or information 'signs' which flow as though natural gas in a pipeline" (Koivunen, 1998, p. 4).

Koivunen eschewed the work of physicist and chemist Michael Polanyi, and stated that "...to analyze and identify these 'signs', people call upon what

they define as their own orientation and significance, their own compass, and their own choices" (Koivunen, 1998, p. 4). The author cited Polanyi's concept of tacit knowledge, defined as "all genetic, bodily, intuitive, mythical, archetypal, and experiential knowledge the human being ever has, even though it cannot be expressed by means of verbal concepts" (p.4).

Tacit knowledge is present in the human being as whole knowledge as "it includes manual skills, knowledge from all sources, and thoughts which guide the individual in their interpretation of the 'signs' and choices in the information flow. Due to this tacit knowledge, the human being can pass by enormous amounts of useless information without ever having to react to it" (Koivunen, 1998, p. 4).

Koivunen postulated that "…while a technical answer can be found for any problem, individuals must sort and glean through information to find that which is essential in terms of their own needs. This ability to choose is tied to the person's own orientation, compass, and tacit knowledge" (Koivunen, 1998, p.5). Similarly, Koivunen stated that:

> …human hypotheses, innovation, and choices are
> enerated in the comprehensive domain of tacit knowledge.
> Hypotheses are not generated systematically from any
> given material - they are leaps in the space of
> associations. Human creativity and the artistic process
> involve all levels of data acquisition, explicit and tacit
> knowledge. This is why the precondition for innovation
> seems to be 'random wandering and messing about in
> unknown areas, which leads to combinations of unexpected
> things and meanings (Koivunen, 1998, p.5).

In a subject as obtuse as tacit knowledge, Koivunen gave me a fresh perspective on the topic and used Sartre's storytelling metaphor as an analogy to the utilization of unconsciously operative tacit knowing. This also presents a new insight into Sartre's atheistic, existentialist doctrine of the "…lonely individual in an absurd world" (in Ozmon & Craver, 1999, p. 250). Living one's life through the tales that were told, or the tales of others, relegates mankind to

follow a worn and beaten path instead of blazing new trails and establishing one's own way in a new, possibly untested direction and dimension of learning.

Koivunen's discussion centered on the impact of human decision-making in the context of choices, from whence our choices arose, and the furtherance of human inquiry at differing conscious and unconscious intellectual levels.

Sveiby (1998) suggested a set of simple experiments that illustrated tacit knowledge in people. The questions that are asked of the audience (after a simple exercise) cut to the heart of implicit learning: How is it that we know things or can do certain things? The audience performed a simple exercise, and the moderator requested that the participants specify their training in this specialized skill area or asked if they recalled any previous demonstrations of this skill. The moderator then asked participants to verbally describe the process they had just performed, and asks them to recollect where they learned the skill. The sheer simplicity of the maneuver (invoking Occam's Razor, a measure of parsimony that implied that the simplest problem may improve understanding by offering a simple, clear, and concise explanation) assisted the participant in understanding that we frequently perform many movements and actions that we cannot explain.

<div align="center">Implicit Learning</div>

Reber (1993) noted that in-depth research is disparate because of the lack of concise and specific definitions available on the subject of tacit knowledge. Implicit learning is defined as the acquisition of knowledge that took place independently of the conscious attempt to learn, and noted that much learning is acquired largely in the absence of explicit (teacher-led) knowledge. A core assumption is that implicit learning is a fundamental root process, one that lies at the heart of learning in every complex organism.

Reber hypothesized that cognition and learning are intertwining issues that complement one another, and suggested that further research into the cognitive unconscious will direct us to apply different heuristics (rules of thumb, skills) and teaching tactics when considering implicit or tacit

knowledge. The availability of knowledge to the conscious and unconscious is found in "measures of mental content" (Reber, 1993, p. 8), an elusive measurement that questioned the primacy of implicit learning over explicit learning.

<div align="center">Tacit Knowledge and Theories of Action</div>

Argyris, Putnam, and McClain (1985) reviewed a theoretical concept that is closely aligned with tacit knowledge. Theories of action generally consisted of two components: Espoused theory (the world view and values that people believed their behavior is based upon), and theory-in-use (the world view and values implied by their behavior or the maps they use to take action).

In 1987, Argyris studied these two components when a consultant stated how he would react and respond to an unhappy client, stating his understanding of the disagreement and his efforts to listen and dialogue with the client. On a videotaped interaction "…he indicated unilateral control when the consultant advocated his point of view in a confrontation with the client, while dismissing the client's point of view" (p. 93).

The issue of theories-in-use was raised in a newspaper article about Virginia motorists who answered a questionnaire about how they drove while in a work zone. The respondents indicated that (espoused theories) their behaviors would include reduced driving speeds, greater caution, and increased surveillance for hazards related to work zones. It is interesting that when their driving behavior was observed and videotaped (theories-in-use) in a work zone, they followed none of the safe driving behaviors they had espoused (Drummond, 1998).

Anderson's (1994) paper evaluated espoused theories versus theories of action. Anderson asked if people are unaware of the theories that drive their action, how can one manage or effectively change those behaviors if they are not cognizant of them? Anderson reviewed action strategies, reactions, beliefs, feelings, outcomes, and their relationship with consequences, both real and imagined. Anderson's work was an effort to make unconscious

thoughts/theories (implicitly learned tacit knowledge) congruent with conscious and visible behaviors by reflective thought after action; a key issue is personal responsibility for one's actions as a component of personal enlightenment and improvement.

Laboratory Research on Implicit Learning and Tacit Knowledge

Polanyi (1966) approached the recognition of implicitly learned tacit knowledge from the perspective of an observer, noting that "The recognition of of a person in the performance of a skill or in the conduct of a game of chess is intrinsic to the understanding of these matters" (p. 30). The uniqueness of Polanyi's methodology, where the *person* (original emphasis) is "...recognized as well as the ownership of the skill" (p. 30); he goes further and stated that "...we never do observe these workings in themselves, as they are so integrated into" a personal performance (pp. 30-31).

Berry (1997) stated that the current research (on implicit learning) is yielding a "...really interesting picture; the problem is that the people doing the research seem too focused on their various disagreements to see the big picture" (Berry, 1997, p. 13). This research is not new because "Research on implicit learning has a long history, going back to Hull's work on concept formation with Chinese ideographs in the 1920's and early studies on learning without awareness" (Berry, 1997, p. 13).

"The issue of implicit acquisition of complex knowledge is rooted in the artificial grammar studies conducted by Reber and associates in the 1960s and 1970s" (cited in Berry, 1997, p. 13). The use of artificial grammar experiments "...led the test subjects to believe that the grammar they were memorizing were randomly generated strings of letters. Later, they are told that the strings were generated by a complex set of rules. Study participants were able to classify strings at above chance as well as explicitly instructed subjects" (Berry, 1997, p. 14).

The possibility of developing tools that would allow us to view implicitly learned tacit knowledge as a personal repertoire versus an isolated skill is

intriguing. Proper use of these techniques could be responsible for improved personal effectiveness and positive behavioral change, if the learner is so inclined to act on those cited behaviors. Personal responsibility, learning, goals, and value systems are retained as measurable outcomes of change in organizations.

The tacit dimension of learning can be researched through introspective analysis, but is best researched through others through the introspective lens of 'separate realities' that most commonly occurred in the phenomenological interview. This philosophy is exemplified in the classroom and curricular modifications offered to a struggling student in Dowling's (1985) story of Mary Ann, "the girl who couldn't possibly pass" (p. 73). Mary Ann is a Greek emigrė, a sophmore in high school who, after multiple attempts, achieves scores on her verbal and performance levels that are well below the 5th percentile nationally.

The teachers expect academic failure, but Mary Ann asks for help and persists in her mainstream education. Mary Ann is fortunate, and with above and beyond the call of duty tutoring from dedicated educators, she passes the New York State Regents' Competency Exams and after years of study becomes an employable and respected professional. In reflection, Dowling selected a quote from Thoreau that paraphrased Mary Ann's learning experience:

> If one advances confidently in the direction of (her)
> dreams, and endeavors to live the life which (she) has
> imagined, (she) will meet with a success unexpected in
> common hours (Thoreau, cited in Dowling, 1985, p. 74)

<div align="center">Related Research on Tacit Knowledge</div>

The utility of somatosensory information is highlighted in many research projects. McLaughlin (2001) interviewed Bob Cuneo, chief designer of bobsleds for the American Winter Olympic team. The modern bobsled differs from ancient models only in design and materials; other than advanced aerodynamic design and lightweight materials, they are otherwise bereft of any sort of technology. Cuneo and the other design engineers helped the sled team to feel the interaction between themselves, the sled and the course.

Cuneo states that the speed of the sled and the handling are the direct result of feedback from the ice, traveling through the sled to the driver. Cuneo stated:

> We have done a lot of work on improving how the sled
> transmits information to the driver...One of the things
> we do best is working on that feedback, it is very important.
> When you are on the edge of control, it is a very fine line
> (Cuneo, cited in McLaughlin, 2001, pp. 92-94).

At the heart of implicitly learned tacit knowledge is the absorption of information (or the construction of words or sentences) that hinted at the acquisition of knowledge through non-traditional means. Dorsey (2000) analyzed the non-verbal messaging of African-American females, and de Warren (2001) examined Husserl's revision of intuition in regard to phenomenological thought.

Bowden and Marton (1998) used the example of the unspoken sharing of research interest between mentor and doctoral student as a "silent partnership" (p. 1), a vital sign to the inner life of university departments.

Crisler reviewed Stanley Aronowitz' (2001) The Knowledge Factory and noted that the author criticized the "...lack of identity of the modern higher education system" by poetically stating that higher education failed "...to nurture the life of the mind" (p. 2).

The Paradox of Expertise and Knowing: Science and Medicine

Knorr-Cetina (1981) noted that while we learn from implicit sources, a lack of information resulted when experts become dependent on implicitly learned tacit knowledge. The provision of a relevant summary required the use of tacit knowledge, and "experts presume matters can be handled by the readers themselves"(p. 127) and may by accident leave out the most important information; the author suggested that this is not negligent or malicious, but due to an "ontological" (p. 142) expert worldview that what is real for them is uniformly observed by all. Knorr-Cetina related an interaction between a master and student in the laboratory, where they are working on potato starch concentrates; in this scenario, the master scientist is being questioned by the

student about experiment notes that do not include any mention of a troublesome foam created by mixing several reagents:

> (The novice asked) Why didn't you mention the foam
> which caused you so much trouble? (The master
> replied) Well, this is trivial because everyone working
> in the area knows about the problem. Only outsiders
> are baffled by it (Knorr-Cetina, 1981, p.128).

The author asked us to reflect on the work of Habermas, "where the context of significance of everyday practice has absolute priority" (Habermas, cited in Knorr-Cetina, 1981, p. 141). Greenhalgh (1999) was curious as to how one asks another about their ownership of tacit knowledge. He noted that communication of tacit knowledge is seldom divulged when asked for, rather "the heart of the learning process is a common language, and suggests removal of the pretentious triangle (where data is at the base and knowledge is at the top)...and he recommended the use evocative "metaphors, pictures and storytelling to avoid knowledge and information words" (p. 1)

Experts may derive meaning from "a theoretical attitide...a technical interestedness which Habermas loathed in practice. Habermas recommended that we make decisions from "the technicity of practical action; and give things meaning in our everyday concerns by interacting with them and by using them" (Habermas, cited in Knorr-Cetina, 1981, p. 141). Van Herck (2000) offered practicality to one who wished to see the correlation between tacit knowledge, sensation, feelings, and the development of expertise in the human psyche:

> Someone tries to find his way in complete darkness for
> the first time with a stick, feels the impact of the stick
> in his palm and fingers and hasn't got the least idea
> what the stick is touching. Only after a lot of practice
> is this sensation in the palm of the hand transformed
> into a feeling for what the point of the exploring stick
> is touching...we decode, as it were tacitly the sensations
> in our hand into three-dimensional objects (Van Herck,
> 2000, pp. 1-3).

This clearly is in agreement with the work of Buchanan and Wilkins (1993), who found that "…master scientists (gather) knowledge from associative relationships and repetitive practices, often performing duties without conscious awareness. (These) duties tend to be performed proficiently, appropriately and effortlessly without thinking…this behavioral finding alone signifies the presence of tacit knowledge" (pp. 284-286).

Musen (1989) wrote about situations when the paradigm is visible and in operation. Musen cited the work of Johnson, author of The Paradox of Expertise (1983), who observed a physician at work and then questioned them as to why medical practice seemed to contradict what medical students were taught in the classroom. The master physician replied:

> Oh, I know that, but you see, I don't know how I actually
> do diagnosis, and yet I need to teach things to students.
> I create what I think is a plausible means of doing tasks
> and hope students will be able to convert them into
> effective ones (Johnson, 1983, cited in Musen, 1989, p. 348).

Musen said that there is a behavioral similarity that existed in most people, as they rarely know the limits of their tacit knowledge. When subjects are asked to self-report on their "…compiled expertise, they frequently give plausible but incorrect answers…their knowledge is implicitly compiled and therefore inaccessible to consciousness" (p. 350).   Epstein (1999) asked physicians to practice mindfulness (similar to the recommended practice of introspeculation), where the mindful practitioner attends to their own physical and mental processes with clarity and insight, consciously using professional knowledge and self-awareness in the routine daily practice.

Jha (1998) described the physician-patient relationship through a Neo-Polanyian lens. This proposal "has implications for clinical medical practice as skillful knowing of disease in patients-as-persons experiencing disease" (p. 1). Jha suggested listening to an inner voice, where the doctor finds a deeper type of knowing of a patient:

> The physician, another being, can know the patient
> as a person by a kind of understanding Polanyi called

"indwelling"…this allows the physician to know the
patient from the inside (Jha, 1998, p. 2).

This cry for human contact and the individuals desire for deeper
understanding of the human situation is not limited to the practice of
medicine. Benbunan-Fich and Hiltz's (1999) fascinating study of asyncronous
learning networks found that participants applauded the anytime-anywhere
"…delivery of case studies (produced longer, better quality solutions to the
case studies than traditional classroom learning situations), but students
stated that they were less than satisfied with the interaction process" (pp. 1-
18).

To gain insight into what patients really feel, physicians have explored
somatosensory perception related to descriptors of the uncomfortable
awareness of shortness of breath or difficulty breathing. Harver, Mahler,
Schwartzstein, and Baird (2000) tested 100 healthy individuals to judge the
dissimilarity of descriptors used by healthy persons versus patients with
cardiopulmonary disease. The findings suggested that distinct qualities of
breathlessness related to different physiologic mechanisms underlying
respiratory discomfort (Harver et al., p. 679).

Durrance (1998) explained why tacit knowledge may be at the core of a
persons feelings in her report on tacit knowledge expert Hirotaka Takeuchi. A
Harvard Business School professor, Takeuchi explains that Western culture
loved "explicit knowledge – the quantifiable, definable information that makes
up the reports, memos, manuals and instructional materials you probably have
on your desk right now. Tacit knowledge is information become action,
performance, it underlies what we actually do" (p. 24). Takeuchi noted that:

> (Tacit knowledge) is what we know in our bodies, in
> our muscles, in our guts. Picture yourself driving a
> car, riding a bicycle, typing on a keyboard. You know
> how to do those things so well that you don't actually
> have to know how to do them, you just do them
> (Takeuchi, cited in Durrance, pp. 24-25).

<u>Problems Arising from Implicitly Learned Tacit Knowledge</u>

Shipman and Reeves (1996) reported on a workshop where the participants explored the down-side or shortcomings of tacit knowledge. One example was the return-receipt dilemma; an employee finds that they can print the electronic mail without the sender receiving a receipt; this prompts them to print all mail without reading it to protect the defense "I haven't had time to read my mail yet" (pp. 1-4). This example showed how and why it is possible for implicit learning to de-rail collaboration efforts.

In the same workshop, participant Jones (1996), when asked about the impact of implicit learning and tacit knowledge, noted "…three potential issues that software designers must grapple with when developing collaborative software products; 1. To what extent does tacit knowledge and embedded skill affect the process for which we are designing (software), 2. What are the tacit responses to managing large amounts of information, and 3. How do people intuitively deal with information overload from a large amount of data?" (Jones, cited in Shipman & Reeves, 1996, p. 2).

<u>Androgogical Alternatives</u>

Adults perceive the need to make a change in their lives and then seek education. Merleau-Ponty's <u>Primacy of Perception</u> (1964) explained a theory of perception that is applicable to the adult who perceived the need for learning and knowledge:

> [Our experience of perception comes from our being present] at the moment when things, truths, and values are constituted for us; that perception is a nascent Logos; that it teaches us, outside of all dogmatism, the true conditions of objectivity itself; that is, summons us to the tasks of knowledge and action. It is not a question of reducing human knowledge to sensation, but of assisting at the birth of this knowledge, to make it as sensible as the sensible, to recover the consciousness of rationality. This experience of rationality is lost when we take it for granted as self-evident, but is,

on the contrary, rediscovered when it is made to appear
against the background of non-human nature
(Merleau-Ponty, 1964, pp. 146-159).

The person who made a decision to reenter an educational institution is usually unaware of the educational bounty of their life experience, and with great haste, they seek the academy to obtain explicit knowledge, that which is primarily learned in classrooms, in lecture halls, and in textbooks.

The adult learner must generally overcome many obstacles. This dissertation directly connected to adult learners and attempted to raise the consciousness of the reader regarding the difficulty of student life for adult learners who re-enter a program of study; in particular, I address the problems faced by learners who were users of complex medical equipment and assistive-augmentative technology. I reviewed the literature and, after speaking with learners and educators, I found a clear pattern that indicated that women suffer unintended discrimination in both rehabilitative and traditional (in particular healthcare) education programs. To the reader who believes that my inclusion of feminist epistemology in this study is an extremist or reactionary point-of-view, consider the reentering woman's experience in traditional secondary or higher education.

Until recently, little attention was given in the literature to physical, psychological, and familial barriers related to women's success or failure in education. These barriers can appear monumental to reentering women and typically are related to aspects of feminine sex role socialization (Rice & Meyer, 1989). Because women are socialized to bear primary responsibility for family responsibilities and child rearing, a return to school often created significant role strain and feelings of guilt, inadequacy, and self-blame over difficulties in handling multiple roles (Patterson & Blank, 1985). Fine (1985) suggested that societal inequities as well as institutional barriers contributed to the so-called purging of students from schools, whether by coercion, ignorance, or by institutional malingering.

Reentering women with lower incomes reported more difficulties in meeting child care and family responsibilities (Smallwood, 1980) and more symptoms of stress, including depression, anxiety, and compulsivity (Sands & Richardson, 1984). If women who are reentering college or training programs, like the training programs offered to users of assistive-augmentative technology, were prepared for the inevitable problems they will face in continuing their education, would they be more informed and better prepared to use the resources at their disposal before they drop out of classes? Would options in distance learning, such as off-campus cohorts and web-enhanced asynchronous learning programs solve the problems caused by daytime, residential programs? These questions will be answered by further research into adult education and the outcomes of distance learning networks.

The significance of the individual learner has been discussed in many contexts of learning and knowing in this paper, particularly the view that conceives of "…man in nature as a kingdom within a kingdom" (Spinoza, 1910, p. 83). The individual learner, while seemingly inconsequential to the operation of the universe, becomes important to society when they join the "…crawling, bewildered swarm of supposedly intelligent animals, who for a moment have discovered knowledge" (Nietzsche, 1873, cited in Heidigger, 1959, p.4). In the discipline of adult education, or androgogy (Knowles, 1980, cited in Merriam & Caffarella, 1991, p. 25) there is a new emphasis on self-directed education, where the adult learner is expected to participate in goal setting and curriculum development as well as "raising the bar" to the level of achievement desired by individual students (pp. 26-27). Vella (1994, 1995) challenged educators to engage in dialogue with students and to have students engage in introspection, so as to better communicate with the educator that they truly know that they know (Vella, Berardinelli, & Burrow, 1998).

The expected outcome of self-directed learning and my theoretical view of introspeculative thought work together in harmony. The learner challenges their knowledge through both introspection and speculation on the sources

from which they draw their knowledge, its veracity and utility, and the possibilities of implicitly learned tacit knowledge as a major source of their knowing. The path to learning is then chosen by the well-informed learner.

Thus society and the universe may prosper from the achievement of the individual. The students, both men and women, leave the academy or the rehabilitation training facility, their educational "inner world", to return to the "…outer world they knew before…But (she) returns as a protagonist, she returns with a *self* which she did not possess before, with a plan of campaign – not to let herself be dominated by things, but to govern them herself, to impose her will and her design upon them, to realize her ideas in that outer world, to mould the planet after the preferences of her inmost being" (original emphasis) (Ortega Y Gasset, 1957, pp. 20-21). It would take a very special teacher to walk on the path with this type of adult learner. Fortunately, Carl Rogers (1902 - 1987) described the perfect personality for the adult educator: the teacher (or therapist) is empathic, supportive, and non-directive, and gives the learner unconditional positive regard. In this approach the learner is a person in process - a changing constellation of potentialities" (Friedman & Schustack, 1999, p. 297). The student is treated as a national treasure, with the potential of making great contributions to the community and to humanity.

The adult learner, before making the contribution to humanity, must first make choices about learning. It is clear that alternative pedagogies must also be flexible to meet the needs of a diverse audience. Students today are older, more diverse in ethnic background, are working more hours and classes are represented by adult part-time students (Cohen & Brawer, 1996).   The adult learner, unlike the Pre-K through grade 12 learner (Kohn, 1996), made conscious choices regarding participation in the learning process in formal education; cognizance of this decision-making also molds the policy of institutions of higher education. For example, Ingram (1999) noted that the mission of the public community college is "to meet the educational needs of individual students" (in Tollefson, Garrett, Ingram, & Associates, 1999, p. 15).

Knox (1986) recommended that educators recognized that the physical features of a learning environment are critical, and that adult educators should seek "...facilities that participants are likely to find hospitable and encouraging of sharing" (Knox, 1986, cited in Merriam & Caffarella, 1991, p. 29). Gardner believed that adult educators must engage in the complicated endeavor of "(recognizing peoples)...different ways of representing and acquiring knowledge" (Gardner, 1991, p. 13).

Summary of the Chapter

The review of the literature on implicitly learned tacit knowledge revealed that acquisition is through observation, internship or experience, and may be acquired without explicit training. The owner of tacit knowledge may not be aware of this knowledge; rather, it is noted by those who observe their work. The nebulous term 'leader' is often defined using observation-based terms or attributes that are implicitly learned in spite of the fact that assessment of implicitly learned tacit knowledge is highly experimental.

I believe that the medically complex community systematically evaluated their needs by evoking lessons learned through implicit and explicit learning. The emergence of tacit knowledge through phenomenological interview and a novel evaluative instrumentation would assist therapists, end-users, caregivers, and client families to identify training needs or the need for improved technology.

CHAPTER 4

METHODOLOGY

<u>Research Design</u>

<u>Phenomenologic Interview</u>

This study used a modified form of the interview technique that was described by Seidman (1998), where the interview is time and context bound in order to compose and organize the phenomenological inquiry. The interview consisted of dialogue between the client and myself; I asked the research questions and I listened as the client responded to the questions.

The role of the interviewer was to listen to the study participant answer the generalized questions that asked how the participant learned to use technology in the context of their physical needs. The interviewer used probes, which were more specific questions related to the main research question; probes were asked to gain specific insight and answers about what the study participant learned, how it was learned, and the utility of what was learned in the study participant's daily use of technology. Hand written field notes were used as appropriate to complement the recorded voice of the study participant who was interviewed.

This study liberated the study participant's view of themselves as learners and users of complex medical technology through the use of dialogue. Transcription of the audio tape recorded proceedings captured the data on hard copy, with preservation and maintenance of the original notes and tape recordings for audit and review purposes.

Glesne (1999) noted that phenomenologic studies focus on "descriptions of how people experience, and how they perceive their experience of the phenomena under study" (p. 7). A phenomenological interview may be unstructured; however, I felt that (by adding the specificity of time and the context of skills involved with complex medical equipment) this method best elicited all aspects of the experience and added clarity to the post-interview

expert analysis. A phenomenological approach was recommended when studying a wide range of phenomenon, and (the) " range assists in the detection of many aspects of the experience that may prove to be important variables in subsequent quantitative studies" (Gall, Borg, & Gall, 1996, p. 603).

I felt that the preconceptions of the interpretivist modes of inquiry, as described by Glesne (1999), would be avoided by using a structured phenomenological interview. In this approach, I accepted the assumption that reality is socially constructed and variables are complex, interwoven and difficult to measure. In the questioning strategy, my intent is "…to place individuals in a state of consciousness that reflects an effort to be free of everyday bias and beliefs" (Gall et al., p. 600). I asked questions that contextualized that which was being studied, particularly unique methods of learning and specific issues and rules of thumbs, or heuristics, which participants had learned in the course of formal and informal instruction, knowledge which was observable during the use of assistive-augmentative technology.

The use of a phenomenological interview as a research method used the "researcher as an instrument of the study, was inductive, and searched for patterns, pluralism and complexity of the subject, to describe the meaning of a concept or phenomenon that several individuals shared" (Marshall & Rossman, 1999, p.112).

The narrative of the study was a provocative conversation between the reader and myself. I relied on thick, rich description in the writing of the study to "serve to immerse the reader in the research, and to express (my) empathic understanding and personal involvement in the design and execution of the study" (Marshall & Rossman, 1999, p. 112).

The Epoché

I endeavored (prior to starting the process of gathering and reviewing literature and ideas supportive of the concept of implicitly learned tacit knowledge) to describe my experiences leading to my personal belief that there

is indeed another way of knowing. This component of the phenomenological study consisted of a thorough self-examination of my beliefs on learning and knowing from life experiences and as a learner and instructor in vocational training and medical technology from the late 1970's until the present time.

Much of the epoché was written after discussions with Dr. Russell Mays, my residency and internship supervisor, who encouraged reflection and speculation regarding my beliefs on the validity of tacit knowledge. The writings of Michael Polanyi, and the support of the Michael Polanyi Society and their journal Tradition and Discovery, gave me a critical second opinion through their peer-reviewed database that I have found to be priceless in the my own perspective transformation and my conceptualization of implicitly-learned tacit knowledge.

The many questions I ask arise from my own confusion as an adult learner, and as a healthcare adult educator-in-training. My research effort challenged the existing paradigms regarding the process of teaching and knowing. I particularly wished to change the way in which we interacted as therapists and caregivers with this very special population, the users of assistive-augmentative technology in Upper East Tennessee and Southwest Virginia.

The purpose of the self-examination in the epoché was to gain clarity on my own preconceptions on the subject, to bracket my own personal experiences gained in the field from those of my current investigation. This self-examination and search for clarity was an initial, basic step, but Patton (1990) recommended that it "...should be ongoing and not a single step...contiguous with the theme and research question throughout the term of the investigation" (Patton, 1990, cited in Marshall & Rossman, 1999, p. 113).

This study was approved by the joint institutional review board (IRB) of the Veterans Administration/East Tennessee State University, and the dissertation committee members were notified of said approval prior to my

beginning the process of selection of the study participant users of assistive-augmentative technology.

At the conclusion of this exercise I better understood how the clients coped with their disease or injury in the context of learning assistive-augmentative technology, and how participants of the study learned from others (and taught themselves how the technology worked) in the context of their disease or injury.

Population

The primary interviewee was an adult (a person older than 18 years of age) who had suffered a neuromusculoskeletal injury or neurologic debilitating disease and who had undergone basic training in one or more types of complex medical equipment, equipment that was termed assistive-augmentative technology in that it assisted the study participant in their effort to regain mobility and augmented their natural ability, talents, and skills.

The term assistive-augmentative technology described mobility devices, devices to assist speaking such as Passy-Muir® valves or the electric larynx, devices that aid in the use of computer hardware, mechanical ventilators, environmental control systems (ECS), and other technology defined as 'assistive-augmentative technology' by the executive director and the peer advisors or associates of the Appalachian Independence Center (AIC) in Abingdon, Virginia and the Commonwealth of Virginia.

Sample

I used a purposive, non-random, convenience sampling method to select a group of volunteer participants for this study. The AIC assisted me in contacting volunteers who wished to become study participants. Volunteers had been previously diagnosed by a licensed, qualified physician; all volunteers had suffered a catastrophic neuromusculoskeletal or related neurological injury at least six months prior to the interview. A brief report of the study participant's history related their malady and a brief investigation into the technology that they were trained to operate was included in the study criteria.

Ten volunteers, six men and four women, were asked to participate in a face-to-face phenomenological interview process with audio recording and transcription of the proceedings. Gender equity was to be established by the inclusion of both men and women, although the number of men in the community-of-need far exceeds the number of women available to study (personal communication, Appalachian Independence Center, 2000).

I was fortunate to establish a friendship and liason with the staff and members of the Multiple Sclerosis Society of Abingdon, Virginia. The partnership with the AIC and MS Society allowed me to meet and talk with participants who were all successful users of assistive-augmentative medical technology. One participant withdrew from the study; nine participants (five men and four women) qualified for the study.

<div align="center">Instrumentation</div>

Research Questions

I asked the study participants (technology users) about their injury, their prognosis, previous medical training, experiences with medical equipment, and experiences in health care institutions that led to their present state of health.

I used dialogue, active listening, and specific questions (probes) to engage the clients in the discussion of the research questions. The probe questions are designed to assist the client to recollect the information that will enrich the dialogue, with specific emphasis on in-depth responses that concern their learning experiences with assistive-augmentative technology.

I believed that, with regard to the overall study design, it was essential to establish a baseline of knowledge from which the emergence of implicitly learned tacit knowledge could be probed and articulated through dialogue with the clients. Therefore, participants were asked to answer the following four uniform questions:

Question 1 examined the rehabilitative basic training of the client. The questions and probes sought to query the patient about their earliest recollection of experiences of their own hospitalization, long-term care, rehabilitation setting or their home or outpatient therapy regimen:

Question 1: Describe the training you received at the rehabilitation center that helped you to learn your...(specific equipment).

I expected the participants to enumerate very specific well-organized, explicitly learned concrete knowledge. The training described would be found in manuals, rehabilitation textbooks, or policy and procedure manuals. The recollection of training verbalized by the client was expected to be primarily explicitly learned knowledge. This information arose from rote memorization, details from texts and lesson plans, and standardized care plan and clinical practice guidelines of the caring professions. I anticipated that there would be little or no evidence of implicit learning, intuition, heuristics, or deviation from the plan of care in responses to question 1.

Probes: What did the technicians at x tell you about the machine(s)?
             Was the training worthwhile at the rehabilitation center x?
             Have you returned to x for further training?
             What would you have changed (or done differently) in your training at x if you were in charge?

In writing Question 2, I designed it to explore the client's view of examples of home-based (wherever they lived: their home, in a facility, or a domociliary) experiential learning, a knowledge that generally was acquired after discharge and return to the home or domociliary environment:

Question 2: List skills that you have learned on your own 'the hard way', that is, by experience. This would include problem solving, crisis intervention and trouble-shooting, or any unique ways that you have found to operate your (here name the specific devices, machines, etc.)

I expected the emergence of experiential 'rules of thumb' and deviations from the explicit domain will be elicited in the clients stories of technological crisis and malfunctions. Responses were increasingly abstract, using both

explicitly learned (from training) and implicitly learned (from experience) algorithms. I believe that implicitly learned tacit knowledge was vicariously reinforced; that a client's confidence is forged through multiple successful executions of a procedure or group of procedures. The probes assisted me in getting more deeply involved in a discussion with the client concerning their learning and knowing:

> Probes: Have you reinvented anything concerning your technology, procedures, or machines?
> Were you taught the wrong way to do something and discovered (on your own) a better way to do it?
> How would you know if there was an equipment problem?
> What would make you lose trust in a device?

In order to extricate specific illustrations, Question 3 searched the clients' cognitive toolbox for examples of problem-solving acumen:

> Question 3: Discuss an incident (or tell a story) that illustrates a problem you have had that you solved or fixed in a unique way.

The researcher presupposed a deviation from concrete knowledge or explicitly learned lessons and skills. The dependency on assistive-augmentative technology required a second-level of preparation and readiness, and deviation from the plan of care was expected. Radical departures from the practitioner's clinical practice guidelines (or those of the caring professions or the community-of-need) will arise.

> Probes: What is the worst problem you have encountered in a facility or at home (regarding your equipment)?
> Do you have the ability to see, hear, smell or feel a potential equipment problem? Please describe that feeling for me.
> Is there a problem you have been unable to fix?

The researcher (in a non-directive fashion) used Question 4 to explicate the study participant's learning experience. This would be a contribution to humanity that addressed other persons' future needs and added to the existing body of knowledge on how people learn assistive-augmentative technology:

Question 4: Describe something that you have learned (and how you might have learned it) that might assist a person in your situation?

I expected that participants would embark on an evocative case study, a discussion in which common sense and logic prevailed over the oppressive technicalities of the lapsed warranty and the infrequent but devastating technical malfunction.

The separate realities of institutionalization, along with a rich blend of good and bad experiences, opened the flood gates of recollection; an equal amount of explicitly learned skills and implicitly learned tacit knowledge emerged from the conversation. I expected that clients would warmly embrace abstract (inclusive of implicitly learned tacit knowledge) experiential learning as superior to the book learning of the explicit domain, particularly in regard to problem solving when they responded to the following probes:

Probes: Since my accident/injury, the most important lesson I have learned is (statement or response). The most (or least) important skill I have gained on my own is (statement or response). What do you know now that you wish you had known at the time of your accident/injury/start the use of assistive-augmentative devices?

The interviews were conducted after Institutional Review Board (IRB) approval. The interview process averaged one to three hours; no judgment of good or bad, appropriate or inappropriate was rendered, nor was it expressed or implied by statements made in these interviews. The discussion of problems participants had with facilities, caregivers, or physicians was avoided if at all possible to maintain long-term client and caregiver harmony; however, compelling information that was important to the study were blinded to allay identification of a facility, the client or the caregiver.

Clients who wished to review the outputs of the interview were afforded the opportunity to view the transcripts. An auditor, Delmar Mack, an Associate Professor at East Tennessee State University, and the peer debriefer, Robert Stewart, a doctoral student at East Tennessee State University,

reviewed the transcribed proceedings of the interviews, assuring that the dialogue was in accord with the information used in the text of the dissertation and the vignettes that were viewed by the expert survey panelists.

I used a trained, professional transcription service (Ablescribe, in Elizabethton, Tennessee) to transcribe the audio tapes; the transcriptionist assisted in the proof-reading of the final narrative of the interviews along with myself and the peer-reviewer, Robert Stewart; this data was then submitted to Delmar Mack for periodic review.

<div align="center">Analysis of the Data</div>

Qualitative Analysis of the Interview Data

This investigation was focused on the participant's past and present experience with the phenomenon of interest; hence, the final narrative of the clients response to the research questions should integrate statements concerning their past and present experiences with the phenomenon under investigation.

The narrative best described the participant's initial experience with the phenomenon and I then compared it to their view of both the present and the future, i.e. their vision, hopes, dreams, success, failures, frustrations, despair, etc., regarding the role of assistive-augmentative technology, it's utility in their life, and how they overcame adversity.

The analytical goal of the researcher was to "identify the essence of the phenomenon" (Patton, 1990, cited in Marshall & Rossman, p. 113) through phenomenological reduction. I, as the researcher, compared and contrasted field notes and itemized the responses of the interviewees to the research questions. My use of phenomenological reduction then (attempted to) "...cluster the data around themes that describe the textures of the experience to provide the framework for a (textural) synthesis involving the imaginative exploration of all possible meanings and divergent perspectives...as well as convergent themes that may elucidate shared experiences" (Creswell,1998, cited in Marshall & Rossman, 1999, p. 113).

The data synthesis sought to identify, define, and understand keywords, actions, ideation, or heuristics indicative of tacit knowledge, its existence and its emergence throughout the phenomenological interview, to what extent it influenced the competency of a person using complex medical equipment, and its importance in re-establishing the study participant's wellness, the return to a communicative state, mobility, independence, and freedom.

The narrative of the findings are crisp, clear and concise; I sought to achieve versimilitude by "…drawing the reader emotionally into the research participants' world…leading (the reader) to perceive the research report as credible and authentic" (Gall, Borg, & Gall, 1996, p. 774).

Participants fulfilled the role of co-researcher (Gall et al.) through their narrative, giving rise to the emergence of multivocality ("…the diverse points of view and interests of those dealing with a common experience" p. 573), which captured both the commonality and the differences of the individual's experience during the process of learning to use assistive-augmentative technology.

The process of reduction was completed when the qualitative data analysis "…infers themes and patterns from an examination of the data" (Gall et al., p. 753), a technique known as analytic induction. Themes and patterns derived from textural descriptions (individualized for each client) noted the similarity and differences of their experience with the phenomenon being studied; the services of the peer debriefer and doctorally-trained auditor assisted me in maintaining credibility, trustworthiness, and dependability during the execution of this study.

I took the narrative and then separated knowledge into two arbitrary but distinctly different domain groups using the following definitions gathered in the reviews of the literature:

1. Explicit learning defines cognition and knowing that is consciously recoverable at will and learned in didactic lecture, textbooks, manuals or pre-planned learning sessions (The memory of explicit learning is usually recoverable and remembered). Tends to be a conscious,

deliberate learning process which yields recoverable cognitive knowledge. Textbooks, didactic lecture or training are primary sources. Evidence exists that learning occurs in the traditional explicit sense; from classroom experience, inservice, lecture, textbook or a teacher-led experience with minimal implicit or accidental or unconscious learning. (The client will usually know and state that there is evidence leading to the source of learning, and the client knows and can usually tell the source of learning).

2. Implicitly learned tacit knowledge is best recovered (in lieu of direct observation) from the analysis of the client's narrative. An unconscious abstraction process yielding abstract knowledge that is usually not recoverable. Learning may occur through the afferent neuronal somatosensory conduits or senses; the auditory, gustatory, olfactory, speech, visual, touch/feel or other physical learning method. Includes learning through a psychomotor or vicarious pathway, where the uptake of learning is through repetition of experience, similar to craft skills learned in apprenticeship. Includes learning through repetition or frequent observation; client may or may not know the source of learning. The client's ownership of skills that are learned implicitly, or knowing that is acquired through vicarious observation or by accidental means theoretically defines and represents the existence of tacit knowledge (see Berry, 1997; Polanyi, 1966; Reber, 1993; Sternberg & Horvath, 1999 for a discussion).

I used a compressed version of the categories found in the review of the literature (Table 2) and created a table of alternative knowledge that corresponded to the statements found in the interviews of the client technology users. The statements found in the interviews referred to skills learned through experience that were inclusive of the aforementioned rules of thumb and heuristics framed by divergent and convergent themes. Likewise, the categories used are defined the authors cited in the review of the literature.

The trustworthiness of statements and appropriateness of their inclusion in the categories was reviewed and critiqued by the author, the peer-reviewer, and the auditor; we reached agreement concerning the categorization as discussed.

Table 2.

<u>Learning Resources For Expert Raters.</u>

The Sources Of Learning And Knowledge	Descriptors
Implicit Learning:	An unconscious abstraction process yielding abstract knowledge; usually not recoverable. (The client knows but cannot identify sources of learning).
Somatosensory Learning:	The uptake of learning via afferent neuronal or somatosensory conduits or senses, (auditory, gustatory, olfactory, speech, visual, touch / feel or other physical learning method. Includes learning through physicality or a vicarious pathway, where the uptake of learning is through repetition of experience, similar to craft skills learned in apprenticeship. (Learning through repetition or frequent observation; client may or may not know the source of learning).
Explicit Learning:	A conscious, deliberate learning process which yields recoverable cognitive knowledge. Textbooks, didactic lecture or training are primary sources (The client knows and can tell the source of learning).
Traditional Didactic: Learning	Evidence exists that learning occurred in the traditional explicit sense; from classroom experience, inservice, lecture, textbook or a teacher-led experience with minimal implicit or accidental or unconscious learning. (The client will usually know and state that there is evidence that leads to the source of learning).

<u>Quantitative Analysis of the Interview Data</u>

The phenomenological approach was recommended by Gall et al. when a researcher was studying a wide range of phenomenon because "the…range assists in the detection of many aspects of the experience that may prove to be important variables in subsequent quantitative studies" (p. 603). To further clarify the existence, utility, and presence of implicitly learned tacit knowledge, and to differentiate it from explicitly learned knowledge, I carried out the following exercise.

The peer debriefer, the auditor, and I reviewed the transcribed documents and converted the narrative data into five short action-oriented stories or vignettes that described real life teaching and learning experiences, as described by the clients in their interviews. The vignettes were then reviewed by 10 persons with expertise in higher education, rehabilitation, homecare, case management, and assistive-augmentative technology.

Based upon the comments and criticisms of these experts, the questionnaire was shortened, unusual vocabulary words were avoided, and the document was made easier to read and comprehend. Recommendations and further changes in minutiae suggested by the experts were implemented in the preparation of the instrument used in the study.

The study was intended to gather ordinal data to support my contention that experts immediately recognize the lush verbiage of implicitly learned tacit knowledge. Vignettes were drawn from the clients' phenomenologic interview, and as expected, the interviews contain rich stories with discernible evidence of both implicit and explicit learning. This survey was my first effort at creating a computer-based instrument, using still digital photos and streaming videos of assistive-augmentative technology users, along with the narrative in the vignettes. My belief is that this combination was useful in helping novices and experts recognize and discriminate between lessons learned by traditional explicit learning as well as those learned by implicit learning, that which theoretically leads to tacit knowledge.

A Likert scale (a two-directional, non-continuous scale ranging from –5 to –1 and +1 to +5) was constructed to score the vignettes in regards to the experts view of the lushness (or richness) of the verbal images. The utility, presence, and lushness are further described in Table 3. In the introduction to the study, the opinions of the expert raters regarding their view of learning and knowing, client education and training techniques are recorded using their responses to 10 questions using a different continuous 5 point Likert scale (Strongly Agree, Agree, Disagree, Strongly Disagree):

Table 3.

Likert Scale Used In The Expert Survey.

DIRECTIONS: Reflect on the introductory training and our discussion on the differences between implicit and explicit learning and knowledge. Please circle **ONE** number on the scoring sheet for each of the three (Q) questions below that you think best indicates the type of learning (**L**) and knowledge (**K**) that is indicated. Your response to each question (circle **ONE** only) indicates your view of how you think they acquired their learning: high to low (-5 to -1) explicit learning or low to high (1 to 5) implicit learning. Your response should be the learning source or style you see used in the short story above.

<table>
<tr><td></td><td>←**High---------------Low**
EXPLICIT (Conscious)</td><td>**Low-------------High→**
IMPLICIT (Unconscious)</td></tr>
<tr><td>Q: The utility or usefulness
of the L and K is…</td><td align="center">**(Please CIRCLE ONLY ONE number per Question)**
-5 -4 -3 -2 -1</td><td>1 2 3 4 5</td></tr>
<tr><td>Q: The presence of L and K
related to client's abilities…</td><td align="center">-5 -4 -3 -2 -1</td><td>1 2 3 4 5</td></tr>
<tr><td>Q: The lushness or richness of
L and K noted in details…</td><td align="center">-5 -4 -3 -2 -1</td><td>1 2 3 4 5</td></tr>
</table>

In short, if you see Learning **(L)** resulting from traditional explicit learning (books, lecture, classroom discussion, videos) *circle a negative number* as to its usefulness to a client, its presence in the story, and the lushness or richness of detail. Likewise, if knowledge **(K)** is learned from the five senses and appears to you to be learned from experience, internship, observation, or hands-on training experience, *circle a positive number* as to its usefulness to a client, its presence in the story, and the lushness or rich detail seen.

This study used the input of study participants, agency members, and expert raters to identify and numerically score the utility and presence of the major categories of acquired knowledge. I examined the results to see if these data summarily yielded how and where the knowledge was acquired or if there were inexplicable variance between the expert raters and the findings noted in the review of the literature. To further clarify the presence of implicit or explicit knowledge, the Appalachian Independence Center advisors encouraged me to use digital images of assistive-augmentative technology users from web-sites, archived photos, and streaming video to clarify and better demonstrate the technology.

Scoring criteria provided quantifiable data on the theoretical sources of implicit knowing and the agreement (or disagreement) of the expert raters on the utility or usefulness of the participants knowledge, the presence of verbiage related to the skill or competency in question, the lushness of detail, and the presence of tacit knowledge in the client's narrative as indicated by the Likert scale.

The panel of rehabilitation and assistive-augmentative technology experts were asked to read a paragraph about the different types of learning; they were asked to view still photos (or streaming video clips) of participants using assistive-augmentative technology prior to reading the vignettes that were extracted from the narrative of the phenomenologic interviews.

<u>Data Collection</u>

A 10-question survey was used; the instrument also included 15 questions (5 stories had 3 questions each) designed to explore the vignettes. Experts who agreed to participate receive a detailed discussion of explicit and implicit learning, with written directions on how to properly complete the survey instrument included, to assist the expert in evaluation of the vignettes. The survey was given to a small groups of experts (24) at their workplace; my immediate, first person follow-up assisted in achieving a high rate of return on

the pilot study (16/24, 67%). The time required to view the photos and video clips and to complete the written survey averages 15-30 minutes.

The same scoring sheet was used to score the vignettes; each expert indicated observations of the client's ownership and use of implicit and explicit learning; further, experts were asked to score the perception of the utility, presence and lush detail of each domain. The experts, based upon their experience and training, evaluated and identified different types of learning (including implicitly learned tacit knowledge) as well as commented on the utility and presence of traditional explicit sources, somatosensory sources, vicarious sources, and skills that theoretically defined implicit learning and indicated the ownership of tacit knowledge.

Summary of the Chapter

The Veterans Administration/East Tennessee State University Institutional Review Board approved this research protocol. The phenomenological inquiry was conducted to gain narrative data that strengthened my theory regarding the emergence of implicitly learned tacit knowledge through dialogue. The narrative analysis was completed by extracting vignettes or short stories of the client's life. Technology was used for the presentation to the expert panel and I asked them to rate the emergence of implicitly learned tacit knowledge and the lushness and imagery of the client experiences and descriptors. The design of the study allowed for statistical processes to be conducted on the data, inclusive of emerging information and new variables that were gathered in the analysis of post-interview data

The uniformity of the scoring matrix and Likert scale allowed for the evaluation of expert rater agreement; other variables could be considered as relevant to the outcome of the study. To protect the clients' confidentiality, all reference to persons, locales, or unique characteristics that make a participant identifiable were changed, and in cases of concern over confidentiality, a composite of cases was used.

CHAPTER 5

ANALYSIS OF THE DATA

<u>Introduction</u>

I conducted the interviews using an Institutional Review Board (IRB) approved interview protocol. The interviews averaged one to three hours; no judgment of good or bad, appropriate, or inappropriate was implied or stated in these interviews. The discussion of participant problems with facilities, caregivers, or physicians was avoided to respect the integrity of the people and the institution; however, compelling information, important to the study, is blinded to allay identification and thereby protect the confidentiality of the facility, the client, and the caregiver.

In the review of the literature I noted that, by definition, tacit knowledge is implicitly learned and not consciously available to the owner. However, the literature is clear that implicitly learned tacit knowledge is noticeable to the trained observer. Therefore, the use of this knowledge and its utility to the owner can only be retrieved through direct observation or dialogue with others. The interview was conducted primarily in the homes or business office of the respondents, and at least one follow-up visit was made if clarification was necessary. One participant withdrew from the study, leaving a total of 9 subjects, 5 men and 4 women. The research questions I sought to answer were as follows:

1. Does implicitly learned tacit knowledge emerge during dialogue with clients?

2. Does implicit or unconscious knowledge have utility to the client as their life changes with adaptation to a disease or injury requiring the use of assistive-augmentative technology?

3. Does richness and thick description in the client's dialogue indicate the ownership of implicitly learned tacit knowledge?

The single remaining research question is answered by a quantitative analysis of the expert raters responses to the survey questions:

4. Is implicitly learned tacit knowledge distinguishable from explicit learning when viewed by trained experts?

Results of the Analysis of the Phenomenologic Interviews

This section of the chapter represented the analysis of data provided by the research participants, assistive-augmentative technology users who volunteered to participate in a phenomenologic interview. These data, which were obtained after receiving the respondent's informed consent, was recorded and captured on audio-tape. The audio-tapes were submitted to a local transcription professional who, using a word processor, turned the interviews into a document. The document was proof read side-by-side with the audio-tape and the field notes to assess the accuracy of the transcription. The phenomenologic interview included questions and evocative probes that were uniformly asked of all participants. The responses to the questions were then audiotaped and transcribed.

A tool was created to discern the origin of knowledge and to answer the question 'How in this particular situation was knowledge gained?' Statements regarding ownership of knowledge were made by the participants and embedded in the phenomenologic interview. The components from the Typology of Knowledge from Chapter 2 were used to track and list statements relating to that typology. The categories of Implicit and Explicit were used that describe how we learn and gain knowledge.

The interview statements, once highlighted, were submitted to the peer-reviewer to assess expert rater agreement. Discussion ensued on the statements until there was consensus on the appropriateness of categorization between the raters.

Theoretical Considerations

A uniform set of questions discussed in Chapter 4 was used as evocative statements and probes to induce the study participants to share their life-long learning experiences; these also served as a catalyst (termed catalytic skilling

codes) to separate the implicitly learned, abstract skills away from the concrete, explicitly learned skills.

To achieve a parsimonious fit between the abstract and concrete knowledge, a modified technique previously used by Seidman (1998) where three multiple, time-oriented levels of phenomenologic interview were replaced by four uniform layers of questions and evocative probes. Phenomenologic reduction was used to strain narrative through a relativist sieve, retrieving statements that emphasize action, experience, heuristics, and perceptual knowledge.

These evoked experiences are moments in time that emerge from convergent and divergent themes, representing the view of the study participant, a view of a reality that only the participant can know and define because it was a lived experience. Likewise, the interviews provided a clearer view of knowledge that is artificially cleaved into implicitly learned skills and explicitly learned skills.

The finished document provided linkage between the typology of classic knowledge embedded in the review of the literature. This resulted in a theoretical framework, a by-product of this work that was designed to be used in future educational research. The phenomenological interviews answered the previously stated research questions.

<div align="center">Research Subjects and the Interview Process</div>

The Interview Questions: Building Bridges

In a previous chapter I discussed my experience with the engineer, a fine gentleman who had been a bridge builder. This man had advised me that I, too, was a bridge builder, using words to build my bridges. In this section I related the usefulness of the interview questions and the evocative probes I used to establish dialogue (to build a word bridge that spans the quiet chasm that exists between strangers) and how the participants and the responses they provided assisted me in answering the three research questions. All of the

statements attributed to study participants are personal communications and were used by permission.

I asked the first question, "Describe the training you received at the rehabilitation center that helped you to learn your...(name of specific equipment). This question examines the rehabilitative 'basic training' of the client from their unique perspective. The intention of the question and probes were to query the study participant about the earliest recollection they had of any learning experiences that occurred during hospitalization, long-term care, in the rehabilitation setting, or learning that happened within the home or outside the home in an outpatient therapy regimen.

The 9 participants spent extended periods of time (range: 2 weeks to 12 years) in out-patient or long-term, acute care rehabilitative training facilities after acute care admissions from an original illness (or they were admitted for status-post complications) diagnosis, or the original injury they had received. This fact, along with their mastery of assistive-augmentative technology, made them well-suited to comment on training programs and the outcomes of the programs.

Participants enumerated very specific well-organized, explicitly learned concrete knowledge; this I attributed to explicit learning and they agreed that they had learned the specifics in training programs. My strategy of asking the open-ended question is reflective of my desire to listen to what they had to say, and I found the explanations most intriguing. The end-product of the early training that the participants had undergone was found, almost verbatim, in manuals, rehabilitation textbooks, or policy and procedure manuals. The recollection of training, as verbalized by the clients, was primarily explicitly learned knowledge.

This concrete information arose from memorization, lecture or media, details from texts or lesson plans, and information was standardized from a standardized care plan or clinical practice guidelines of the caring professions. As expected, responses to question 1 revealed little or no evidence of implicit

learning, intuition, heuristics, or deviation from the plan of care during the early learning of the technology. In the acute phase of illness or injury, the participants had minimal time for anything except sleep, considering the rigorous physical therapy, pool therapy, speech pathology, physician and therapist evaluations, and diverse training protocols dedicated to swallowing, breathing re-training, nutrition, and medication.

This explains why explicit learning so overshadowed implicitly learned tacit knowledge at early phases of expertise in participants. This agreed with the review of the literature because implicitly learned tacit knowledge arose over time and was acquired during experience based trial-and-error learning, which is less pronounced in acute care.

Patient training is a great concern to facility administrators, risk managers, and therapists, so much so that standardized training packages are considered more acceptable when we plan to establish a baseline of training. Some of the institutions used very progressive methods of training study participants to use technology.

I was struck by the classic training that was provided by several of the rehabilitation centers. The following comments were made by a participant who was very skilled in the use of his complex medical technology. The participant used a laser guided computer cursor, controlled by a sip-and-puff mouse; the participant controls the cursors' strike on his keyboard by moving his head, and then sucking or blowing on a straw in his mouth. The participant related this Socratic learning moment:

> First I learned a little about the sip-and-puff (controls)
> and learned how it worked…then (the staff would think
> of) answers and we would think of questions. Yeah,
> that was one way of learning the computer that I
> thought was pretty cool…just sitting there doing that…
> they set there and made you think of different shapes
> and things like puzzles. You'd actually have to
> link up puzzles or even make up your own pieces (using
> the laser). Some of the (puzzles) were like old puzzles
> where you take each piece and put it together or

> move the (pieces) around like the old puzzles, where
> you slide the pieces until you get it straightened out.

In the face-to-face interview, I asked the participant questions (and probes) to jar their memory about their medical technology training; specifically, I asked questions about what the technicians at the rehabilitation center or hospital had told them about the machines they were now using, and if they, the participant (in their opinion) thought the training at the rehabilitation center or hospital was worthwhile. The recollection of most of the study participants are very positive when one considers what they had endured; one possibility that emerges in the narrative of the interviews was that most or all of them were emotionally distressed and very ill when admitted, and they voiced that the training programs offered them a chance to grab at "a golden ring", or a "second chance at a productive life".

One study participant stated they did not retain very much of the learning gained at the rehabilitation center as accessible and useful short term knowledge:

> At (the center) you learned about the cane and also some
> other things related to energy conservation. However, I was
> still suffering some of the effects of the accident, suffering
> from a lot of pain…I had crushed ribs in both sides of my
> chest so I was not feeling very well. In the years since then
> I have just gradually remembered what I was taught in the
> first place.

I asked participants if they had returned to a rehabilitation center or a hospital for further training. I expected that, considering the severity of their injuries and illness, and the complexity of the assistive-augmentative technology, all would have made repeat visits. Interestingly, I found that very few of the participants had been re-admitted for training, and most had not returned to the center unless a secondary diagnosis or complication was involved. However, because all participants live in an area serviced by a state-wide rehabilitation network of independent living centers, all had been visited by experts (generally an occupational and/or physical therapist accompanied

by biomedical technologists) who had made community or home visits to assess their progress, reinforce lessons learned and to make improvements or adjustments on the technology. In the words of this participant, the program was a great experience:

> When I first got the computer (an agency-supplied
> computer)(it was) just something to pacify my time,
> play solitaire, things like that…to learn a little bit.
> Then, some guys came from (the center)…in fact,
> three of them, and they set down and spent a whole
> day going over everything with me, giving me their
> 800 (toll free) number, and said, hey, any questions give
> them a call. It was cool and I learned. I (also) learned a
> lot by reading books and then going to the Help, going
> through all of that on the computer.

All of the study participants use devoted family members, personal care assistants (PAS program), homecare professionals, and good neighbors to help them with their activities of daily living. The support system in the home was one of the variables that most significantly affected client satisfaction, kept them motivated and enhanced their ability to thrive in a less than optimal situation.

I asked study participants "What would they have changed (or done differently) if they were in charge of the rehabilitation center or hospital?" The majority of the participants were not critical of the experience, and most had very positive memories of their caregivers and the training program. Some had very crystallized ideas about how they would make changes to the facility and others stated that the tough rehabilitation regimen had literally saved their future for them. I asked question 2 to explore the participant's view of home-based (wherever the participant lived: at home, in a facility, in a domociliary center, or facility) learning, learning that generally occurred after discharge and return to the domociliary environment. I asked them to "List skills that you have learned on your own 'the hard way', that is, by experience. This included problem solving, crisis intervention and trouble-shooting, or any unique ways

that you have found to operate your (here name the specific devices, machines, etc.).”

The emergence of experiential 'rules of thumb' and deviations from the explicit domain are elicited in the participants' stories of technological crisis and malfunctions. However, the stories did not arise as spontaneously as I expected in some of the respondents. Responses became increasingly abstract, using both explicitly learned (from training) and implicitly learned (from experience) algorithms, when the situation or scenario became more context bound. This was particularly true when the discussion broached an area of interest to the study participant. A participant (a young man) told this story:

> The center sent me on a mission because there had
> been a complaint. They sent me to the ladies
> bathroom stalls in a local discount super-store. My
> wife made sure the coast was clear and I sneaked into
> the ladies bathroom What I found was that the door
> swings in…and the lady who made the complaint could
> not transfer from her chair to the toilet because the door
> was propped open by her chair and there was no privacy
> or dignity in that …on the other hand, it was important
> that it was accessible, so I told them, why don't you just
> remove the door, please and they just take the door off
> of the hinges. If it was them, and they had to use the
> stool, they would have fixed it. It's not that big of a thing
> to them because they don't have to use it.

“It is not that big of a thing”, says the person who easily provided an answer to the problem, almost without thinking; indeed, the literature review supported the link between common sense and tacit knowledge. I believe that implicitly learned tacit knowledge is vicariously reinforced and that a client's confidence is truly forged and the ownership of skill is reinforced through multiple successful executions of a procedure or group of procedures.

To better understand (and to evoke the colorful memory of their experiences in the short time I had to interview them) I asked them probing questions such as: “Have you reinvented anything concerning your technology, procedures or machines? Were you taught the wrong way to do something and

discovered (on your own) a better way to do it? How would you know if there was an equipment problem? and, What would make you lose trust in a device?" I was indeed surprised at some of the stories:

> ...let me give you an experience story, a different way
> of learning. I talked to a man who used an electric
> wheelchair and he literally ran backwards, using the
> sip-and-puff, and crashed through his wall, broke
> the plaster, broke the sheet rock, just destroyed it.
> Now that is learning the hard way about how to back
> up your wheelchair.

In order to extricate specific illustrations, I used question 3 to query the client's cognitive toolbox for examples of problem-solving acumen that might have an implicit learning foundation, such as the question "Discuss an incident (or tell a story) that illustrates a problem you have had that you solved or fixed in a unique way."

I presupposed that a deviation from concrete knowledge or explicitly learned lessons and skills would occur. What I found is that the blend of implicit and explicit learning best emerge from these informal conversations, noted in William James' theoretical stream of consciousness, where knowledge species emerged in the repertoire of behavior.

The dependency on assistive-augmentative technology requires a second-level of preparation and readiness, and deviation from the plan of care is an expectation that we, the home practitioners, try to prepare the patient and family. Radical departures from the clinic or hospital healthcare practitioner's clinical practice guidelines (or those of the community-of-need) frequently arise. If a deviation occurs from the standardized plan, or if the patient's caregiver is not prepared, heuristics or newly acquired rules of thumb took the place of a plan. This may be the genesis of truly useful implicitly learned tacit knowledge, where the utility of knowledge allows one to survive in a situation that was well beyond the situations for which we ostensibly train them to thrive.

Much of the implicit learning arises from trouble shooting, or as clinicians call it, 'putting out fires'; to extricate this information I asked the questions: "What is the worst problem you have encountered in a facility or at home (regarding your equipment), Do you have the ability to see, hear, smell, or feel a potential equipment problem? Please describe that feeling for us" and "Is there a problem you have been unable to fix on your own?"

I related this to case, where, while walking down a street in my old home town of Jacksonville, Florida, I noted the familiar motorized wheelchair of a neighbor, a sight I was used to as he was very independent and traveled the community in his chair which sported a slow-moving vehicle sign and day-glow orange flag to notify the oncoming motorists of the wheelchairs presence on the very busy 6 lane highway.

On this day, the batteries had died in the busy intersection, and I ran to aid him; the chair, which weighed about 300 pounds, would not disengage the clutch from the motor, a usually simple task. I dragged the chair, with my friend protesting, out of harms way, and finally, with the help of a passerby, accomplished the feat. The very means of his independence, in this case, became a danger to his life.

My goal in the use of question 4 was to explicate the clients' learning experience in the context of a contribution to humanity, one that may address the future needs of another person or add to the body of knowledge concerning how we teach people to use assistive-augmentative technology. I ask the study participants, in a non-directive fashion, to "Describe something that you have learned (and how you might have learned them) that might assist a person in your situation?"

The clients did, as predicted, embark on an evocative case study in which common sense and logic prevails over the oppressive technical malfunction. The separate realities of institutionalization, along with a rich blend of good and bad experiences, acted to open the flood gates of recollection; explicitly learned skills and implicitly learned tacit knowledge emerge in our

conversations; however, the client warmly embraces their abstract, experiential learning as superior to the book learning of the explicit domain, particularly in regard to problem solving.

In regards to a contribution to humanity, question 4 included several probes, asking "Since my accident/injury, the most important lesson I have learned is (a statement or response)", "The most (or least) important skill I have gained on my own is (a statement or response)", "What do you know now that you wish you had known at the time of your accident/injury/start the use of assistive-augmentative devices?" The respondents were generous of their time and experiences, sharing several case situations previously unknown to me and the experts who graciously evaluated the responses and the stories contained in the vignettes.

Conversations with Technology Users

All of the following block quotes or statements in quotation marks, unless otherwise annotated, are made by study participants and are used with written permission that was requested in the informed consent.

I established dialogue with the study participants to learn from them; the dialogue was unobtrusive and I behaved as a welcome guest in their home or office. I explained to them my lack of knowledge in specific areas, and told them what I wished to learn from them. In the process, I gathered data to answer the research questions that were specific to the phenomenologic interview, a major component of the study. I asked them questions and evocative probe questions to answer the following:

1. Does implicitly learned tacit knowledge emerge during dialogue with clients?

I was interviewing a study participant; the interview was at a critical point and I felt a tension between us; the participant was getting very upset during his recollection of his time in a long-term facility. He questioned the rules, and then suddenly and without any prompting from me, restated verbatim one of my key reasons for conducting this study:

...see, doctors and nurses and stuff, when they are
trained, it's everything is in a guideline. This is the
way we do it. You do this, you do this, and you do this.
But, when you put that into use, whether it's in a
hospital or in a person's home, every person is different.
There is no set one certain way to do something. They
teach them how to roll a patient over. I can't roll over
the way they teach them, and they need to teach them
to listen to the patient.

The interview used probing questions to engage the participants in
dialogue and introspeculation, where the discussion is structured to evoke in
the participant introspection and speculation on the source and veracity of
personal knowledge. In this study, participants frequently reported that they
had to learn many difficult lessons that were well beyond the scope of operating
complex medical devices or assistive-augmentative technology. The
participants use of thick description, analogy, metaphor, and storytelling is
indicative of implicitly learned tacit knowledge.

A very special person who has encouraged and mentored me throughout
my career gave me a new insight into knowledge acquisition:

I remember (as a little girl...thinking) that everyone is born,
but somebody (made) the comment to me that, well, the
first thing you did you didn't even do right, you were born,
and that really hit me hard well, (that) I did it wrong...
everybody else came out okay and here, right from the
beginning, I had problems and I was different. You know,
even my baby pictures reinforce that...I had to sit up in an
inner tube or was propped up somehow. And yeah, that
made a difference...right from the beginning I had
problems and I was different.

I asked about her first experience in dealing with some of her mobility
issues. "I was different and I didn't like it...I went into my baby book and tore
out my pictures, tore some of them up, you know...now I am sorry I did, but
yeah, that had a big influence...that also made me more determined to
overcome it".

The statement is made by a well known community leader, famous for
fighting government bureaucracy, prejudice, and bigotry in the name of

independent living and the quality of life of her clients. The good she has done seemed overshadowed by her battle with the enormity of the neuro-musculoskeletal problems she has suffered from the effects of cerebral palsy (CP), effects that she has had to cope with from birth. Her strength and spirit were amazing, and she inspired many of us who work with her in the field.

I wondered early in the interview, why did she feel her birth was a mistake? She told a vivid story that occurred well after her diagnosis. One day, when she was a little girl, she came home and found her parents burning their belongings. She continued "We burned everything and sterilized the house" in an effort to rid the family of disease (a brother who is 5 years older had poliomyelitis at the same time). She noted that in 1950 "that (polio) was a good diagnosis", acceptable to the community, whereas CP "made you a cripple" causing ostracism and exclusion. Unfortunately, she acknowledged that these beliefs still flourish today.

She grimaced slightly, and without a smile and in a newly somber tone, tells me that some people are blessed with a " sexy or cool diagnosis, or an okay reason" for the physical infirmity: her examples were injuries that occurred in an extreme sport or those from a car or motorcycle accident.

She continues her narrative, and there is no levity in her tone when she says that those people with traumatic injuries at least had some fun getting their injury. "I was born with CP", she says, "and that isn't any fun at all". Her diagnosis caused a social rejection that is difficult to fathom. The diagnosis of CP at that time seemed to make her a pariah; she was refused entry to kindergarten and then, as a small girl, was sent away to a special school far from home "because she was a cripple". Many years later, she found evidence that her grandfather made a philanthropic donation that she explained as "a little bribery to get me into public school".

She saddened, and stopped talking for a moment, then poignantly noted that she remembered being "sent away when she was little" and indicated that

this was brought about because of the burden of her CP on the family who already had to care for her brother who "was living in an iron lung at the time."

She struggled as a child, looking for a rationale for why this happened to her. She smiles wryly as she recounts an irrational fear of gophers because "this is where the germs came from...the bite of a gopher could give you polio", a fallacy that was long ago proven to be wrong. She related to me that she still thinks that some people hold firm to the fears and superstitions related to diseases of physical impairment, as if you might catch the germ that causes CP. I sense her use of metaphor here; she related her fear of the deadly gophers to the unfounded fear she encounters in people who fail to understand neuromusculoskeletal ills; however, in her metaphor, the victim of the disease serves as a surrogate for the dreaded varmint. "It's taking me a long time to get over that...gophers and rodents and the sterile house...I am getting over that slowly but surely". She does not leap over the obstacles in a single bound, but methodically fixed the problem, formulated a response, and then executed it in spite of the subliminal baggage she carried about what people think "cripples" can or cannot do.

A leap of this magnitude may be justified. Recall that she experienced the wrath of public misperception; even though she had a brother who suffered with polio, her being sent away, and the rejection from kindergarten makes her believe her presence was the reason for the unreasonable "sterility" that was imposed upon her home and family (she now thinks "her parents may have overreacted by burning their possessions").

Candidly (in conversation) she revealed how she learned while doing battle with a physical infirmity that a less-than-caring world equates to personal weakness. I felt the opposite, for I perceive no weakness in her at all. When I first met her, I found her somewhat intimidating. Her neuromusculoskeletal problem results in altered mobility, requiring assistive-augmentative technology in the form of a motorized wheelchair; she has a soft heart but her spirit is made of hardened chromium steel.

She grew up labeled, as she terms it, one of those poor "crippled children...but I was smarter than most of the kids. "I learned the system" she says, noting that she was thriving in that system because "I used my intelligence to get whatever I wanted." In one instance:

I found ways to take advantage of the system as far as,
like, after lunch I'd take a nap in the nurse's office
because I told them my doctor said I needed one...
finally, a year and a half later (they) checked the
records and there was no doctor's note. I told one
teacher that under stress I would have a seizure,
although I never had seizures. She never made me
do anything in front of the class, which helped me
ease along out of assignments. You may call this
maneuvering, but I think it is manipulation, getting
what I wanted in a way I knew would work.

She was right of course, in that she followed the rules she felt were set before her, the rules she interpreted drove society. "I had my picture taken in the newspaper a lot. I was really a token...I am pretty used to getting attention, but I didn't like that; I didn't like that because it wasn't earned". It does not please me to think of her there, in front of the large flashing bulbs, this girl who destroyed her own photographic images.

The interview continued as she said "Enough of illness, we can return to that later"; she deftly controlled the conversation and lithely transformed herself into the lady I know so well, the advocate of liberation and independent living, the crafty grant-writer and salesperson, a person now focused on the self-taught survival skills that have taken her so far. How did she learn these skills; she was very willing and able to self-define and I explained her learning in the context of experience versus explicit learning, and I am glad I interviewed her because I learned so much about what I have come to know as the cognitive unconscious. This may be where the clients go when they engage in introspection (or seek respite), a place deep within the sources of cognition where they speculate on what it is they know and how they came to learn it. In introspeculation, the individual explored sources of learning and knowing

115

beyond traditional book learning, and the feedback from these clients gave us reason to pause and reconsider our own empirical beliefs about education.   In the following exchange I asked a study participant to reflect on the most important skill he had learned:

> The most important skill? I guess using my feet
> Everybody was amazed that I type with them. They
> don't believe me, but that's why I ask them, that's,
> everywhere I go they say, you know, that it's physically
> impossible for you to have taught yourself, but…I started,
> I don't mean to go into stories, but…I started playing with
> my toys with my feet, and I developed a skill for my feet.
> I dig up sand with little toys. I used to try to hold a block
> with my toes. Yeah. I couldn't hold it between these two,
> but I would…Hold it like that in between both great toes
> Okay, my mom didn't want me to use my feet. She
> wanted me to use my hands. I was discouraged in
> the beginning, but I didn't know what else to do.
> (The participant signed his informed consent with his right foot).

The interviews led me to a participant who was struggling with the rules, paperwork, signatures, regulations, and approvals that were required to obtain assistance for a wheelchair lift for a new van that had been in his possession for a year. He was on a waiting list for the lift, so the van was waiting for him; sitting, unused, in his driveway. He related that the van wasn't his only concern, that most of his medical equipment was delivered and left for him without training or instruction. His less-than-positive experience left him an expert, revealing his knowledge as he responded to my question regarding what he would do differently if he were in charge of the rehabilitation equipment training process:

> I would have them (a client) to get into the chair and go
> over all the controls with them, explain everything to
> them step by step right on down to plugging it up to the
> (battery) charger and everything, as to what kind of air
> pressure should be in the tires, you know, and how
> much air they need they should have in their (inflatable
> air seat) cushions, you know, just step by step instructions
> one on one. You know, nothing was explained to me.

It was like, okay, here's the chair you wanted and
see you, bye. I had to learn everything by doing it myself.

A client's expertise, however, did not stop at cognitive knowledge regarding the process of training people in medical technology. In this case, two clients relate similar learning and operation problems with the unusual geometry operative in the perplexing design of a tilt-in-space wheelchair:

I have finally gotten to where I can recline and go
down the driveway slowly, I get around good (he is
paralyzed completely from the neck down) visit neighbors
and drive my chair to the store...once I started
down my driveway to get under a shade tree one day.
It was real hot. And, I got under the shade tree, but
I wasn't in the position I wanted to be...The wheels,
one wheel started turning backwards and the wheelchair
was out of control, so I guided it enough to headed it into
the shade tree, because there is a creek right below it. I
would have ended up in the creek. So, I had to holler
for my wife to come and get me...luckily, I didn't go in
the creek.

Another participant relived his own similar experience:

Yeah, I mean, it wasn't, ah, there wasn't any training
sessions or, you know, whatever you would want to call it.
It was just basically, okay, here you go, this was what
you wanted. I just trained myself to...judge my
distance and, you know, get through the doors...I've just
done that myself. The only scary part's like when you're
going down the ramp, you know, it's like, ah, I hope these
wheels are not going to go off the side or whatever, you
know? Yeah, and it's hard to see down...You can't see
what's going on...you can't see the wheels, so you've got
to be able to judge your distance and know where they
are. What helps is, I was a truck river for eight and a
half years, and when you drive a truck you learn to
judge your distance.

The discussions with users of assistive-augmentative technology explicated a knowing beyond the understanding of instructor-led equipment training. The emergence of implicitly learned tacit knowledge can be measured using guidance from Polanyi (1966) who notes knowledge as proximal and distal; that which is close (easily told to an interviewer) and that which the

owner "...can know more than they can tell" (p. 4). In these cases, acquisition of knowledge arose from sources other than traditional, explicit learning.

2. Does implicit or unconscious knowledge have utility to the client as their life changes with adaptation to a disease or injury requiring the use of assistive-augmentative technology?

I asked the study participant to recall how and when she had learned about her diagnosis. The recollection of her learning started within her family, and she explained the dynamic of the aforementioned older brother afflicted with polio, the older sister "who wished that there was something wrong with her so that she could get the attention that everyone else did (a problem which plagues her to this day). Her mother is not directly mentioned; the father "he was the breadwinner and was sort of overwhelmed by everything, supportive but busy making money" and "well, you do what you gotta do, I got no counseling, no substance, it was maybe just survival skills...you had to survive".

She is quite direct, noting that the "survival skills" she spoke of are not the ones needed when you lace up your hiking boots and head out of doors, definitely not the skills related to survival in a cold, barren wilderness. One of the most important skills are positive communication and her 'disability pride', the skills learned "through experience". In this conversation she addressed labels noting that:

> I am an individual; I am a mother, a female, a wife. I
> have done this and that, and I have cerebral palsy, but
> it is not the first on the list......but it is on the list
> because it is a very important thing. I have to be a
> good salesman, have good salesmanship skills because
> in the first there minutes I have to sell them on the fact
> that I am okay and they are not going to catch my disability,
> and then that I know what I am talking about.

She is animated and laughing now, and then she catches me off guard. I shudder, trying to hold back my giggle and to maintain my composure; did she really say what I thought she did, and exactly what does that mean? I

reflected on the statement that I thought I had heard. She continued to talk about her training and I interrupted her by asking " 'I am sorry, but what exactly did you mean when you said 'I don't do pits?' ":

> I will not do arm pits...I will not do pits. That is,
> when somebody opens the door and then they lean over
> holding the door, you know, you have to go under. Well,
> God only knows what is going to fall out of their armpit
> on to your head. I am trying to teach them to go out
> and hold the door...it is safer for them and I won't run
> over their toes...and it is physically easier for them, safer
> for them and easier for me.

I am not sure that I understood how the armpits of a well-meaning assistant would be such a problem. I saw it from my perspective and always felt I was being so gallant, running to the door to prop it open so the wheelchair pilot could navigate around me...from now on I will think about something falling out of an armpit as one stretches to hold the door. Our roles have reversed, for when I met her I was the teacher, the expert who had come to fix her medical equipment. She now is independent, and I am dependent on her. And now I am very thoughtful about holding the door in a way that might be considered distasteful to a person in a scooter or wheelchair.

In retrospect, perhaps the problem with TABs, (or as noted in the interviews, the Temporarily Able Bodied) is that their whole concept of consideration starts from their effort to grasp at feelings (understanding, sadness, empathy, sympathy) whereas my study participants must focus on what they hear, feel, smell, see, taste or touch to give them a clear vision of what is, even in sight-impaired participants. The study participants had a very keen sense regarding people who disregard them as human beings:

> And, then they tried the method of using the slide board.
> the transfer board. Well...that didn't work, because I
> couldn't balance or nothing, you know. And, it was like
> each person that would come in to do anything or to help
> me had their own methods of doing things, and this was
> going to work no matter what. We don't care what we
> break, we're going to get you over there. You know, and
> I'm saying, well, this won't work...anyway this little old

woman decides, now they had three other nurses coming
to help me, you know, to transfer back to bed. Well, this
woman decides she can do this on her own before they get
there, and I'm telling her, lady, this won't work. You can't
do that. She goes ahead and tries to jerk me out of there
and put me in the bed. Where do I end up, in the floor.
And, then she starts apologizing. It's a little late then, and
I run upon that everyday, you know, right here. People
think just because you're handicapped you're stupid, or
they think just because you're handicapped, you know, that
you're paralyzed that you don't have feelings, you can't feel
nothing. That's not true. I have feelings. I have sensation
from head to toe. There was a time that I didn't have, but
thank God I do now.

The following participant recalls the problems he has encountered with

his spouse, who suffered from polio, and his own problems post-injury:

People still associate, just because you're in a wheelchair,
that you can't feel nothing…in several different ways.
I've been dealing with that 30 years, too. I'd take (her)
to a restaurant. They'd look at me and ask 'me what
does she want to eat'? I'd say ask her. Don't ask me,
ask her…that happened (with me) and also with (my) wife…
that had polio. You know, that's something that's,
unfortunately, has not changed in, I guess ever since
time began.

The utility of learning that arises from other than explicit sources seems

to have broader based applications. Somatosensory perception painted reality

with a broad brush and a bold-hued palette; this may accentuate progress in

recovery from an illness or injury that is measured in millimeters. In this

experience, I expected to find a sadness, depression, or remorse in the

participants related to what the disease or injury had done to the physical self.

What I found was a level of mastery that can only be described as exultant; the

joy of accomplishment and readiness to take on a new challenge, or in several

cases, to assist others in a similar plight. That utility or usefulness of

experiential learning occurred along with traditional explicit learning is

noteworthy. A participant related to me, author unknown, a parable stating

that "…the strongest steel is forged in the fire of adversity". The utility of

implicitly learned tacit knowledge may be what gives study participants the flexibility to deal with unusual circumstances. In all of the participants, circumstances are well outside of their locus of control, yet they go forward with a positive attitude and a willingness to help others who might someday find themselves in a similar situation.

<div align="center">Limits of Book Learning: A Pedagogy of Living</div>

3. Does richness and thick description in the client's dialogue indicate the ownership of implicitly learned tacit knowledge?

In this study, the presence of lushness, which embodied both richness and thick description in the narrative, was evident. The participants in this study must carefully plan everything, every activity must be orchestrated. The criticality of planning was relayed by one of my most talented participants, a lady, a talented artist who must track events of the day using post-it notes. She uses the position of the sun in the sky to plan her outdoor activities, applying the brakes on her wheelchair to allow herself to slip to the ground and weed her lawn in the wax and wane of the bright Spring midday sun:

> Well, I love to work in the garden…I like that a lot…right now it's been raining a lot, and it would be very good to start weeding. I have a lot of weeds in my yard, and if I can get there, I can work all day weeding. I start out the first thing in the morning, put the brakes on my wheelchair and then gradually work my way down the driveway to the back yard, which is shaded all afternoon, and then I can weed in the back yard all afternoon because it's shady, and I'm cool enough to keep going. So, you just sort of have to start with where the sun is and….work my way back there on my knees, staying in the shade.

The planning component is important because the diagnosis of multiple sclerosis (MS) progressively demyelinates the nervous system, and like a wire bared of its insulation, the neuromuscular system short-circuits, causing energy levels to be sapped as the day marches on: "I keep a diary and a checklist of all I want to get done in the day…you only have so much energy…so I learned to prioritize my activity." This example and the following

clearly demonstrate knowledge beyond book learning, a case where the body dictates through feelings and senses when it is time to start and when to stop.

Time is but one variable that can be measured on a somatosensory scalar; in many cases, clients learn that their feelings are usually signals that they must interpret to assist caregivers in providing life-saving care. In the next story, a study participant describes how she learned to deal with the light headedness that arises from low-blood volume or hypovolemia that is too frequently induced by the blood-cleansing process of invasive hemodialysis:

> ...when my kidneys failed, they put me on hemodialysis,
> which really you do not (participate in). I had no control
> over the hemodialysis. I went to the hospital and they did
> the treatments. The only thing with hemodialysis that...
> I had to learn was to gauge my own blood pressure.
> And, it was mainly to gauge whether it was too low, and I
> would tell that it was low by just, I could feel that I was
> becoming lightheaded because they were pulling...so much
> fluid off at one time. I learned to say 'Mom' and my Mother
> knew to put my head down automatically and tell them
> to run the fluids... And, (we) would...tell the nurses that I
> was feeling lightheaded, and they would check the blood
> pressure instantly and find out...that I had a very low
> blood pressure.

The discussions about agency assistance or governmental support of assistive-augmentative technology is a another discussion that the participant must usually learn by experience. In this regard multivocality was achieved through the repetition of issues related to support systems and the desire to work and be productive. This client related a sad experience with a bench used to transfer to the tub, shower, or toilet:

> Oh yeah, a transfer bench, right. Well, I got one about
> a year and a half ago, and the stupid thing broke and
> the agency, they said they couldn't get another one for
> five years. And, they're $200.00, I think...the thing
> across the leg broke...it actually broke. Well, that's
> pretty silly, they are practically disposable. So, a
> friend had to give me hers, and that's how I got most
> of my equipment, my living equipment I call them.
> My friends have to give me my living equipment...

A participant who struggled with the rehabilitation bureaucracy gives us insight into the learning process at a Tennessee school that she attended from kindergarten through 12th grade:

> As far as teaching adaptive equipment and ways to adapt to society, that was great. The social training and socialization were lacking in that we were not allowed to have normal peer relationships....many people left the school and were not able to function...they had the poor me syndrome where they expect where they expect to be handed everything because of their handicap. It took a year to get a computer when it should have taken two months...the biggest problem (with rehab equipment) is that it is out of date before I get it...too much red tape.

A network exists that support the clients in spite of the regulations and rules, and as noted, participants used alternatives to the rule book when simple but incredibly important equipment fails. The clients know, implicitly, that others who understand their situation are best capable of assisting them. My colleagues who started the independence movement and the independence centers, both the established centers in Southwest Virginia and the budding centers in Northeast Tennessee are there to answer questions and assist technology users in need. They have served as my guide this past four years and have helped me to understand knowledge that is well beyond book learning.

Trustworthiness is achieved in this study through listening to the study participants tell what they know. In these studies, the participants gave examples of learning that arise from experiences, both good and bad, and from the physical senses, the somatosensory conduits where time is constructed from shadows and warm sun, where a single word, Mom, stimulates a healthcare team to action. The use of alternate ways of knowing, outside of the guidelines of explicit learning, suggests that implicitly learned tacit knowledge may have more utility for the users of assistive-augmentative technology than traditional pedagogical approaches. The thick description and use of story-

telling and metaphor by the study participants suggests a need for somatosensory perception to input data into their alternative learning styles.

<div align="center">Quantitative Analysis of the Expert Responses</div>

The quantitative analysis answered research question 4:

4. Is implicitly learned tacit knowledge distinguishable from explicit learning when viewed by trained experts?

Data Analysis

The data received from the questionnaire were scrutinized and entered into a data file for statistical analysis. The statistical software employed for this study is the Statistical Analysis Software (SAS 6.12®). Descriptive and inferential analyses were performed on the data from the questionnaires that were completed by the experts in rehabilitation and assistive-augmentative technology.

The four research questions noted in Chapter One of the qualitative study were designed to highlight the explicit and implicit learning theories seen in the review of the literature; research questions one through three looks at the emergence of implicitly learned tacit knowledge and the conjoined stream of explicit and implicit learning, and question four looked specifically at the possibility of evaluating implicitly learned tacit knowledge by expert opinions drawn from observation. There was no ambivalence choice on the Likert scale; responses to questions on the Likert scale low range (-1 to +1) indicated the presence of the conjoined stream of implicit and explicit learning working together in unison, as noted in the review of the literature. The experts, given a choice, could reject the notion of implicitly learned tacit knowledge for the more palatable explicit learning given as an option in each of the short stories that illustrated the use of assistive-augmentative technology. The stories or vignettes as given to the experts appear in Appendix B.

The statistical analysis illustrated the significance of the relationship or lack of interaction between the experts' responses on the survey questions considering the variables of gender, expertise, and service.

The experts' response data indicate ordinal properties; therefore, I tested the hypotheses using non-parametric statistics. The results of questions 1-10 present as an ordinal data set, and a Wilcoxon-Mann Whitney U test was selected to test the null hypothesis (Hø: 1) of no difference between gender, service, and expertise with regard to questions 1-10. A Kruskal-Wallis One Way analysis of variance (ANOVA) and Fishers Exact Chi Square were used in the analysis of (Hø: 2). A Chi-Square distribution was used as an ancillary test for significant differences (GBStat® help, 2000).

The study was conducted between June and September of 2001. Sixteen respondents (16), all of whom were healthcare experts (16/24 for an 67% return), properly completed the written study and returned a useable questionnaire.

A preliminary analysis of the data was conducted using the GBStat® student software. To check the precision of the findings, the numerical data set (TACQUES) for questions 1-10 (answered from a scale of 1-5 by the experts) was entered into the Statistical Analysis Software (SAS 6.12®) and the data set is contained in Table 4.

Table 4.

Responses Of The Experts On Questions 1-10 On The Survey.

Ser	Gen	Exp	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
16.00	1.00	4.00	3.00	4.00	2.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00
10.00	1.00	2.00	3.00	2.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00
16.00	1.00	4.00	3.00	4.00	3.00	3.00	4.00	3.00	3.00	3.00	4.00	4.00
15.00	1.00	3.00	2.00	3.00	2.00	3.00	4.00	3.00	3.00	3.00	3.00	3.00
10.00	1.00	1.00	2.00	4.00	1.00	3.00	3.00	2.00	2.00	3.00	4.00	4.00
16.00	1.00	1.00	3.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00
16.00	2.00	4.00	1.00	4.00	2.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00
15.00	1.00	4.00	3.00	4.00	2.00	3.00	4.00	3.00	3.00	3.00	4.00	3.00
15.00	1.00	3.00	3.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00
16.00	1.00	4.00	2.00	3.00	2.00	3.00	3.00	3.00	3.00	3.00	3.00	2.00
10.00	2.00	2.00	2.00	4.00	3.00	4.00	4.00	4.00	2.00	3.00	4.00	2.00
16.00	1.00	2.00	3.00	4.00	3.00	4.00	4.00	3.00	4.00	4.00	4.00	3.00
16.00	1.00	4.00	3.00	3.00	2.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Variables: Ser-Years, Gen-Gender, 1-Women, 2-Men. Exp-Expertise:1-Low, 4-High

Questions 11-25 (answered by the experts) were entered into the Statistical Analysis Software (SAS 6.12®) and the data set is seen in Table 5.

Table 5.

Responses Of The Experts On Questions 11-25 On The Survey.

Ser	Gen	Exp	q1a	q2a	q3a	Q1b	Q2b	q3b	q1c	q2c	q3c	q1d	q2d	q3d	q1e	q2e	q3e
16	1	4	3	3	3	-3	-3	-3	-4	-4	-4	4	4	4	-3	4	-3
10	1	2	3	1	2	2	1	1	3	4	5	2	3	3	3	3	2
16	1	4	4	4	3	4	5	5	4	5	5	4	5	4	5	5	5
15	1	3	4	4	4	4	4	4	-3	-3	3	5	5	5	-4	-4	4
10	1	1	2	3	3	2	3	4	3	-3	4	4	3	4	-3	-3	-1
16	1	1	-5	5	3	4	5	3	5	4	5	3	5	1	-4	-2	3
16	2	4	5	5	5	5	5	5	-1	-2	-4	4	4	4	-5	-5	-5
15	1	4	-4	4	4	-5	-5	-5	3	4	4	-4	4	4	-4	-5	-5
15	1	3	3	4	5	5	4	4	4	5	2	4	3	4	-4	5	-2
16	1	4	4	4	5	-3	-3	5	4	-3	5	5	5	5	-3	-3	-3
10	2	2	5	5	5	4	4	3	4	4	4	2	5	5	-5	-5	-5
16	1	2	5	-5	5	-5	5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
16	1	4	-4	4	4	-3	-3	-3	4	5	5	-4	5	4	-5	-5	-5
10	1	4	4	3	-2	-4	-4	-4	4	3	3	-4	3	4	-4	-5	-4
15	1	3	5	5	5	3	5	5	-3	-5	-5	-5	-5	-5	-5	5	-5
15	2	4	5	5	5	4	4	4	5	5	5	5	5	5	4	4	4

Variables: Ser-Years, Gen-Gender, 1-Women, 2-Men, Exp-Expertise:1-Low, 4-High

Expert Measures of Explicit and Implicit Learning

The 16 experts were encouraged to read the brief instructions that told them about the review of the literature. I encouraged them to view still photos or streaming video clips of the study participants using technology. The experts were then given five short vignettes or stories that paraphrased the experiences contained in the study participant interviews. The intent of this analysis was to gather data on the opinion of experts in assistive-augmentative technology regarding the clients ownership of implicitly learned tacit knowledge, its presence and utility to the client, and the lushness or thick description in the vignette details that might signal an expert that implicitly learned skills were in use.

The Likert-type response scale had ordinal properties, and taking into account the small sample size and gender inequalities, nonparametric hypothesis tests are appropriate. The SAS 6.12® statistical analysis software program was used; a 2 x R (R = 3 or 4) contingency table was chosen and designed for the questions showing implicit or explicit learning.

To facilitate the contingency table model, when explicit learning or a negative number was chosen by the expert it was coded 1, and when implicit learning or a positive number was chosen by the expert, it was coded 0. Fisher's Exact Chi Square Test or the Exact Chi Square were used in consideration of the sample size and the high percentage (>75%) of cell counts less than five; in these cases, the Asymptotic Chi Square was not a valid test and was not used as data, and this was explained in data tables where appropriate.

<div align="center">

Results of the Analysis of the Survey

Expert Responses to the Survey Questions

</div>

The Wilcoxon-Mann Whitney U test and Kruskal-Wallis One-Way Analysis of Variance (ANOVA) were used for hypotheses testing with an alpha (α) level of 0.05. A careful analysis of the data revealed that it would be necessary to manipulate the alpha level to achieve a Type 1 error protection level (Whitney & Feldt, 1973) for each hypothesis test; this manipulation is done by calculations from the proposed formula:

$$\alpha i = \alpha / \tau$$

where αi is the new alpha level. In this case, the alpha level of .05 (α) is divided by the number of hypotheses (τ) to be tested (Lunney, 1969, cited in Whitney & Feldt, 1973, p. 366). This was calculated and proposed as the new significance level for each test (αi) to assist in preventing Type 1 error. The new alpha (α) level is now .05/30 or 0.0017 for the total possible questions or hypotheses that dealt with gender, service, and expertise.

> H$\emptyset$1: There will be no statistically significant difference between the responses of women and men (2 groups), service level (4 groups) or expertise ratings (4 groups) in regard to questions 1-10 contained in the study questionnaire.

Gender Hypotheses

The Wilcoxon-Mann Whitney U test and Kruskal-Wallis One-Way Analysis of Variance (ANOVA) with Chi Square approximation were used for hypotheses testing with an alpha (α) level of 0.05. A careful analysis of the data revealed that it would be necessary to manipulate the alpha level to achieve a Type 1 error protection level (Whitney & Feldt, 1973). The results of the tests for the gender hypotheses appear in Table 6.

Table 6.

Wilcoxon Scores (Rank Sums) By Question For Gender,

Kruskal-Wallis Test (Chi Square Approximation) (n = 16).

Question	Z score	Prob > $\mid Z \mid$	Prob > CHISQ
1	-2.52293	0.0116	0.0093
2	-2.46703	0.8051	0.7422
3	1.03042	0.3028	0.2696
4	2.52293	0.0116	0.0093
5	1.36109	0.1735	0.1495
6	2.04293	0.0411	0.0330
7	-1.04809	0.2946	0.2615
8	-0.41345	0.6793	0.6198
9	0.79882	0.4269	0.3714
10	-0.93484	0.3499	0.3112

Notes: Modified α level 0.0017 (Lunney, 1969).

There was no statistically significant difference in responses between women or men in questions/hypotheses 1-10; I failed to reject the null hypothesis.

Expertise Hypotheses

The Wilcoxon-Mann Whitney U test and Kruskal-Wallis One-Way Analysis of Variance (ANOVA) with Chi Square approximation were used for hypotheses testing with an alpha (α) level of 0.05. A careful analysis of the data revealed that it would be necessary to manipulate the alpha level to achieve a Type 1 error protection level (Whitney & Feldt, 1973). The results of the tests for the expertise hypotheses appear in Table 7.

Table 7.

Wilcoxon Scores (Rank Sums) By Question For Expertise,

Kruskal-Wallis Test (Chi Square Approximation) (n=16).

Question	CHI SQ	DF	Prob > CHISQ
1	0.1970	3	0.9781
2	1.5046	3	0.6812
3	1.9337	3	0.5863
4	3.5505	3	0.3143
5	0.3333	3	0.9536
6	1.4519	3	0.6934
7	1.6234	3	0.6541
8	1.3250	3	0.7232
9	1.3248	3	0.7233
10	3.6111	3	0.3066

Notes: Modified α level 0.0017 (Lunney, 1969).

There was no statistically significant difference between the levels of expertise (4 levels) in response to the questions/hypotheses 1-10; I failed to reject the null hypothesis.

Service Hypotheses

The Wilcoxon-Mann Whitney U test and Kruskal-Wallis One-Way Analysis of Variance (ANOVA) with Chi Square approximation were used for hypotheses testing with an alpha (α) level of 0.05. A careful analysis of the data revealed that it would be necessary to manipulate the alpha level to achieve a Type 1 error protection level (Whitney & Feldt, 1973). The results of the tests for the service hypotheses appear in Table 8.

Table 8.

Wilcoxon Scores (Rank Sums) By Question For Service,

Kruskal-Wallis Test (Chi Square Approximation)(n = 16).

Question	CHI SQ	DF	Prob > CHISQ
1	0.21429	2	0.8984
2	0.33049	2	0.8477
3	0.21319	2	0.8986
4	1.40510	2	0.4953
5	0.94286	2	0.6241
6	1.26100	2	0.5323
7	4.40550	2	0.1105
8	2.45140	2	0.2935
9	1.28570	2	0.5258
10	1.12500	2	0.5698

Notes: Modified α level 0.0017 (Lunney, 1969).

There was no statistically significant difference between the levels of service (4 groups) in responses to questions/hypotheses 1-10 contained in the study questionnaire; I failed to reject the null hypothesis.

Expert Analysis of the Vignette Survey Questions

A 2 x R (R= 3 or 4) Contingency Table using Fisher's Exact Test and Exact Chi Square and were used for hypotheses testing with an alpha (α) level of 0.05. A careful analysis of the data revealed that it would be necessary to manipulate the alpha level to achieve a Type 1 error protection level (Whitney & Feldt, 1973) for each hypothesis test; this manipulation is done by calculations from the proposed formula:

$$\alpha i = \alpha / \tau$$

where αi is the new alpha level. In this case, the alpha level of .05 (α) is divided by the number of hypotheses (τ) to be tested (Lunney, 1969, cited in Whitney & Feldt, 1973, p. 366). This was calculated and proposed as the new significance level for each test (αi) to assist in preventing Type 1 error. The new alpha (α) level is now .05/30 or 0.0017 for the total possible questions or hypotheses that deal with gender, service, and expertise.

Hø2: There will be no statistically significant difference between the responses of women or men (2 groups), service level (4 groups) or expertise ratings (4 groups) in regard to the 3 questions (presence, lushness, utility) contained in the expert study questionnaire:

Gender Groups

A 2 x R (R= 3 or 4) Contingency Table using Fisher's Exact Test and Exact Chi Square and were used for hypotheses testing with an alpha (α) level of 0.05. A careful analysis of the data revealed that it would be necessary to manipulate the alpha level to achieve a Type 1 error protection level (Whitney & Feldt, 1973) for each hypothesis test. The results of the tests for the gender groups appear in Table 9.

Table 9.

Statistics For Table Of Gender By Response (n=16).

Question	Cramer's V	Implicit wo♀ me♂		Explicit wo♀ me♂		Fishers Exact Test (2 tail)/Exact Chi Square
S1Q1	0.231	10	3	3	0	1.00 / 0.582
S1Q2	0.124	12	3	1	0	1.00 / 1.00
S1Q3	0.124	12	3	1	0	1.00 / 1.00
S2Q1	0.372	7	3	6	0	0.250 / 0.250
S2Q2	0.324	8	3	5	0	0.509 / 0.509
S2Q3	0.324	8	3	5	0	0.509 / 0.509
S3Q1	-0.092	10	2	3	1	1.00 / 1.00
S3Q2	0.101	7	2	6	1	1.00 / 1.00
S3Q3	-0.092	10	2	3	1	1.00 / 1.00
S4Q1	0.324	8	3	5	0	0.509 / 0.509
S4Q2	0.182	11	3	2	0	1.00 / 1.00
S4Q3	0.182	11	3	2	0	1.00 / 1.00
S5Q1	0.179	2	1	11	2	0.489 / 1.00
S5Q2	-0.0041	5	1	8	2	1.00 / 1.00
S5Q3	0.022	4	1	9	2	1.00 / 1.00

Note: Modified α level 0.0017 (Lunney, 1969).
Asymptotic Chi Square may not be a valid test; Fisher's Exact Test Chi Square and the Exact Chi Square were used.

There was no statistically significant difference between women or men in response to the 15 questions/hypotheses contained in the study questionnaire; I failed to reject the null hypothesis.

131

A 2 x R (R= 3 or 4) Contingency Table using Fisher's Exact Test and Exact Chi Square and were used for hypotheses testing with an alpha (α) level of 0.05. A careful analysis of the data revealed that it would be necessary to manipulate the alpha level to achieve a Type 1 error protection level (Whitney & Feldt, 1973) for each hypothesis test. The results of the tests for the expertise groups appear in Table 10:

Table 10.

Statistics for Table of Expertise by Response (n=16).

Question	Cramer's V	Implicit 1 2 3 4	Explicit 1 2 3 4	Exact Chi Square
S1Q1	0.396	1 2 3 7	1 0 0 2	0.807
S1Q2	0.228	2 2 3 8	0 0 0 1	1.000
S1Q3	0.228	2 2 3 8	0 0 0 1	1.000
S2Q1	0.683	2 2 3 3	0 0 0 6	0.036
S2Q2	0.595	2 2 3 4	0 0 0 5	0.210
S2Q3	0.595	2 2 3 4	0 0 0 5	0.210
S3Q1	0.509	2 2 1 7	0 0 2 2	0.301
S3Q2	0.373	1 2 1 5	1 0 2 4	0.780
S3Q3	0.333	2 2 2 6	0 0 1 3	0.763
S4Q1	0.399	2 2 2 5	0 0 1 4	0.593
S4Q2	0.333	2 2 2 8	0 0 0 1	1.000
S4Q3	0.333	2 2 2 8	0 0 1 1	1.000
S5Q1	0.396	0 1 0 2	2 1 3 7	0.807
S5Q2	0.394	0 1 2 3	2 1 1 6	0.568
S5Q3	0.250	1 1 1 2	1 1 2 7	1.000

Notes:
Expertise Level; a composite, the highest level was 4, lowest was 1.
Modified α level 0.0017 (Lunney, 1969).
The Asymptotic Chi Square may not be a valid test; Exact Chi Square was substituted.

There was no statistically significant difference between the levels of expertise (4 groups) in responses to the 15 questions/hypotheses contained in the study questionnaire; I failed to reject the null hypothesis.

This was a small group of experts; those who had an opinion selected the presence of implicit learning in their evaluation at or near a 2:1 ratio,

suggesting that practitioners with high levels of expertise would be open to new pedagogical practices to train users of assistive-augmentative technology.

Service Groups

A 2 x R (R=3,4) Contingency Table using Fisher's Exact Test and Exact Chi Square and were used for hypotheses testing with an alpha (α) level of 0.05. A careful analysis of the data revealed that it would be necessary to manipulate the alpha level to achieve a Type 1 error protection level (Whitney & Feldt, 1973) for each hypothesis test. The results of the tests for the service groups appears in Table 11.

Table 11.

Statistics For Table Of Service By Response (n=16).

Question *	Cramer's V	Implicit 1 2 3 4	Explicit 1 2 3 4	Exact Chi Square
S1Q1	0.293	0 4 4 5	0 0 1 2	0.750
S1Q2	0.293	0 4 5 6	0 0 0 1	1.000
S1Q3	0.447	0 3 5 7	0 1 0 0	0.250
S2Q1	0.360	0 3 4 3	0 1 1 4	0.432
S2Q2	0.224	0 3 4 4	0 1 1 3	0.808
S2Q3	0.224	0 3 4 4	0 1 1 3	0.808
S3Q1	0.352	0 4 3 5	0 0 2 2	0.500
S3Q2	0.263	0 3 3 3	0 1 2 4	0.816
S3Q3	0.402	0 4 4 4	0 0 1 3	0.385
S4Q1	0.131	0 3 3 5	0 1 2 2	1.000
S4Q2	0.230	0 4 4 6	0 0 1 1	1.000
S4Q3	0.230	0 4 4 6	0 0 1 1	1.000
S5Q1	0.112	0 1 1 1	0 3 4 6	1.000
S5Q2	0.315	0 1 3 2	0 3 2 5	0.537
S5Q3	0.131	0 1 2 2	0 3 3 5	1.000

Notes:
Service (1) 0-5 years, (2) 6-10 years, (3) 11-15 years, (4) 16-20 years.
Modified α level 0.0017 (Lunney, 1969).
Asymptotic Chi Square not a valid test; Exact Chi Square used.

There was no statistically significant difference between the levels of service (4 groups) in responses to the 15 questions/hypotheses contained in the vignettes in the study questionnaire; I failed to reject the null hypothesis.

Synopsis of the Findings

Hø1: There was no statistically significant difference between the responses of women or men (2 groups), service level (4 groups) or expertise ratings (4 groups) in regard to questions 1-10 contained in the study questionnaire. I failed to reject the null hypothesis.

Hø2: There was no statistically significant difference between the responses of women or men (2 groups), service level (4 groups) or expertise ratings (4 groups) in regard to the 15 questions (presence, lushness, utility) contained in the vignettes in the expert study questionnaire. I failed to reject the null hypothesis.

My original contention was that there would be a statistically significant difference between women and men on survey responses regarding the theory, presence, emergence, or utility of implicitly learned tacit knowledge. The literature assumed women handle ambiguity and theoretical untidiness better than males. In this small study, the numeric responses of women and men on the survey questions were predictably the same, beyond chance.

Experts who had an opinion again recognized the presence of implicit learning in their evaluation at or near a 2:1 ratio, suggesting that both women or men practitioners with high levels of expertise and service would possibly be open to new pedagogical practices in training users of assistive-augmentative technology. I was heartened when experts, given multiple options in the vignette and having read and interpreted the videos, still photos, and short stories, gave 150 responses (of a possible 240 total responses) supporting the presence of implicitly learned tacit knowledge in the vignettes.

The Theoretical Framework

I constructed a theoretical framework; this framework was inspired by an Australian folk-tale stating that in Australia there are winners but there are no losers, only 'battlers' who carry on the fight. The battler fights for what is right regardless of their qualification or lack of qualification to do something. The person is respected for battling against the odds, trying to accomplish what

ever it is that person set out to do, even if it is a seemingly Herculean task. This is not the case in America, where those who cannot do or do not know are pitched aside and considered losers. A person is not given credit for a battle well fought, and effort without success goes unrewarded. The framework is seen in Table 12; this is reality, the world as seen by the study participant. Table 12.

The Theoretical Framework.

Theoretical Framework: How We Extract Implicitly Learned Tacit Knowledge From The Interviews.

PARTICIPANT-DEFINED STATEMENTS OF LEARNING AND KNOWLEDGE	CATALYTIC SKILLING CODE	TRADITIONAL WORLDVIEW OF OF KNOWLEDGE ACQUISITION AND OWNERSHIP	CATALYTIC SKILLING CODE	EXPERT-DEFINED LEARNING AND KNOWLEDGE
EXULTANT	KNOWS/CAN-DO/ MASTERY			TYPOLOGY OF TRADITIONAL
EXPRESSIVE	KNOWS/CAN-DO/ SKILLED	WIN	KNOWS	AND EMERGING THEORIES OF LEARNING AND
SUPPRESSIVE	NOT SURE/CAN-DO/ NOVICE	DRAW	NOT SURE	KNOWING (REVIEW OF THE
REPRESSIVE	DOES NOT KNOW/ CANNOT DO/TRYING	LOSE	DOES NOT KNOW	LITERATURE AND APPENDIX)
DEPRESSIVE	DOES NOT KNOW/ CANNOT DO/DEFEATED			

I MUST KNOW TO SURVIVE

I MUST KNOW TO THRIVE

ABSTRACT TACIT KNOWLEDGE
FUNDAMENTAL SURVIVAL ISSUES

CONCRETE KNOWLEDGE
SOCIO-ECONOMIC HIERARCHICAL ISSUES

WILLIAM JAMES' "CONJOINED STREAM OF CONSCIOUSNESS"

IMPLICIT LEARNING

EXPLICIT LEARNING

LEARNING AND KNOWLEDGE ACQUISITION OCCUR IN AN INCALCULABLE SPACE AND TIME THAT IS DIFFERENT FOR EACH INDIVIDUAL. THE STREAM OF CONSCIOUSNESS INTERSECTS WIITH THE WORLDVIEWS AND CATALYTIC SKILLING CODES. PEOPLE WHO ENGAGE IN INTROSPECULATION MAY USE THIS FRAMEWORK DEFINE THEMSELVES AS LEARNERS AND KNOWERS AND UNDERSTAND HOW THEY THRIVE AND SURVIVE IN SOCIETY.

This is particularly true of the participants in this study; paradoxically, after years of intense training on assistive-augmentative technology, they find themselves caught in a bureaucratic pincer: they are not considered employable, but if a meager position opens, they dare not take it or they will lose their social security insurance (SSI), vocational rehabilitation, or risk the loss of their valuable Medicare Part A and Part B insurance.

Trapped, they remain unemployed in what can best be described as a self-perpetuating circle of reliance, a learned helplessness brought about by the government subsidy and over-regulation.

The framework starts on the far right of the table with a statement of the traditionally valued outcomes of education, the ability to thrive in society and the community. The catalytic skilling codes deal simply with the ability to do; that is, an acceptable outcome of the winner who 'can do' or the unacceptable outcome of one who is unsure or cannot do. Imperceptible to some, these catalysts are the foundation of all the rights and wrongs that are discussed in and about modern education: the preparation of people for the labor market, definitions of academic achievement, the viability of the American student in the global market, and achievement scores in high stakes testing both here and abroad.

The traditional catalytic skilling codes are compared to those used by the client assistive-augmentative technology users. The study evoked participant-defined catalytic skilling codes ranging from the exultant master of technology to the depressive neophyte who presents to the healthcare facility, the community, and their family after a catastrophic illness or injury, knowing not what the future holds in store for them nor what they can do to take control of their body or their environment. The harsh reality of the framework is justified when I listen to the participants and saw the way they were treated by the society they so much longed to join. One person talked about travel problems:

> I wanted to go on vacation…so I call a (major hotel chain)
> and they fully assure me that it was handicapped accessible.
> I tell them I am quadriplegic, on a ventilator, had nursing,
> and I contacted the hospital so they knew I was there.
> Got down there and no ramp to the hotel, had to pick me up
> (and carry me) over two curbs to get me in the room…I gave
> them hell over it…I got a lawyer from Florida to go back
> and make sure they put in a ramp and made everything
> handicapped accessible.

Knowing was not enough, for in this world one must be ready to push back when the pressure is on.

The artificial duality of implicit and explicit learning was exaggerated for this study, helping me in my role of the theoretician to differentiate the important variables between unconscious, implicitly learned, abstract tacit knowledge and explicitly learned, conscious concrete knowledge. My labors to bifurcate these two species for the sake of this study (I now believe there are more than two species) were not in vain; I acquiesce that while reality is defined in the metaphorical waters of William James' conjoined stream of consciousness, implicitly learned tacit knowledge remains a deep, quiet but not-so-far-away stream in which all of God's creatures dip and quench their thirst for knowledge.

Summary of the Chapter

The results of the qualitative analysis sought to group the data that was gathered in the phenomenological interviews of the nine study participants into the category implicitly learned or explicitly learned knowledge. A thorough evaluation by the investigator and peer-reviewer reached agreement. Data were used to answer the study questions, finding that 1. Implicitly learned knowing emerged simultaneously with explicit learning during dialogue, 2. Implicit, unconscious, or alternative forms of knowledge had greater utility for the user of assistive-augmentative technology than explicit learning alone, and implicitly learned tacit knowledge better helped to adapt and cope with illness or injury, 3. Richness and thick description appears to signal the ownership of knowledge obtained through sources other than explicit learning, most likely implicitly learned tacit knowledge, and 4. Experts recognized the presence, utility, and emergence of implicitly learned tacit knowledge in their evaluation of short stories or vignettes that discussed the experiences of the study participants with assistive-augmentative technology. However, there were no statistically significant difference in the responses to the survey questions or vignette questions regarding, gender, service, or levels of expertise of this group of experts (n = 16).

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

This study investigated the emergence, the presence, and the utility of implicitly learned tacit knowledge. The findings suggested that medical experts in Southwest Virginia and Upper East Tennessee were open to the possibility of alternative methods of teaching individuals who find themselves, by no choice of their own, candidates for assistive-augmentative technology or other forms of complex medical equipment. The demographic profiles of the experts were purposefully skewed towards professionals with higher levels of education, work experience, and credentials, and the gender ratio (4:1, or 81% female and 19% male) approximated a consistent gender mix in the region over the past 10 years.

The evidence is compelling in all aspects of the study. The phenomenological survey, with evocative, probing questions, explicated far more detail concerning learning experiences than expected; many of the experiences were positive and a few less than positive; however, in almost all of the situations, an important learning experience was discussed in fine detail.

In the analysis of the findings, I failed to reject the null hypothesis in both hypotheses, Hø1 and Hø2. The experts, in their evaluation of the study questions, were more than willing to consider the presence and utility of an extraordinary type of knowledge, knowledge that was well suited to these study participants.

Of interest is the exquisite detail and the depth of discussion undertaken by the study participants in thoughtful response to my questions. The clients, all of whom live in remote rural locations within a 200-mile radius of the university, seemed to appreciate me as a visitor, as I sense that several are not able to socialize as much as they would like to due to travel and transportation issues.

No participant was given advance copy of the study questions or evocative probes, yet the responses gave new meaning to crystallization of

knowledge, as many turned the expertise of previous careers into mastery of their current situation.

<div align="center">Somatosensory Influence of Participants</div>

An important but underestimated naturalistic component of this study is the regional predilection for oral history. This critical component was studied thoroughly by a local physician, Douglas Vance, M.D. (1977). Dr. Vance, a long-time family practitioner who was born and raised in the mountains of Southwest Virginia and Upper East Tennessee and schooled in medicine in Virginia. He practiced family medicine for almost 40 years in the Bristol, Tennessee-Virginia area, and respectfully noted in his book Doctor, Is My End In Sight? (1977) that::

> My people are adept in the usage of colloquialisms
> which are endemic to this area. I trust that my readers
> will not interpret anything I say as a reflection of the
> mentality of those quoted, as many of them have brilliant
> minds and they are among the finest people on earth
> (Vance, 1977, p. x).

Dr. Vance went on to examine the uncanny ability of local people to accurately self-diagnose and re-name conventional signs and symptomology. Of special interest were the following symptoms, all patient self-diagnosed:

> I am having trouble with my git-alongs (gastrointestinal
> problems), ...My ribs have dropped loose from the
> breastbone and are rambling around in my interior
> (arthritis),...going through the Evolution of Life, which
> could be treated with a harmonica shot (menopause),
> ...she looked like she had eat huckleberries for three
> months (cyanosis from cardiac or pulmonary disease)
> (Vance, 1977, pp. 6-12).

This uncanny ability was noted and detailed by Dr. Abraham Verghese (1994) who chronicled his immersion into the epidemiological nightmare of the human T-lymphotrophic virus' (now the human immunodeficiency virus or HIV) invasion of Upper East Tennessee, a journey that was chronicled in the literary masterpiece My Own Country.

Dr. Verghese, while moonlighting in rural hospitals in Southwest Virginia, learned that there is a language of synonomous phrases not learned in medical school, for example: "fireballs in the ovurus" for uterine fibroids, "smilin' mighty Jesus" for spinal meningitis, and "roaches in the liver" for cirrhosis of the liver (p. 20). This uncanny ability to describe country medical acumen is not lost on me, for one of my study participants told me that: "Doug, if you become a researching doctor, c'mon up here any time if you wants to do a medical asparagus" (personal communication, used with permission, 2001).

All variables considered, I believe the methodology used in this study assist the technology user to state what they know, and that their comments are pure representations of implicitly learned tacit knowledge.

<u>Experts Listening, Clients Teaching</u>

This paper confirms the premise that implicitly learned tacit knowledge emerged during dialogue with clients, that implicit knowledge had utility to the client, and that richness and thick description in dialogue indicated the ownership of implicitly learned tacit knowledge.

In the introduction to this paper, I suggested the importance of implicitly learned tacit knowledge not only for physicians, therapists, nurses, and caregivers of people using assistive-augmentative technology, but also for professors' teaching teachers, education administrators, and classroom teachers who will see complex medical technology users, especially children, who are now being mainstreamed into traditional classrooms.

The inclusion of these special students is due to the regulations seen in the Individuals with Disabilities Education Act (IDEA), section 504 of the Americans with Disabilities Act (ADA) and the use of individual education plans (IEPs) where children are welcomed into 'normal' classrooms. Many of the children have sound intellect, vast experience with the illness, and have mastered the equipment. The complex medical equipment will consist of mobility and independence equipment like wheelchairs and scooters, or

physiologic monitors, intravascular medication or fluid infusors, feeding tubes and pumps, mechanical ventilators, artificial airways, and artificial speaking valves like the Passy-Muir® valve.

A cognizance of the cognitive unconscious prepares the teacher to use accidental pedagogy (Masini, 2001), a style that purposefully includes the students' life experience, both positive and tragic, to enlighten the lesson plan and help teachers guide and expand the direction of student learning.

If one heeds the existing experiential learning, and give native tacit knowledge and its resulting expertise relevance in lesson planning, it is possible that less accidental learning and more explicit learning may take place due to the need for reflection after action, where introspection and speculation (introspeculation, an artificial form of reflection after action) naturally occur in tandem.

I feel that this form of pedagogy honors the participants' achievement, as children in particular have well-defined ideas about who they are and what gifts they believe they possess (Masini, 2000), and users of assistive-augmentative technology, regardless of age, have life-support knowledge and skills beyond what the temporarily able-bodied will ever experience. Use of this alternative pedagogy is not difficult, in that it requires the educator to listen more, speak less, and include the learner in the creation of educational goals and objectives. The teacher's focus is more on the journey and less on the destination, and while controversial, it calls upon the teacher to assess the presence of Hull's (1993) critical literacy, suggesting that the end product of learning is the realization that the environment can be altered.

<u>Future Research Agenda</u>

Johannesson (1996) wrote that a "psychologically motivated conceptual space can be obtained with multidimensional scaling (MDS)" (pp. 1-5). The use of other statistical analysis software to extricate meaningful data from the interview narratives and scoring matrices is under investigation for future research.

The data from the Likert scale, analysis of the responses to questions and probes, and the scoring matrices appear to form a multidimensional, topographical map that gives a visually rich demonstration of the emergence (or lack of emergence) of tacit knowledge in these clients. The gathering of data post-phenomenological interview, as well as the perceived utility of tacit knowledge and frequent use of evocative probes gives the researcher and the experts the opportunity to compare and contrast visual assessment field-notes and itemize the heuristics or keyword responses of the interviewees to the research questions that are considered representative of tacit knowledge. The combination of the narrative results, scores, and data would present a lush verbal image map (LVIM) of the findings for each client as scored by the expert panelists.

I believe that the use of lush verbal images allows us to create maps as a novel knowledge management tool that can be used in any field or profession as indicative of perceived implicit or explicit learning; the scoring matrices and content of desired abstract and concrete knowledge would change with the practices of the group in question. However, it is important to note that the analysis is specific to the knowledge of any particular group and inference cannot be made on other groups of people, vocational groups, or professions.

The measurement of tacit knowledge is an important adjunct to career-mapping, employee self-enlightenment, and professional process improvement efforts.

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APPENDICES
Appendix A.
Informed Consent For Research Project
TITLE OF THE RESEARCH PROJECT:
The Accidental Expert: A Demonstration of the Existence, Utility and
Emergence of Implicitly Learned Tacit Knowledge in Assistive-Augmentative
Technology Users.

PRIMARY INVESTIGATOR:
Douglas E. Masini, a graduate student at East Tennessee State University,
Johnson City, Tennessee.

This informed consent will explain about being a research subject in an
experiment. It is important that you read this material carefully and then
decide if you wish to be a volunteer.

PURPOSE:
This research project will study persons like yourself who use medical
equipment such as environmental control systems, mechanical ventilators,
speaking devices or electric wheelchairs. You will be asked to answer
questions about the training you received and then I will ask you to discuss the
usefulness of the training. I want to know if your training helps you to cope
with any mobility or technical problems you had prior to receiving the
equipment. I am interested in what you have learned since you started using
this equipment and how you learned this new information.

DURATION:
If you volunteer for this study, I will make an appointment to visit your home
(or a place that you designate) at least one time to talk with you for about one
(1) to three (3) hours. If you wish, I will break up the session (for example,
three one hour sessions in three visits) to make it convenient for you. **I will
record our conversation on audio-tape and then have our words,
questions, answers and all comments typed for my research. I will inform
you when I start recording and when I stop recording our discussion.** You
may have family members or friends with you during our discussion, but I will
only use your answers, words and comments concerning the questions in this
study. **This conversation is confidential, and you will not be identified in
the paper.** After we complete the discussions, you will be able to contact me if
you have further questions about the study. You may quit the study at any
time.

Page 1 of 3
Participant initials_____
Principal Investigator: Douglas Eugene Masini   Title of Project: The Accidental Expert: A Demonstration of the
Existence, Utility and Emergence of Implicitly Learned Tacit Knowledge in Assistive-Augmentative Technology Users.

155

PROCEDURES:

This study consists of my asking you questions about what you learned about your medical equipment when you were trained in the hospital or rehabilitation center. I will ask you specific details about the training and what it consisted of, any videos or films you saw, or any group or individual discussions you had on using the equipment. I will ask how your family was involved in your training, any demonstrations or classroom training that you had and the hands-on experience you received. I will then ask you about what you have learned since you left the hospital or rehabilitation center, what you do if the machine stops working or what you do if it breaks. I am very interested in what you think about the equipment that you use because you are an experienced user. I would like to hear any ideas you may have on improving the training you received at the hospital, how you would improve the training you received as an outpatient, or how you would change the training you have received since you have been home.

POSSIBLE RISKS OR DISCOMFORTS:

The possible risks and/or discomforts of your involvement include any memories of the illness, accident or injury that may be unpleasant to you. You may feel uncomfortable about having your voice or comments recorded on tape. You may be inconvenienced by my visit; if this occurs, we can reschedule the appointment for another time. If the conversation fatigues you, we can take a break or we can stop the discussion at any time. If you do not wish to continue answering the questions, we will terminate the discussion. You can quit the study at any time.

POSSIBLE BENEFITS and/or COMPENSATION:

There is no offer of compensation for your participation in this study. The possible benefit to you as a volunteer is your personal satisfaction for helping to solve teaching and learning problems and assisting people who are or will be in your situation. **Your experience is a real contribution to humanity, as this study should improve how we train the people who teach others how to use this equipment, especially health professionals like therapists, nurses and doctors**. Otherwise, there is no direct benefit or compensation for your participation in this study.

CONTACT FOR QUESTIONS:

If you have any questions, problems or research-related medical problems at any time, you may call Douglas E. Masini at 423-652-2175 (**or eMail: demG8RS@aol.com**) in Bristol, Tennessee, or Gunapala Edirisooriya, Ph.D at 423-439-7519 in Johnson City, Tennessee. You may call the Institutional Review Board at 423-439-6134 for any questions you may have about your rights as a research subject.

Participant initials_____Principal Investigator: Douglas Eugene Masini
Title of Project: The Accidental Expert: A Demonstration of the Existence, Utility and Emergence of Implicitly Learned Tacit Knowledge in Assistive-Augmentative Technology Users.

CONFIDENTIALITY:

Every attempt will be made to see that my study results are kept confidential. **All audio-tapes of our conversations will be destroyed after they are transcribed, without retaining any identifying information.** All records of this study will be stored in the College of Education's Department of Educational Leadership and Policy Analysis for at least ten (10) years after the end of this research. The results of this study may be published and/or presented at meetings without naming me as a subject. Although your rights and privacy will be maintained, the Secretary of the Department of Health and Human Services, the East Tennessee State University/V. A. Medical Center Institutional Review Board, the Food and Drug Administration and the East Tennessee State University's Department of Educational Leadership and Policy Analysis in the College of Education have access to the study records. My records will be kept confidential according to current legal requirements. They will not be revealed unless required by law, or as noted above.

COMPENSATION FOR MEDICAL TREATMENT:

East Tennessee State University (ETSU) will pay the cost of emergency first aid for any injury which may happen as a result of your being in this study. They will not pay for any other medical treatment. Claims against ETSU or any of its agents or employees may be submitted to the Tennessee Claims Commission. These claims will be settled to the extent allowable as provided under TCA Section 9-8-307. For more information about claims call the Chairman of the Institutional Review Board of ETSU at 423-439-6134.

VOLUNTARY PARTICIPATION:

The nature, demands, risks, and benefits of the project have been explained to me as well as are known and available. I understand what my participation involves. Furthermore, I understand that I am free to ask questions or withdraw from the project at any time, without penalty. I have read, or have had read to me, and fully understand the consent form. I sign it freely and voluntarily. A signed copy has been given to me. Your study record will be maintained in strictest confidence according to current legal requirements and will not be revealed unless required by law or as noted above.

SIGNATURE OF VOLUNTEER   DATE

SIGNATURE OF PARENTS OR GUARDIAN   DATE

SIGNATURE OF INVESTIGATOR   DATE

SIGNATURE OF WITNESS   DATE

Page 3 of 3
Participant initials_____
Principal Investigator: Douglas Eugene Masini
Title of Project: The Accidental Expert: A Demonstration of the Existence, Utility and Emergence of Implicitly Learned

157

Survey Questions - Tacit Knowledge in Assistive-Augmentative Technology Users.

> Thank you for participating in this study! As an expert, your input will help me to
> design a study focused on different aspects of learning and knowing.
> Please answer these questions regarding **your** learning history.

I have been in my job or profession for...
Circle one: 1-5 years   6-10 years   11-15 years   16 or greater
----

I am a...
Circle one: Male   Female

List your highest degree and professional credentials here_____
_____

> The following questions relate to your own experience, ideas and opinions on
> learning and knowledge. Please answer them by **circling the number** below which
> <u>best</u> represents your opinion:

	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
1. The best way to teach is by using classroom or book learning methods.	1	2	3	4
2. The best way to learn is by field experience or 'hands-on' training.	1	2	3	4
3. Ideal learning happens only by students listening to the teacher's lecture.	1	2	3	4

> Think about how you learn; in your experience, learning can occur through:

	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
4. Hearing	1	2	3	4
5. Seeing	1	2	3	4
6. Reading	1	2	3	4
7. Tasting	1	2	3	4
8. Smelling	1	2	3	4
9. Doing	1	2	3	4
10. Talking	1	2	3	4

<u>Let's Talk About This Study And The Questions You Will Answer</u>
In this study, learners tell, in their own words, the story of how they learned different lessons. My research suggests there are at least two forms of learning; **1. concrete, conscious (explicit) knowledge** and **2. abstract, unconscious (implicit) knowledge**. Together they make us proficient, skilled and knowledgeable. Implicitly learned knowledge has also been called tacit knowledge, where people know more than they can tell (Polanyi, 1966). The severity of injuries or illness in my clients have forced me to rethink and modify my teaching methods to include new types of implicitly learned knowledge and explicitly learned knowledge. This study attempts to determine if persons using complex medical equipment think they learned more from traditional explicit methods (such as lecture, videos, rote memorization and book learning) or from implicit methods (such as hands-on experience, internship or vicarious reinforcement through observation). Learning through the senses (hearing, seeing, smelling, tasting and speech) leads to implicitly learned tacit knowledge; because this learning occurs outside of any book or lesson plan, I call these folks accidental experts. In the following cases I have asked the clients a series of questions during a lengthy interview. Your task, as an expert reviewer, is to carefully read the stories provided on the following pages. You will then score the type of learning that is revealed to you by the client's story. Look for rich details and the usefulness of this knowledge to a client. Completing the answer sheets will take approximately 15 to 30 minutes. **Below I have written the directions and they are repeated on each page; please read carefully before circling a response**.

DIRECTIONS: Reflect on the introductory training and our discussion on the differences between implicit and explicit learning and knowledge. Please circle **ONE** number on the scoring sheet for each of the three (Q) questions below that you think best indicates the type of learning (**L**) and knowledge (**K**) that is indicated. Your response to each question (circle **ONE** only) indicates your view of how you think they acquired their learning: high to low (-5 to -1) explicit learning or low to high (1 to 5) implicit learning. Your response should be the learning source or style you see used in the short story above.

	←High--------------Low	Low-------------High→
	EXPLICIT (Conscious)	*IMPLICIT (Unconscious)*
Q: The utility or usefulness	**(Please CIRCLE ONLY ONE number per Question)**	
of the L and K is…	-5 -4 -3 -2 -1	1 2 3 4 5
Q: The presence of L and K		
related to client's abilities..	-5 -4 -3 -2 -1	1 2 3 4 5
Q: The lushness or richness of		
L and K noted in details…	-5 -4 -3 -2 -1	1 2 3 4 5

In short, if you see **Learning (L)** resulting from traditional explicit learning (books, lecture, classroom discussion, videos) *circle a negative number* as to its usefulness to a client, its presence in the story, and the lushness or richness of detail. Likewise, if **knowledge (K)** is learned from the five senses and appears to you to be learned from experience, internship, observation or hands-on training experience, *circle a positive number* as to its usefulness to a client, it's presence in the story, and the lushness or rich detail seen.

CASE STUDY SAMPLE 1.

This young man suffered a traumatic broken neck and is a C-4 quadriplegic (a high spinal injury causing complete paralysis of legs and arms). His injury affects his vital signs and he is extremely unstable, ventilator dependent for his breathing, and spoke during inhalation through a special valve (the Passy-Muir,) for this interview. He is describing a situation where he became unhooked from the ventilator and the circuit became caught in the blanket, disabling his ventilator alarms (and stopping his breathing) for at least 4 minutes. His story retrospectively speaks to the appropriateness of the ventilator alarm settings and his experience while disconnected:

I was asleep in my bed and suddenly felt very cool and lightheaded, but as if in a dream. I realized I had fallen into the swimming pool and it felt very cold and wet. I was sinking to the bottom of the pool and couldn't make any noise, and no one could help me. I wasn't afraid of drowning, but I felt that I shouldn't be in the pool because my ventilator might short out, or the electric cord would be too short and pull out of the outlet. I don't think I hit the bottom, I just kept sinking and looking up at the bright, blue sky. My mother and a nurse are my attendants, but for some reason I think I whispered the name of my ex-wife, who had left me after the accident 8 years ago. I am not sure why I said her (my wife's) name, but that brought the nurse over, and she found that I had become disconnected from my ventilator with the pressure alarm disabled by the bedcovers. I was covered in sweat and very cold and clammy from the experience. It was all just a dream but at the same time very real. I wasn't afraid but I wonder, what would have happened if I had gone to the bottom of the pool? (personal communication, 2001, used with permission).

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Q: The lushness or richness of
    L and K noted in details…   -5 -4 -3 -2 -1   1 2 3 4 5

CASE STUDY SAMPLE 2.

This young man suffered a traumatic broken neck in a football injury and is paraplegic, having suffered a spinal injury that caused paralysis of both legs. After years of hard work and rehabilitation, he has gross motor function of his arms and hands with good motor function of his head and neck. He uses a motorized wheelchair and has a conversion van that allows him to drive. His injury, while affecting mobility, has allowed for a successful career: he is an aggressive spokesperson advocating client rights and independent living. The interview was held in his office, where he is serving as the executive director of a non-profit organization. In this story he is describing a common situation related to room design and layout, as well as access and egress for wheelchair clients:

I was hungry one evening and was complaining to myself about the physical environs of my dorm room, which was very wheelchair unfriendly: everything was too high, too low or plain out of my reach. I decided to snag a Snickers® candy bar that was resting just out of reach on the metal shelf of the small dorm 'fridge. The front of my wheelchair prevented me from reaching it from the front, and the side wheels of my chair prevented the door from opening at my sides. Using my razor-sharp intellect, I hypothesized that if I could exert enough force on the metal rack of the refrigerator, it had enough spring to make the candy bar do a half-gainer, fly through the air, and land where I could snag it with a coat hanger. With my coat hanger (which I deftly pulled off the back of my portable TV set) at the ready, I banged my fist on the rack, and was astonished that the bar of candy did a flip that the Olympic diver Greg Louganis would envy; the candy landed right in my lap. I had made the refrigerator rack a precision candy-bar firing mechanism, and had made the laws of nature work for me (personal communication, 2001, used with permission).

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CASE STUDY SAMPLE 3.
**This study participant learned to use his feet instead of his hands
when he was very young. He is very proficient in this skill:**

My Mother discouraged me from using my hands, but I found that they worked much
better than my hands. I was able to play with my toys, grasp things between my toes
and pick them up and dig in the dirt or sand. When I grew up I took a little grief for
this but most people think it is really neat and they wonder how I learned to do this, it
seems so amazing and impossible. It is really better for me because at this point I
have no dexterity of either my arms or my hands, when I use my feet I can type at the
keyboard or dial a phone, or even use a joystick to control my wheelchair very
effectively...I had the left foot joystick made especially for me. When someone brings a
delivery of my medical supplies, I like to impress them so I sign the bill with my foot
(personal communication, used with permission, 2001).

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CASE STUDY SAMPLE 4.
This interview is of a young female who required hemodialysis (starting at age 17) for 4 years while awaiting a successful kidney transplant. In the story below, our volunteer describes her analysis of some the side effects of hemodialysis therapy from her own unique perspective:

There was no patient training to prepare me for hemodialysis. I was told during the procedure that the dialysis machine would move water and waste products from out of my blood into a filter and then the blood would be returned to me in a 'cleaned state'. I thought I was ready for anything because I had so many surgeries, central lines and I had been stuck so often during my illness that I wasn't really afraid of the large bore needles used in this procedure...the big needles were sort of expected. But the sudden changes in my blood pressure; now I really wasn't prepared for that. You see, we have a time period (4 hours) for each patient and the clinic is really busy. In the allotted time they draw off a certain amount of fluid, using your weight before and after therapy as one indicator of the 'success' of this procedure. They also check your blood frequently, every week or so. But the primary goal always seemed to be the regular loss of fluid weight. Sometimes I would lose the fluid weight (we called it 'pulling off the weight') too quickly and my blood pressure would drop really low, so low that I would get nauseated, pale and clammy, and very light-headed. I developed sort of a knack of being able to give them a verbal clue prior to my blood pressure becoming too low, and when I said I could feel it (sometimes I'd just say 'Mom' or 'Daddy'); then the nurse would give me fluids and I would be OK. I became very assertive about the staff slowing down the pulling off of fluid and gave them heck when they threw away my red blood cells in waste tubing...Hey, I didn't have any red cells to begin with! I was able to get my diet compatible with renal failure and my hemoglobin and blood pressure became more stable; this new stability allowed me to be able to tell the staff how I wanted the waste fluid to be pulled off. After that, I did better at controlling my weight and the discomfort of hemodialysis (personal communication, 2001, used with permission).

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CASE STUDY SAMPLE 5.

The following case regards a young man with a neuromuscular disease who was ventilator dependent and was successfully weaned off of the breathing machine. In this story he is relating his experience in a large rehabilitation facility:

I knew when I was admitted to the rehab center that I would have to work really hard to get myself off of the ventilator. They (the physical and occupational therapists) worked me very hard, to the edge of my physical endurance and I am glad they did. I feel that the success I enjoy today was in large part to being pushed to the maximum while I was a patient there in (the big city rehabilitation center). The staff, from the housekeepers to the therapists and doctors and nurses, all treated me with dignity and respect, and once they got me talking and I could hear my voice talking back to them, I feel that was a big milestone towards my success. I had the opportunity to work with the respiratory therapists and they re-taught me how to cough, talk, breathe, swallow on my own efficiently and to change my tracheostomy, to ambu-bag and even suction myself if I had to. The classes I attended were great and I had a chance to study my ventilator and play with it so that I could tell my home caregivers how to adjust the settings and how to tweak it for my comfort if I was suddenly short of breath. I bet I read the manual for the T-Bird® more thoroughly than many healthcare personnel, because, hey, I had nothing but time to do what I wanted. I really wanted to get smarter but I desperately wanted that tracheostomy tube out and I wanted off of that darn breathing machine in the worst way (personal communication, 2001, used with permission).

DIRECTIONS: Reflect on your introductory training and our discussion on the differences between implicit and explicit learning and knowledge. Please circle **ONE** number on the scoring sheet for each of the three (Q) questions below that you think best indicates the type of learning (**L**) and knowledge (**K**) that is indicated. Your response to each question (circle **ONE** only) indicates your view of how you think they acquired their learning: high to low (-5 to -1) explicit learning or low to high (1 to 5) implicit learning. Your response should be the learning source or style you see used in the short story above.

<div align="center">

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Q: The lushness or richness of
   L and K noted in details...   -5 -4 -3 -2 -1   1 2 3 4 5

Thanks for taking the time to respond to this study!!! To conclude your valuable contribution to this work, please answer the following questions related to **your** own life and work experience, ideas and opinions on learning and knowledge. Please answer them by **circling the number** below which <u>best</u> represents **your** opinion:

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

Think about **your client's** learning; in your opinion, learning occurs through:

1. Talking	1	2	3	4
2. Hearing	1	2	3	4
3. Smelling	1	2	3	4
4. Seeing	1	2	3	4
5. Doing	1	2	3	4
6. Tasting	1	2	3	4
7. Reading	1	2	3	4

Think about **your** client's learning and then respond to the three questions below.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

8. The best way to learn is by field experience or 'hands-on' training.   1   2   3   4

9. The best way to teach is by using classroom or book learning methods.   1   2   3   4

10. Ideal learning happens only when students listen to the teacher's lecture.   1   2   3   4

Please note any additional comments or questions...
_____
_____
_____
_____
_____ thank you!
Please return this survey to the Doug's office in Room 122 or to...
Doug Masini, xxxxx, Bristol, TN 37620
H: *1-423-652-xxxx* **W:** *1-423-547-xxxx* eMail: *demG8RS@aol.com*
work: *masini@etsu.edu*

Appendix C. Typology of Classical Knowledge Related To Somatosensory Conduits.

KNOWING-GAINED	PERCEPTION-GAINED	ACTION/ EXPERIENCE GAINED
A divine intellect		Action consequences
	Backward cast shadow	
	Better way to live alone in enlightenment	
		Cannot step into the same river once
	Centrality of the whole	
Classical metaphor of cognition		
Cogito ergo sum		
Cognitio reflexiva		Cognitive unconscious
		Come and see
Complete clarity		
Conjoined stream of knowledge		
Cosmology		
Enlightenment		
	Esse est pricipi	
	Essential attributes	
Examination of knowing		
	Ideas and reality	
	Ideas and reality	
	Innatis instrumentis	
	Introspection	
	Introspective self-analysis	
Invisible things of God		Knowing is standing in the truth
Knowledge of world		Leader behavior
	Liberation of person	
	Logomathematical limit	
	Methodological doubts	
	Necessary knowledge	
	Perceiving	
	Perception	
	Perception	
	Personal knowing	
	Phenomenal features	
Possible intellect		Pure experience
	Rational reflection	
Reflexiveness of knowing		Rule+ Instance-based knowledge
		Sense certainty
		Sense data
		Sense experience
		Sense experience
		Stream of consciousness
		Study world; Observe + Reason
		Subjective experience
Term for Learning and Knowing		
	The eye of the soul	
	Transcendental unity of apperception	

Learners traverse a range of perception-action-experiences that is not synchronized with conscious cognition or the eye of the observer.

1. EXULTANT-MASTERY   (KNOWS-CAN DO)
2. EXPRESSIVE-SKILLED (KNOWS/CAN-DO)
3. SUPPRESSIVE (NOT SURE/CAN-DO/NOVICE)
4. REPRESSIVE (DOES NOT KNOW/CANNOT DO/TRYING)
5. DEPRESSIVE (DOES NOT KNOW/CANNOT DO/DEFEATED)

Appendix D. Interview Statements Linked to Acquisition Categories.

KNOWING-GAINED	PERCEPTION-GAINED	ACTION/EXPERIENCE GAINED
	A	M
		V
B	N	C
E		
F	X	D
		O
W	STRONG	P
R		Q
	U	
	G	
		H
	MODERATE	
		I
		J
	K	S
L		T
	WEAK	

Appendix E.
Patient Interviews and Vignettes, Pre-analysis.

A. First I learned a little about the sip-and-puff (controls) and learned how it worked…then (the staff would think of) answers and we would think of questions. Yeah, that was one way of learning the computer that I thought was pretty cool…just sitting there doing that…they set there and made you think of different shapes and things like puzzles. You'd actually have to link-up puzzles or even make up your own pieces (using the laser). Some of the (puzzles) were like old puzzles where you take each piece and put it together or move the (pieces) around like the old puzzles, where you slide the pieces until you get it straightened out.

B. When I first got the computer (an agency-supplied computer)(it was) just something to pacify my time, play solitaire, things like that…to learn a little bit. Then, some guys came from (the center)…in fact, three of them, and they set down and spent a whole day going over everything with me, giving me their 800 number. That was cool and I learned. I (also) learned a lot by reading books and then going to the Help, going through all of that on the computer.

C. The center sent me on "a mission" because there had been a complaint. They sent me to the ladies bathroom stalls in a local discount super-store. My wife made sure the coast was clear and I sneaked into the ladies bathroom …and the lady who made the complaint could not transfer from her chair to the toilet because the door was propped open by her chair and there was no privacy or dignity in that …on the other hand, it was important that it was accessible, so I told them, why don't you just remove the door, please and they just take the door off of the hinges. If it was them, and they had to use the stool, they would have fixed it. It's not that big of a thing to them because they don't have to use it.

D. …let me give you an experience story, a different way of learning. I talked to a man who used an electric wheelchair and he literally ran backwards, using the sip-and-puff, and crashed through his wall, broke the plaster, broke the sheet rock, just destroyed it. Now that is learning the hard way about how to back up your wheelchair.

E. What would I do if I were in charge of training? I would have them (a client) to get into the chair and go over all the controls with them, explain everything to them step by step right on down to plugging it up to the (battery) charger and everything, as to what kind of air pressure should be in the tires, you know, and how much air they need they should have in their (inflatable air seat) cushions, you know, just step by step instructions, one on one. You know, nothing was explained to me. It was like, okay, here's the chair you wanted and see you, bye. I had to learn everything by doing it myself.

F. …see, doctors and nurses and stuff, when they are trained, it's everything is in a guideline. This is the way we do it. You do this, you do this, and you do this. But, when you put that into use, whether it's in a hospital or in a person's home, every person is different. There is no set one certain way to do something. They teach them how to roll a patient over. I can't roll over the way they teach them, and they need to teach them to listen to the patient.

G. I remember (as a little girl…thinking) that everyone is born, but somebody (made) the comment to me that, well, the first thing you did you didn't even do right, you were born, and that really hit me hard well, (that) I did it wrong…everybody else came out okay and here, right from the beginning, I had problems and I was different. You know, even my baby pictures reinforce that…I had to sit up in an inner tube or was propped up somehow. And yeah, that made a difference…right from the beginning I had problems and I was different.

H. I found ways to take advantage of the system as far as, like, after lunch I'd take a nap in the nurse's office because I told them my doctor said I needed one…finally, a year and a half later (they) checked the records and there was no doctor's note. I told one teacher that under stress I would have a seizure, although I never had seizures. She never made me do anything in front of the class, which helped me ease along out of assignments. You may call this maneuvering, but I think it is manipulation, getting what I wanted in a way I knew would work.

I. The most important skill? I guess using my feet. Everybody was amazed that I type with them. They don't believe me, but that's why I ask them, that's, everywhere I go they say, you know, that it's physically impossible for you to have taught yourself, but…I started, I don't mean to go into stories, but…I started playing with my toys with my feet, and I developed a skill for my feet. I dig up sand with little toys. I used to try to hold a block with my toes. Yeah. I couldn't hold it between these two, but I would…Hold it like that in between both great toes…Okay, my mom didn't want me to use my feet. She wanted me to use my hands. I was discouraged in the beginning, but I didn't know what else to do.

J. I have finally gotten to where I can recline and go down the driveway slowly, I get around good (he is paralyzed completely from the neck down) visit neighbors and drive my chair to the store…once I started down my driveway to get under a shade tree one day. It was real hot. And, I got under the shade tree, but I wouldn't in the position I wanted to be…The wheels, one wheel started turning backwards and the wheelchair was out of control, so I guided it enough to headed it into the shade tree, because there is a creek right below it. I would have ended up in the creek. So, I had to holler for my wife to come and get me…luckily, I didn't go in the creek.

K. At (the center) you learned about the cane and also some other things related to energy conservation. However, I was still suffering some of the effects of the accident, suffering from a lot of pain…I had crushed ribs in both sides of my chest so I was not feeling very well. In the years since then I have just gradually remembered what I was taught in the first place.

L. Yeah, I mean, it wasn't, ah, there wasn't any training sessions or, you know, whatever you would want to call it. It was just basically, okay, here you go, this was what you wanted. I just trained myself to…judge my distance and, you know, get through the doors…I've just done that myself. The only scary part's like when you're going down the ramp, you know, it's like, ah, I hope these wheels are not going to go off the side or whatever, you know? Yeah, and it's hard to see down…You can't see what's going on…you can't see the wheels, so you've got to be able to judge your distance and know where they are. What helps is, I was a truck river for eight and a half years, and when you drive a truck you learn to judge your distance.

M. I am an individual; I am a mother, a female, a wife. I have done this and that, and I have cerebral palsy, but it is not the first on the list…but it is on the list because it is a very important thing. I have to be a good salesman, have good salesmanship skills because in the first there minutes I have to sell them on the fact that I am okay and they are not going to catch my disability, and then that I know what I am talking about.

N. I will not do arm pits…I will not do pits. That is, when somebody opens the door and then they lean over holding the door, you know, you have to go under. Well, God only knows what is going to fall out of their armpit on to your head. I am trying to teach them to go out and hold the door…it is safer for them and I won't run over their toes…and it is physically easier for them, safer for them and easier for me.

O. And, then they tried the method of using the slide board, the transfer board. Well…that didn't work, because I couldn't balance or nothing, you know. And, it was like each person that would come in to do anything or to help me had their own methods of doing things, and this was going to work no matter what. We don't care what we break, we're going to get you over there. You know, and I'm saying, well, this won't work…anyway this little old woman decides, now they had three other nurses coming to help me, you know, to transfer back to bed. Well, this woman decides she can do this on her own before they get there, and I'm telling her, lady, this won't work. You can't do that. She goes ahead and tries to jerk me out of there and put me in the bed. Where do I end up, in the floor. And, then she starts apologizing. It's a little late then, and I run upon that everyday, you know, right here. People think just because you're handicapped you're stupid, or they think just because you're handicapped, you know, that you're paralyzed that you don't

have feelings, you can't feel nothing. That's not true. I have feelings. I have sensation from head to toe. There was a time that I didn't have, but thank God I do now.

P. People still associate, just because you're in a wheelchair, that you can't feel nothing...in several different ways. I've been dealing with that 30 years, too. I'd take (her) to a restaurant. They'd look at me and ask me 'What does she want to eat'? I'd say ask her, don't ask me, ask her...that happened (with me) and also with (my) wife...that had polio. You know, that's something that's, unfortunately, has not changed in, I guess ever since time began.

Q. Well, I love to work in the garden...I like that a lot...right now it's been raining a lot, and it would be very good to start weeding. I have a lot of weeds in my yard, and if I can get there, I can work all day weeding. I start out the first thing in the morning, put the brakes on my wheelchair and then gradually work my way down the driveway to the back yard, which is shaded all afternoon, and then I can weed in the back yard all afternoon because it's shady, and I'm cool enough to keep going. So, you just sort of have to start with where the sun is and....work my way back there on my knees, staying in the shade.

R. ...when my kidneys failed, they put me on hemodialysis, which really you do not (participate in). I had no control over the hemodialysis. I went to the hospital and they did the treatments. The only thing with hemodialysis that... I had to learn was to gauge my own blood pressure. And, it was mainly to gauge whether it was too low, and I would tell that it was low by just, I could feel that I was becoming lightheaded because they were pulling...so much fluid off at one time. I learned to say 'Mom' and my Mother knew to put my head down automatically and tell them to run the fluids... And, (we) would...tell the nurses that I was feeling lightheaded, and they would check the blood pressure instantly and find out...that I had a very low blood pressure.

S. Oh yeah, a transfer bench, right. Well, I got one about a year and a half ago, and the stupid thing broke and the agency, they said they couldn't get another one for five years. And, they're $200.00, I think...the thing across the leg broke...it actually broke. Well, that's pretty silly, they are practically disposable. So, a friend had to give me hers, and that's how I got most of my equipment, my living equipment I call them. My friends have to give me my living equipment...

T. I knew this young girl with spina bifida and paraplegia...well, her school calls me and says she was cited in the school hall for excessive speed and recklessness, she crashed and wasn't wearing a seatbelt and was thrown out of the chair...she was OK. The professional in me said "I'll get after her about

that" but a side of me said "This is so vital...after all of the hardship, she is getting her vigor and her life back..."

U. I was asleep in my bed and suddenly felt very cool and lightheaded, but as if in a dream. I realized I had fallen into the swimming pool and it felt very cold and wet. I was sinking to the bottom of the pool and couldn't make any noise, and no one could help me. I wasn't afraid of drowning, but I felt that I shouldn't be in the pool because my ventilator might short out, or the electric cord would be too short and pull out of the outlet. I don't think I hit the bottom, I just kept sinking and looking up at the bright, blue sky. My mother and a nurse are my attendants, but for some reason I think I whispered the name of my ex-wife, who had left me after the accident 8 years ago. I am not sure why I said her (my wife's) name, but that brought the nurse over, and she found that I had become disconnected from my ventilator with the pressure alarm disabled by the bedcovers. I was covered in sweat and very cold and clammy from the experience. It was all just a dream but at the same time very real. I wasn't afraid but I wonder, what would have happened if I had gone to the bottom of the pool.

V. I was hungry one evening and was complaining to myself about the physical environs of my dorm room, which was very wheelchair unfriendly: everything was too high, too low or plain out of my reach. I decided to snag a Snickers® candy bar that was resting just out of reach on the metal shelf of the small dorm 'fridge. The front of my wheelchair prevented me from reaching it from the front, and the side wheels of my chair prevented the door from opening at my sides. Using my razor-sharp intellect, I hypothesized that if I could exert enough force on the metal rack of the refrigerator, it had enough spring to make the candy bar do a half-gainer, fly through the air, and land where I could snag it with a coat hanger. With my coat hanger (which I deftly pulled off the back of my portable TV set) at the ready, I banged my fist on the rack, and was astonished that the bar of candy did a flip that the Olympic diver Greg Louganis would envy; the candy landed right in my lap. I had made the refrigerator rack a precision candy-bar firing mechanism, and had made the laws of nature work for me.

W. My Mother discouraged me from using my hands, but I found that they worked much better than my hands. I was able to play with my toys, grasp things between my toes and pick them up and dig in the dirt or sand. When I grew up I took a little grief for this but most people think it is really neat and they wonder how I learned to do this, it seems so amazing and impossible. It is really better for me because at this point I have no dexterity of either my arms or my hands, when I use my feet I can type at the keyboard or dial a phone, or even use a joystick to control my wheelchair very effectively...I had the left foot joystick made especially for me. When someone brings a delivery of my medical supplies, I like to impress them so I sign the bill with my foot.

X. I knew when I was admitted to the rehab center that I would have to work really hard to get myself off of the ventilator. They (the physical and occupational therapists) worked me very hard, to the edge of my physical endurance and I am glad they did. I feel that the success I enjoy today was in large part to being pushed to the maximum while I was a patient there in (the big city rehabilitation center). The staff, from the housekeepers to the therapists and doctors and nurses, all treated me with dignity and respect, and once they got me talking and I could hear my voice talking back to them, I feel that was a big milestone towards my success. I had the opportunity to work with the respiratory therapists and they re-taught me how to cough, talk, breathe, swallow on my own efficiently and to change my tracheostomy, to ambu-bag and even suction myself if I had to. The classes I attended were great and I had a chance to study my ventilator and play with it so that I could tell my home caregivers how to adjust the settings and how to tweak it for my comfort if I was suddenly short of breath. I bet I read the manual for the T-Bird® more thoroughly than many healthcare personnel, because, hey, I had nothing but time to do what I wanted. I really wanted to get smarter but I desperately wanted that tracheostomy tube out and I wanted off of that darn breathing machine in the worst way.

Appendix F. Auditor's Report

Mr. Douglas Masini asked me to serve as auditor for his qualitative and quantitative study. Our initial discussions centered on topics such as study design, potential pitfalls, the interview process, the possibility of personal bias, and collection and management of data. Discussions after the initial meeting occurred in both formal meetings and informal contacts such as short meetings between classes or by electronic mail.

This study progressed and our conversations migrated from study design to the initial findings in the interviews and comments of the study participants. Mr. Masini had established an epochè (a mechanism for the researcher to establish a priori bias prior to embarking on a phenomenologic study) during internship and he shared his ideas about what participants meant by their statements and how tacit knowledge was emerging from the narrated interview.

I had ample opportunity to evaluate the vignettes, the instruments proposed by Mr. Masini, the rough drafts of the chapters and the outcomes of the study. I made suggestions for clarification and asked questions to determine how the researcher had reached stated conclusions. The researcher's strong belief in the presence and utility of tacit knowledge was discussed; I am sure that this issue was considered throughout the study.

Mr. Masini was well-organized, focused, and meticulous in his approach and presented supporting evidence for conclusions reached. Discussions with the researcher about this study and the involved participants led me to believe that the research was conducted ethically with no breech of confidentiality.

I enjoyed working with Mr. Masini on this project and found the topic to be interesting and of importance to the education and allied health fields. I believe that the completed study will add to the body of knowledge on implicit learning and tacit knowledge.

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Appendix G. Peer Debriefer's Report

Doug Masini asked that I serve as the peer debriefer of his phenomenological study. Early in the development of the study, Doug decided that he would establish what he calls "thematic credibility" with the addition of a quantitative analysis of a survey of experts in the field of assistive-augmentative technology. My service consisted of listening to the tapes and comparing it to the content of the transcribed data, in particular assisting Doug with the development of the flow of the study. Doug wanted to tie the rather strenuous reviews of the literature into the daily experiences of the participants. This effort has produced a work that is interesting yet rigorous regarding both research worldviews; a relativist framework is established for the existence, utility, and emergence of implicitly learned tacit knowledge, and the positivist view is satisfied with the analysis of the expert survey data. I believe Doug guarded the anonymity of the participants and that their confidentiality was assured by several layers of protective mechanisms. I enjoyed working with Doug on this study and look forward to future collaboration with him in his role of assistant professor.

Robert G. Stewart

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VITA

DOUGLAS EUGENE MASINI

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