Transformative learning theory: a neurobiological perspective of the role of emotions and unconscious ways of knowing

EDWARD W. TAYLOR
PennState Harrisburg, Pennsylvania, USA

Transformative learning as explained by Mezirow in the field of adult education has been criticized as a process that is overly dependent on critical reflection, such that it minimizes the role of feelings and overlooks transformation through the unconscious development of thoughts and actions. This paper further substantiates these concerns by exploring the emotional nature of rationality and unconscious ways of knowing (implicit memory) from the field of neurobiology and psychology and offers a physiological explanation of the interdependent relationship of emotion and reason and the role of implicit memory in transformative learning theory. Recent research not only provides support that emotions can affect the processes of reason, but more importantly, emotions have been found to be indispensable for rationality to occur. Furthermore, brain research brings to light new insights about a form of long-term memory that has long been overlooked, that of implicit memory, which receives, stores, and recovers outside the conscious awareness of the individual. From implicit memory emerges habits, attitudes and preferences inaccessible to conscious recollection but these are nonetheless shapes by former events, influence our present behaviour, and are an essential part of who we are. Finally, based on these new insights for fostering transformative learning is discussed, revealing the need to include practices inclusive of 'other ways of knowing,' and more specifically, from the study of emotional literacy and multiple intelligences.

Introduction

There has been a notable increase of scientific studies published over the last decade on the subject of neurobiology—life sciences that involve the anatomy, physiology and pathology of the nervous system (Davidson and Cacioppo 1992, Restak 1995, Pinker 1997, Gazzinger 1998). Research is bringing to light a greater understanding of how the brain processes information, co-ordinates various everyday physical and mental tasks and continues to grow and develop well into the later years of adulthood. In addition, due to recent technological developments in the health care sector, positron emission tomography (PET) and magnetic resonance imaging (MRI) allow neurobiologists to view for the first time how the brain functions. These new insights into the internal operation of the brain are even starting to have an impact on the study of adult education as well (Merriam and Caffarella 1999).

Edward W. Taylor, School for Behavioral Sciences and Education, PennState Harrisburg, Middletown, PA 17057-4898; e-mail: ewt1@psu.edu

> In the past ten years, the educational field has learned more about how the brain works than in the previous ninety years. Largely due to the convergence of neuro-science, cognitive psychology and technology, new information is possible, information that for many of us verifies the effectiveness we've enjoyed with students and at the same time radically shifts our models of instruction. (Reardon, 1999:10)

In particular, three areas of research that have received much attention from the field of neuroscience are the study of emotion and memory and their relationship to the cognitive processes of the human brain. Recent research has revealed that emotions are indispensable for rationality, such that one cannot reason without emotions or feelings (Damasio 1994, LeDoux 1989, 1998). In addition, research on memory, particularly implicit memory, which deals with nonconscious cognitive processing of past experience, reveals that a great deal of learning takes place outside our working memory and has a tremendous influence on how we look and act in the world (Kihlstrom 1987, Roediger 1990, Greenwald and Banji 1995, Schacter 1996).

These new insights involving emotions and implicit memory arrive at an opportune time in the ongoing research and debate about Mezirow's (1991, 1995) transformative learning theory and the role of critical reflection. Recently, a review of related empirical studies in the field of adult education revealed a transformative process that is not just rationally driven and overly dependent on critical reflection, but in addition relies significantly on the exploration and resolution of feelings (Taylor 1997a, 1998). Moreover, several studies reviewed demonstrate that meaning structures were altered on a nonconscious level outside the awareness of the individual, without deliberate rational examination of assumptions (critical reflection), either by introspection or by rational discourse with others of differing viewpoints. Despite the significance of these empirical studies, their methods, particularly qualitative ones, are limited in providing an in-depth explanation about the nature of emotions and implicit memory (nonconscious cognitive processes) and the role of critical reflection in transformative learning. Study participants are generally unable to verbally explain a phenomenon that operates on a nonconscious level. However, recent research in the area of neuroscience and psychology offers a new perspective from which to critique transformative learning theory by discussing the complex relationship that exists between feelings and reflection, as well as provides a plausible explanation of how meaning structures could change outside the focal awareness of the individual (Taylor 1996, 1997b). Therefore, the purpose of this paper is threefold:

- to describe, from a neurobiological perspective, the interdependent relationship that exists between emotion and reason and how it informs transformative learning theory and critical reflection;
- to describe the nature of implicit memory based on contemporary research in psychology and neurobiology and how it contributes to a greater understanding of nonconscious cognitive processes; and
- to explore the implications that emotions and implicit memory have for the fostering of transformative learning.

This paper extends from a different perspective what was initiated by earlier critiques of transformative learning theory (Ekpenyong 1990, Clark and Wilson 1991, Cunningham 1992, Newman 1996, Tennant 1993), that of its over-reliance on critical reflection and rationality.

Transformative learning: learning as rational and conscious

Since 1978 the theory of transformative learning, as defined by Mezirow from his study of women returning to school, has stimulated much discussion in the field of adult education. Transformative learning is 'the social process of construing and appropriating a new or revised interpretation of the meaning of one's experience as a guide to action' (Mezirow 1994: 222–223). The process of making meaning is shaped and circumscribed by meaning structures. It is the revision of meaning structures from experiences that is addressed by the theory of perspective transformation. Critical reflection is seen as essential to transformative learning, and is the conscious and explicit reassessment of the consequence and origin of our meaning structures (e.g., our orientation to perceiving, knowing, believing, feeling and acting).

> [It] is a process by which we attempt to justify our beliefs, either by rationally examining assumptions, often in response to intuitively becoming aware that something is wrong with the result of our thought, or challenging its validity through discourse with others of differing viewpoints and arriving at the best informed judgment. (Mezirow 1995: 46)

Of the empirical studies that explored transformative learning and critical reflection, many concur with Mezirow on one level, that critical reflection is important to transformative learning. However, on another level some studies find critical reflection granted too much importance, a process too rationally driven, that overlooks the role of feelings and emotions (Taylor 1997a, 1998). Criticism of Mezirow's over-reliance on rationality has led to several studies that have demonstrated the essentiality of feelings of 'other ways of knowing' in transformative learning. These studies refer to their significance, in ways such as intuition (Brooks 1989), affective learning (Clark 1991, Scott 1991, Sveinunggaard 1993), the guiding force of feelings (Hunter 1980, Taylor 1994) and whole person learning (The Group for Collaborative Inquiry 1994). Sveinunggaard (1993: 278), in a recent study exploring the role of affective learning in a transformation, found that participants could not act on cognitive learning until they had engaged in 'learning how to identify, explore, validate, and express affect'. These studies clearly show that the emphasis on rationality is disproportionate, and much more attention needs to be given to the emotional nature of transformative learning.

In addition to the lack of recognition of emotions and feelings in relationship to critical reflection, other studies have shown that some participants who experienced a perspective transformation responded to the initiating disorienting dilemma with little or no questioning of their values and assumptions (Hunter 1980, Taylor 1994). Instead of critically reflecting on their experience, they seem to respond with unmediated perception, trusting their reaction of direct

apprehension and sensory understanding, whereby the process of transformation takes place on an implicit level, outside the awareness of the individual. Taylor (1994) found, in a study on the learning process of intercultural competency, that some participants living in a second culture showed little conscious connection between their cultural disequilibrium (culture shock), possible learning strategies, and their change towards competency. Instead of critical reflection, they preferred thoughtful action and an experiential approach to learning. In addition, there seemed to be little questioning of the validity of presuppositions of prior learning experiences from their primary culture. 'The nonreflective participants expressed that thinking about the problem would only slow them down. They had a strong need to take immediate action in response to their intercultural challenges' (Taylor 1994: 204).

This minimization of in-depth reflection in relation to transformative learning is also seen in studies by both Scott (1991) and Elias (1993) whose participants were involved in social transformation. They found that the power of the unconscious was not recognized in transformative learning theory. More specifically, Scott (1991: 240) identified the power of the collective unconscious as a stronger force than 'rational assumptions or self interest' and in Elias' study, it meant discovering the irrational and developing life's direction through visions and dreams. These studies show that transformative learning is not just rationally and consciously driven, but incorporates a variety of extrarational and nonconscious ways of knowing for revising meaning structures.

All things considered, the emphasis on rationality, particularly critical reflection, is imbalanced and much more attention needs to be given to both the roles of emotions and implicit memory in the transformative process. Despite the significant insight that the previously mentioned studies reveal about the role of emotions and the nonconscious play in transformative learning, they are limited in describing their intricate relationship with rationality. This is especially the case when it comes to participants' descriptions of their cognitive processes (Fang 1996). It is very difficult for people to identify accurately emotions, reasoning processes, and their connection to each other, particularly since much of it happens on a tacit level. However, recent research in the field of neurobiology and psychology brings to light an explanation of the interdependent relationship that exists between reason and emotions and how decision making can occur outside one's conscious awareness.

Emotion and rationality: a physiological perspective

In the field of neurobiology, reason, which is the basis for rationality, has been traditionally perceived as a high order function located in the neocortical area of the brain (grey matter) operating as a single system, a process based on valid rules of inference like rules of grammar (Johnson-Laird and Oatley 1992). In contrast, emotions (feelings representative of distinctive psychological and biological states) have been viewed as low order functions, separate from reason, located in the subcortical structures (inner layer), apart of the limbic system of the brain. When discussing cognitive processes, emotions are often omitted, considered too elusive, despite their qualifying nature in the process of reason (Damasio 1994).

Historically, this hierarchical relationship between emotions and reasoning goes as far back as Descartes, who had a dualist notion of the body and the mind and classed emotions as perceptions of events inside the body. He argued a 'separation of the most refined operations of the mind from the structure and operation of a biological organism' (Damasio 1994: 250). William James (1890) continued in this direction, explaining that emotions are the result of a perceived bodily change in response to a stimulating event. As an individual perceives the event it produces a somatic change and, in turn, this change flows back to the brain and gives rise to a feeling about the stimulus. The feeling is the emotion. As brain research became more sophisticated, Cannon (1931) criticized James, arguing that bodily changes were too slow and not specific enough to account for emotional experiences. Furthermore, he argued, based on research with cats, the brain possessed a special system known as the hypothalamus for processing emotions.

Papez (1937) extended Cannon's work, by postulating an emotional system, a circuit theory in the brain involving the subcortical structures of the brain (e.g. hypothalamus, anterior thalamus, cingulate gyrus and the hippocampus). He believed that external sensory signals were routed to the hypothalamic centre where they acquire significance and expression (Gainottie et al. 1993). In 1952 Maclean extended the work of Papez, by arguing the existence of a triune brain theory. He purported that due to evolutionary needs the brain developed more or less separate functions, that of the reptilian brain (survival and maintenance of the human body), limbic brain (emotions) and the neocortex (reason, logic and creativity). Important to this paper is the limbic system (the middle structure), which McLean saw as 'a group of phylogentically old cortical structures located in the medial walls of the cerebral hemisphere...forming an integrated neural system involved in the mediation of all aspects of emotion' (cited in LeDoux 1989: 268–269). This view of a unified system of emotions separate from cognition and less evolved dominates to this day despite little evidence for:

- the evolutionary concept on which the limbic system was built;
- that it operates as a singular system; and
- that the hippocampus (located in the limbic area of the brain) is more involved in emotional functions than other cognitive processes. (Damasio 1994, LeDoux 1989).

Contemporary research is revealing a more integrated relationship between the physiological process of cognition and emotion. LeDoux (1989, 1998) argues that cognition and emotion are mediated by separate and interacting systems of the brain. Emotions reside predominantly in the subcortical structures of the brain, but have an interdependent relationship with the neocortex in managing the cognitive process of the brain. Parrot and Schulkin (1993) go even further and argue that the continued separation of emotions from cognition perpetuates the belief that emotions are less complex and primitive. Instead emotions should be recognized as inherently cognitive, because research shows that 'emotions anticipate future needs, prepare for actions, and even prepare for thinking certain types of thoughts' (1993: 56). The functions of emotions are seen more and more as filling the 'gaps left by 'pure reason' in the determination of action and belief...' (De Sousa 1991: 195). Damasio (1994: 139) sees 'the essence of emotion as the collection of changes in body state that are induced in myriad organs by

nerve cell terminals, under the control of a dedicated brain system, which is responding to the content of thoughts relative to a particular entity or event.' He argues that there are a collection of systems in the human brain that are dedicated to goal-oriented thinking processes (e.g. reason and decision-making) with a special emphasis on the social and personal domain. Damasio (1994: 71) has identified a region (apart of the limbic system) 'where the systems concerned with emotion/feeling, attention, and working memory interact so intimately that they constitute the source for the energy of both external action (movement) and internal action (thought, animation, reasoning).'

A possible physiological explanation of how emotion and reason intersect can be explained through an actual event, such as, making a decision about which job offer to take. The process begins with a conscious deliberation and evaluation of verbal and nonverbal images (mental dispositions) that an individual holds about the various job offers. The mental images are formed by a collection of separate topographical representations in different sensory cortices (visual, auditory, language [temporal], etc.) of the brain. On a nonconscious level the prefrontal cortex (front and outer layer of the brain) automatically responds to signals arising from the processing of the different images from subcortical structures (e.g. amygdala and anterior cingulate). These responses emanate from acquired dispositional representations, knowledge pertaining to the pairing of certain situations (job offers) with certain emotional responses. Also activated by these images are autonomic systems generating reactions of internal organs and the motor system of the skeletal structure creating facial expression of the related emotion. It is the changes initiated by the chemical processes that have a major impact on the style and efficiency of cognitive processing, ultimately influencing the decision regarding which job offer to choose. In essence, emotions provide a valence to the various decisions related to the different choices of jobs helping prioritize the decisions, much of which takes place on a nonconscious level.

A traditional view of rationality, reason or formal logic assumes that decision-making devoid of emotions and unencumbered by passions will provide the best available solution for a problem. However, without emotions rationality cannot work. Purely objective reasoning results in an endless listing and exploration of various options, the need for perfect mental models, and an inordinate amount of time and memory capacity: 'No logic determines salience: what to notice, what to attend to, what to inquire about. And no inductive logic can make strictly rational choices' (de Sousa 1991: 192–193).

There is also another problem: we know too much. When reasoning, how is one able to access knowledge and ignore what is not relevant? In large measure, it is emotions that limit what the brain will take into account, determined by patterns of salience (value) from the choices and options of almost limitless possibilities. Emotions establish the agenda for desires and beliefs. They are metaphorically the equivalent of judgements, determining the criteria of how we view the world. Emotions can be understood as 'guiding the process of reasoning—or distorting them, depending on the describer's assessment of the appropriateness' (de Sousa 1991: 197). Without emotion, individuals are unable to co-ordinate their behaviour, respond to emergencies, prioritize goals, prepare for proper action and make progress towards goals—incapable of filling the gaps often found in the slow and error-prone process of objective rationality (Johnson-Laird and Oatley 1992).

Research in the area of brain pathology, specifically about patients who have experienced neurological disease and trauma to the prefrontal cortex, add support and clarity to the nontraditional relationship of emotions and reason (Damasio 1994, Gardner 1983). Despite their intact intelligence and apparent cognitive abilities these impaired individuals regularly make self-destructive decisions in their lives and obsess endlessly over the simplest decision. This inability to think rationally, reason and decide, is due to a view of life that takes on grey neutrality, devoid of necessary emotional memory and learning. Two types of experiments, skin conductant and gambling, carried out with both prefrontal damage patients and patients with no brain pathology, provide clarity of the emotional nature of rationality. Skin conductant experiments (electrodes connected to the skin and to a polygraph machine) involve measuring the autonomical responses to a succession of slides (pictures of bland scenery patterns with randomly interspersed slides of disturbing images). When prefrontal damage patients were compared to patients with no damage, prefrontal patients failed to generate any sensory response whatsoever to the disturbing images, even though on a cognitive level they were able to describe the differences found among the slides.

Gambling experiments involve playing a game of cards between the researcher and the patient where few rules of how the game is played are shared with the patient. As the game evolves the patient is to develop an understanding of the pattern of the game. The game, in essence, reflects real time factors in punishment and reward (loss or gain of money), encourages the patient to find a pattern of advantage, poses risk and offers options, but the researcher does not tell the patient how or what or why to choose particular cards. The experiment is full of uncertainty and the only way not to lose money is to generate rational possibilities and estimate odds. The prefrontal lobe patients responded in direct contrast to the patients with no damage by continually losing money in these experiments even though on a cognitive level they knew which deck of cards were more risky. When combining skin conductant and gambling experiments, the intent was to look for patterns of autonomic responses during an actual game. Findings reveal that over time normal patients demonstrated a learned response to negative and positive experiences, and in an anticipatory fashion attempted to choose what would or would not be a good move as the game progressed. However, prefrontal patients showed no anticipatory response, and were unable to develop salient patterns (values) of predictions of negative or positive future outcomes (Calvin and Ojeman 1994, Damasio 1994). In essence, without the emotional value that gives salience to positive and negative decisions, people are unable to reason. This research reveals a view of rationality that evolves from multiple systems, both high and low order functions, working in collaboration with each other and where emotions are seen as essential and interrelated in the process of decision-making.

Recently research has gone a step further through the use of dynamic brain imaging techniques (e.g. positron emission tomography (PET)) to explore cerebral blood flow while the participant is involved in different experimental tasks. Blood flow has been shown to increase while performing specific emotional tasks and decrease while doing cognitively demanding tasks in areas of the brain implicated in emotional processing (e.g. the amygdala). Conversely, this is true for areas in the brain that are implicated in cognitive processing tasks, such as the prefrontal

cortex. The observations analysed in this study indicate 'that during some mental operations, a reciprocal relationship exists between local cerebral blood flow changes in areas specialized for processing negative emotions and those specific for other cognitive processes, provide insights into a neural basis for interactions between cognition and emotion' (Drevets and Raichle 1998: 379).

These recent neurobiological findings offer support for earlier studies on transformative learning theory that found feelings integral to the process of a perspective transformation and recommend they be given equal attention as critical reflection and rational discourse. For example, Neuman's (1996: 460) two year longitudinal study on the development of critical reflection in a leadership programme found that a prerequisite to developing a critical reflective capacity (critical reflection and critical self-reflection) was 'acquiring the ability to recognize, acknowledge and process feelings and emotions as integral aspects of learning from experience'. Further, it is feelings that are often the trigger for reflective exploration, and by exploring one's feelings, greater self-awareness and change in meaning structures occur. Neuman found that despite the fact critical self-reflection often involved intensive emotional experiences (e.g. the grieving of the loss of old meaning structures and acquiring of new ones), it was feelings that provided the guidepost for critical reflection leading to more substantive self-reflection. This conclusion seems consistent with the previously mentioned neuroscience description of the role of feelings, that of creating patterns of salience among various thoughts and assumptions, determining what will and won't be reflected upon, and guiding or distorting the process of reasoning. The outcome of this emotional exploration in conjunction with critical reflection leads to greater self-trust, inner strength, and feelings of courage.

By recognizing the interdependent relation of feelings and critical reflection there are significant implications for fostering transformative learning. These implications will be discussed in the last section of this article. In addition, as we will see in the next section, transformative learning is a process that can operate on an implicit level, less dependent on the conscious act of reasoning and rationality.

Implicit memory and rationality

As mentioned in the previous section, transformative learning has long been seen as a consciousness and rational process towards change in perspective. It is purported to be highly dependent upon the centrality of experience, rational discourse and critical reflection. However, recent research reveals a process of transformation independent of critical reflection, whereby there is a nonconscious development of thoughts and actions such that 'meaning structures may become altered outside the participant's focal awareness' (Taylor 1997a: 171). This learning that takes place implicitly provides insight into transformative learning theory, revealing a process less dependent upon the conscious act of reasoning and logic, and similar to understanding the role of feelings and emotions. However, like the research on feelings and transformative learning, the present research designs are inadequate at explaining the process of change that takes place on an implicit level. By exploring research on memory from the field of psychology and neurobiology insight into the process can be gained.

In psychology the classical model of human cognition saw consciousness as higher mental processes made up of explicit memory (e.g. declarative). Consciousness was the cognitive staging area that held memories, precepts and actions for attention and rehearsal. On the other hand nonconscious mental life, implicit memory (e.g. nondeclarative), was seen as only involving latent memory traces and early pre-attentive processes, such as feature detection and pattern recognition and had little influence on conscious experience, thought and action. The unconscious was indicative of products of the perceptual system that were unrehearsed and memories lost from short-term memory due to a lack of processing or decay before they were stored in long-term memory. There was little or no appreciation for the significance of implicit memory in its influence on consciousness (Squire *et al.* 1993).

Recent research in long-term memory has changed this classical view of implicit memory. Our understanding has moved from a rather monolithic view of long-term memory to one that is less hierarchical, involving several different kinds of memory systems, each playing a significant role in defining who we are as a person (Squire *et al.* 1993). One part of the long-term memory system is explicit (declarative) and conscious, indicative of two types of memory, episodic (autobiographical) and semantic (general knowledge about the world). In declarative memory individuals are consciously aware of the storage and retrieval of information. Although this system of long-term memory is more sensitive and prone to interference, it is also invaluable, providing the ability for personal autobiography and cultural evolution (Johnson and Hasher 1987). A second system, which is the focus of the latter half of this paper, is implicit (nondeclarative) memory, which involves the nonconscious development of thoughts and actions. Implicit memory of experiences can be received, stored and recovered without the participation of the limbic system and outside the conscious awareness of the individual. These memories seem to be long term, consistent and reliable, and provide an array of nonconscious ways to respond to the world. From implicit memory emerge habits, attitudes, emotions and preferences inaccessible to conscious recollection but they are nonetheless shaped by former events, influence our present behaviours, and are an essential part of who we are (Roediger 1990, Schacter 1996).

Research in the area of psychology and neurobiology, particularly working with amnesia patients, has begun to identify several forms of implicit (nondeclarative) memory, dependent upon a variety of neurological systems (Roediger 1990, Squire *et al.* 1993, Schacter 1996). These tentative forms involve the learning of procedural and category-level knowledge, learning through conditioning and priming. Procedural knowledge is skills and habits, inclusive of perceptual and cognitive abilities, which research has shown can be learned and improved upon outside one's focal awareness. Existing neural evidence suggests that skills and habit learning are less dependent on declarative memory and don't involve the same brain structures. For example, research with amnesia patients showed that they could 'learn some complicated rule-based strategies required to solve certain mathematical problems or puzzles' and 'have no recollection of ever learning the various tasks' (LeDoux 1998: 195).

A second form of implicit memory is category-level knowledge, which is the ability to classify information based in natural categories (e.g. plants and animals) and for example the implicit acquisition of rules often found in grammar. Grammar is a particularly good example of implicit memory, where people have

acquired abstract rules, but are unable to articulate what guides their speech and writing. This category of knowledge has also been shown to operate independently of declarative memory (explicit) and is another indicator of a separate brain system involving memory (Squire *et al.* 1993).

A third form of implicit memory is conditioning, learning a simple conditioned response, which is best understood in relation to emotions such as fear, where people's actions in dangerous situations are often based on nondeclarative thought. Also, research with amnesia patients found 'participants exhibited progressive learning and 24 hour retention of a conditioned eyeblink response, despite inability to describe the apparatus or what it had been used for' (Squire *et al.* 1993: 477). This means that conscious awareness of certain knowledge is not necessary for conditioning to occur and that learning can take place on an implicit level. In essence, memories are stored directly in these areas and bypass the typical retrieval and storage mechanisms that are used for declarative memory.

An interesting story that brings this phenomenon to light is of an amnesia patient written about in the early part of this century. A French physician, Edouard Claparede, is working with a patient that has lost her ability to create new memories. Each time he sees her he has to introduce himself, because she has no memory of having seen him before. One day he tries an experiment as he enters her room, greeting her as he always does by extending his hand. She responds in fashion by shaking his hand as if she is meeting him for the first time. However, this time when they clasp hands Claparede pricks her with a tack that he has concealed in his hand. When he returns to the room next time, she demonstrates no recognition of him like before, but this time refuses to shake his hand. Further, she is unable to tell him why she would not shake his hand. This story brings to light the nature of conditioned responses as a form of implicit memory. 'The learning that occurs does not depend on conscious awareness, and once the learning has taken place, the stimulus does not have to be consciously perceived in order to elicit the conditioned emotional responses' (LeDoux 1998: 182).

The fourth form and the most researched memory phenomenon in the study of implicit memory is priming (Schacter *et al.* 1993, Squire *et al.* 1993, Schacter 1992, 1996). Priming is the 'facilitated ability to identify, or make judgements about, target stimuli as a consequence of a recent exposure to them' (Schacter 1992: 1113). In essence, amnesia patients could be influenced by recent experiences that they failed to recall consciously. A typical experiment involves a list of words, pictures or novel objects, which are viewed by the research participants. Following this initial review, participants are tested again after a predetermined period of time with both new and old items (those previously shown). They are asked to name words or objects, to produce words from fragments or make quick decisions about new and old items. Findings reveals that 'responses are better for old than new items. Priming betters the fluency and speed by which an individual responds to a familiar stimulus (Squire *et al.* 1993). Research with amnesia patients has shown priming to be fully intact, as measured by word stem completion (several letters of a word with multiple possible completions) and perceptual identification (visual identification of various objects and pictures) (Schacter 1996). Each of these forms of implicit memory begins to create a picture of learning that not only operates as a separate system in the brain, but also has a tremendous influence over our thoughts and actions. Furthermore it operates outside our conscious awareness and ability to reflect,

and would seem like to have the potential to contribute to a transformation of meaning structures.

Much of the research on implicit memory has derived support from studies of brain-damaged patients, most significantly amnesiacs. Typically, amnesiacs are incapable of retaining knowledge of new experiences although other cognitive functions remain intact. They generally demonstrate normal performance on short-term memory tasks (e.g. recall and recognition test), but fail miserably on long-term memory tasks. Through a variety of experiments it was found that 'amnesia patients could indeed be influenced by recent experiences that they fail to recollect consciously' (Schacter 1996: 166). Much of this influence seems to occur through priming.

Schacter (1996) shares an interesting story where a patient named Barbara in her mid 20s contracted encephalitis which resulted in a loss of memory of large chunks of her personal past and much of her general knowledge of routines, facts of everyday life. Eventually she was able to learn to read and write again, but the disease left a profound amnesiac syndrome, such that she could only handle simple clerical tasks. Schachter believed that he could help Barbara by tapping into her implicit memory abilities, such as teaching her skills and knowledge to deal with everyday challenges, such as keeping a job. In particular, he used a computer that was programmed to provide a repeated portion of a programme based on the memory of the user. In essence, the computer records how many hints the amnesiac individual requires to carry out the programme. If she can't complete a particular task, cues start to appear until she correctly completes the task. Barbara was trained to file information in a computer database. After six-months of training with the priming of information Barbara was able to work effectively on the computer database system. She eventually learned over 250 different rules, symbols and codes, even though she was unable to tell anyone where, when or what she had learned. In addition, since Barbara relies heavily on implicit memory to learn complex tasks it does come with some disadvantages, such that the memory acquired through priming is found to be quite inflexible. She responds to a visual perception of commands without any in-depth comprehension, suggesting that she lacks deep understanding of the underlying concepts of how the information is filed in the computer.

Implicit memory and perspective transformation

Barbara's story, as well as the other research on the different forms of implicit memory, reveals the existence of a subterranean world of nonconscious memory that has a tremendous influence on how we think and act. It would seem quite plausible that implicit memory would also influence the transformation of meaning structures outside our focal awareness. One possible explanation for the change in meaning perspectives among the participants is understanding their implicit learning of new skills and habits and the impact it has on changing meaning structures. As mentioned earlier, skills and habits (e.g. procedural knowledge), such as swimming, sewing, or riding a bike, are often nonreflective actions that 'take place outside focal awareness in what Polanyi (1967) refers to as tacit awareness' (Mezirow 1991: 106). These skills and habits can be learned and improved upon on a nonconscious level.

A recent review of research on transformative learning revealed that some participants experienced a perspective transformation without critical reflection, such that a transformation occurred on an implicit level (Taylor 1997a, 1998). One particular study from the review, Taylor's (1993) research on the learning process of intercultural competency, offers a good example of procedural learning taking place and how it played a role in a perspective transformation. He found that when individuals attempt to live in a new culture they have to develop many new habits, such as local greetings, customs and daily routines. This circumstance is particularly the case with participants working in developing countries. They often struggle with the elements (e.g. weather, scarcity of water, insects and sanitation) on a daily basis and have to learn new ways to lessen the impact the elements have on their lives. Taylor found that several participants who experienced a perspective transformation approached their intercultural challenge in a nonreflective manner. For example, Chepe, a participant in the study, shared his experience as an American working as a former pastor in Nicaragua and Costa Rica. He described how he approached his intercultural challenges: 'I just tried to accept every situation as it was, instead of trying to think . . . Not trying to be judgmental, I think that is the most important thing not trying to be judgmental. Not thinking' (1993: 153). Another example is offered by Alima, an American ESL teacher in Burkina Faso and who like Chepe also attempted to accept things without much critical thought. When it came to dealing with the harsh environment she stated: 'I just got used to it . . . the poverty, the open sewage, stuff like that. At first it is completely shocking, then again it is so sensory, but you're used to it. Two weeks later your eye doesn't go first to the sewer, your eye goes somewhere else' (Taylor 1993: 153). Both Chepe and Alima had to learn new ways for handling many taken-for-granted routines (e.g. preparing and cooking meals, preparing for bed, going to the bathroom) from their primary culture, just to mention a few. Over time these new daily routines became habits, operating at an implicit level without provoking much thought or reflection. These patterns suggest that possibly by the very act itself of taking on and practising new skills and habits without reflection, meaning structures are altered on a nonconscious level.

This same study could also suggest support for other forms of implicit memory such as conditioning. For example, Alima and Chepe, who had recently moved to a new country, were very vulnerable to change due to the recent cultural disequilibrium in their lives. Their senses were inundated with unfamiliar stimuli and they were conditioned, with little or no thought on their own, to begin responding to events and relating to others in new and different ways. And at the same time they can't explain where, how, or why they learned these new behaviours. Through conditioning these new behaviours became habits, meaning schemes were altered and new ones were acquired. As a result of this conditioning these individuals experienced a perspective transformation and began to look at the world more inclusively than in the past (Taylor 1993, 1994).

This conclusion also seems to be supported by the outcome of a study by Hunter (1980) who looked at the transformational learning process of individuals who radically changed their nutritional beliefs and practises. She found that, in response to a personal health crisis, individuals took on a new nutritional lifestyle in an unquestioning manner. Essential to a successful change was a commitment based on faith alone with a suspension of critical facilities. On an implicit level,

possibly through regular conditioning of new habits of consumption, new meanings schemes were acquired and others were altered outside the focal awareness of the participant.

Exploring the role of implicit memory sets the stage to look further at the implications this construct has for critical reflection. Since many of these new habits, skills and behaviours are inaccessible via introspection, the role of reason and rationality (critical reflection) in relationship to implicit memory is called to question.

Implicit memory and critical reflection

As research from the field of neurobiology and psychology begins to provide insight into the change of meaning perspectives on an implicit level it also raises issues about the role of critical reflection in the fostering of transformative learning. The *Annual Review of Psychology* has noted that there has been 'a swing from interest in deliberate strategies to interest in automatic, unconscious (even mechanistic!) processes, reflecting an appreciation that certain situations (e.g. recognition, frequency judgments, savings in indirect task, aspects of skill acquisition, etc.) seem not to depend much on the products of strategic, effortful or reflective processes' (Johnson and Hasher 1987: 655). In essence, there is a need to better understand how people can demonstrate many skills, tasks and cognitive abilities without the use of specific reflective strategies and yet are unable to explain how these abilities occur and where or when they learned them.

One area that sheds further light on these phenomena is research that has explored the effect of verbal processing and reflection on memory. Studies in this area have shown that giving attention to improving memory performance through verbal processing, particularly with an intent to recall previously seen visual stimuli (faces), at times interferes with retrieval (Schooler and Engstler-Schooler 1990: 62). In a series of six experiments, it was found that 'the verbalization of a visual memory, such as a face, can foster the formation of a non-veridical (untruthful) verbally-biased representation corresponding to the original visual stimulus. Access of this verbally-biased representation can then interfere with subjects ability to make use of their intact visual code.' Many non-verbal stimuli (e.g. faces) cannot be adequately recalled in words, but can be recalled visually. Recollection in the same modality can be veridical (genuine), such that verbalizations are less likely to impair one's verbal memories. This scenario would seem to imply that greater self-understanding can occur through a variety of means (e.g. visual, somatic, olfactory), rather than just rational discourse and critical reflection, which are seen as essential to transformative learning.

Appreciating the significance of implicit memory can be further understood by recognizing additional contexts where critical reflection has found to be self-defeating. It has been 'hypothesized that contrary to conventional wisdom, introspection is not always beneficial and might even be detrimental under some circumstances' (Wilson and Schooler 1991: 181). A good example is the skills involved in riding a bicycle (procedural implicit memory) a task most of us can do easily. However, when we attempt to retrieve from memory and explain the skills involved, our automatic behaviours are disrupted. Another example involves the comparison of choices using various levels of introspection (analysing the reasons

behind the various choices). Research has demonstrated that reflecting on the reasons we make can lead to decisions and preferences that contradict expert opinion and reduce people's satisfaction with their choices. These studies 'suggest that it may not always be a good idea to analyse the reasons for our preferences too carefully' (Wilson and Schooler 1991: 191). This research does not rule out the need for introspection, but recommends that at times, an unexamined choice is worth making. It also validates trusting what you learned on an implicit level and not always resorting to critical reflection when reasoning and making decisions. Interestingly, it has been found in this same research that participants who were more aware of how and why they felt about a particular object and could easily verbalize related attributes, were more immune to the negative effects associated with introspection. This final conclusion, a major theme discussed earlier, recognizes the significance of feelings and emotions in the reflective process.

This emphasis on trusting one's implicit memory and its relationship to introspection seems to be consistent with other earlier research that encourages a more whole-person approach when fostering transformative learning. Multiple studies imply its significance in a variety of ways, such as intuition (Brooks 1989), affective learning (Clark 1991, Scott 1991, Sveinunggaard 1994), and the guiding force of feelings (Hunter 1980, Taylor 1993). The Group for Collaborative Inquiry (1994: 171) in a recent study reconceptualizing transformative learning process identified the significance of whole person learning—'awareness and use of all the functions we have available for knowing, including our cognitive, affective, somatic, intuitive, and spiritual dimensions'. In essence, the more ways of knowing we engage the easier it will be to trust what we know implicitly.

The fields of neurobiology and cognitive psychology offer much support for recent research from the field of adult education on the emotional and implicit nature of transformative learning. It seems that emotions and rationality are much more interdependent than previously understood, each acting in concert with the other in the decision-making process. Furthermore, rationality promoted through critical reflection is one means of several to promote change in perspectives. At times introspection should be de-emphasized, with greater attention and appreciation given for nonconscious ways of change. For this article, two further questions remain for discussion: what do these findings suggest for the practise of fostering transformative learning in the adult education classroom; and where will practitioners go for help in finding ways to promote 'other ways of knowing in the classroom?'

Implications in the fostering of transformative learning

At present there has been an increase in the adult education literature that offers practitioners a variety of innovative methods and techniques for fostering transformative learning in the classroom (Jamieson *et al.* 1996, Mezirow and Associates, 1990, Mezirow 1991, 1996, Cranton 1994, 1996). Despite this interest in transformative pedagogy much of the work over emphasizes methods grounded in rationality with little appreciation for the role that emotions and nonconscious ways of knowing play in transformative learning. For example, Mezirow believes that the most significant learning occurs in the communicative domain which

'involves identifying problematic ideas, values, beliefs and feelings, critically examining the assumptions upon which they are based, testing their justification through rational discourse and making decisions predicated upon the resulting consensus (1995: 58). He outlines ideal conditions for rational discourse, the teacher and student's role, and the related instructional approaches (Mezirow 1991, 1995, Mezirow and Associates 1991). This is not to say that this information isn't helpful, but rather that if feelings are so significant to critical reflection as discussed earlier, it is imperative that teachers and educators are given more guidance in how to manage the emotional nature of learning in the classroom. In addition, if critical reflection at times impedes insight and self-understanding, help is needed in facilitating transformative learning that occurs on an implicit level.

Two overlapping areas that assist in addressing this need and help balance the reliance on critical reflection, are found in the recent work promoting emotional literacy and the teaching practises offered in the study of multiple intelligences. Emotional literacy is the development of emotional intelligence where people manage their emotions well and can interpret and deal effectively with other people's feelings (Goleman 1995). The practise of emotional literacy offers adult education practitioners a new approach for improving upon the challenging practise of fostering transformative learning. It helps address the limitations of rational discourse through the promotion of emotional understanding. It is based on the premise that:

> People with well developed emotional skills are also more likely to be content and effective in their lives, mastering the habits of mind that foster their own productivity, people who cannot marshal some control over their emotional life fight inner battles that sabotage their ability for focused work and clear thought. (Goleman 1995: 36)

Emotional literacy involves promoting the following abilities:

- the ability of immediate self-awareness, recognizing a feeling as it happens, understanding the causes of feelings and being able to separate feelings from actions;
- the ability to manage the sometimes obstreperous nature of emotions, which involves more effective anger management and tolerance for frustration;
- the productive utilization of emotions which involves marshalling emotions in the service for focusing attention, self-motivation, delayed gratification and more self-control;
- the ability to empathize, reading emotions of others, reflecting their needs and wants by taking another's perspective and through active listening; and
- the ability to handle relationships, the skill in managing emotions in others. (Goleman 1995)

Another interpretation of emotional intelligence can be seen in one of Gardner's (1983) multiple intelligences, that of personal intelligence. Similar to the earlier research mentioned on brain pathology, one of his criteria for each intelligence is that it can be biologically isolated in the brain. Personal intelligence, a core capacity, means having:

> access to one's own feeling life—one's range of affects or emotions: the capacity instantly to effect discriminations among these feelings and, eventually, to label them, to enmesh them in symbolic codes, to draw upon them as a means of understanding and guiding one's [behaviour]. (Gardner 1983: 239)

Gardner believes that for people to interact appropriately with others and secure a proper place within a society it is essential that they come to understand their feelings, related responses and the behaviours of others.

Promoting emotional intelligence in the practise of fostering transformative learning includes continuing some of the same methods that Mezirow (1991) has outlined but, in addition, focuses more attention on developing emotional self-awareness, the management of emotions in one's self and others, and the building of trusting relationships. These outcomes rely on metacognitive activities that promote emotional expression and exploration through collaborative learning, conflict management, developing multiple perspectives, role-playing and peer networks (Campbell *et al.* 1992, Sylwester 1994). Furthermore, 'it is essential to establish a positive classroom environment, to recognize the range of feelings students experience, to teach appropriate methods of emotional expression, and to offer feedback on emotional [behaviour]' (Campbell *et al.* 1992: 151). It means that in the practise of fostering transformative learning, rational discourse has to include the discussion and exploration of feelings in concert with decision-making. Feelings and rationality need to be placed on equal footing, recognizing their interdependent relationship. This recommendation is consistent with the earlier discussion on Neuman's (1996) study, who found that a prerequisite for developing a critical reflective capacity rested on the ability to recognize, acknowledge and process feelings.

In addition, there is the research on multiple intelligences, which not only encourages emotional understanding but also offers other ways of knowing that have implications for implicit memory. More specifically, there are three intelligences identified by Gardner (1983) that of kinesthetic, visual/spatial, and music, that could provide avenues to learning which are less dependent on critical reflection and rational discourse. Bodily kinesthetic intelligence focuses on the ability to unite body and mind in the refinement of physical performance' (Campbell *et al.* 1992: 8). Its intent is to promote the use of our bodies in highly skilled and differentiated ways, externalizing the process of learning. Practically speaking, in the classroom, it means involving students in physical activities as means to promoting understanding of the topic under study. Activities include role-plays, modelling, art projects, games, simulations and drama just to mention a few.

Gardener's (1983: 42) visual spatial intelligence 'includes an aggregate of related skills including visual discrimination, recognition, projection, mental imagery, spatial reasoning, image manipulation, and the duplication of inner or external imagery'. In the classroom, this would involve activities that could include the demonstration and production of movies, television, slides, and the like. Also, it could include the use of visual tools such as computers, telescopes, video cameras, art projects and drafting supplies.

Musical intelligence involves the appreciation and sensitivity for 'pitch, melody, rhythm, and tone' (Gardener 1983: 42). It has also been found to have a strong connection with emotion, lending itself as a tool for creating positive learning environments. Research has shown (although preliminary) that music by Mozart when played to students actually promotes learning (Campbell 1997). Practically speaking, adult educators would: play music in the classroom based on the mood they were trying to promote, integrate music into the course curriculum, have students express their thoughts and ideas via music, and utilize available technology and software for promoting the appreciation of music (Campbell *et al*. 1992).

In addition to the ideas shared above more can be learned by exploring the brain-based learning literature found in the children and adolescent education field (Caine and Caine 1994, Sylwester 1995). This neuroscientific approach to learning has been a growing trend in the public school sector over the last 5 to 10 years. However, there is an important caveat to keep in mind when reviewing research on the brain, particularly when it purports to have implications for education. Science is only beginning to understand the processes of the brain and much of the research is very preliminary. Furthermore, researchers believe there is still a major disconnect between the established field of cognitive sciences and neuroscience, such that '...we should remain skeptical about brain-based educational [practise] and policy' (Bruer 1998: 15). This implies that the above implications for fostering transformative learning are only suggestions, based on a neuroscience connection that is only beginning to be understood and is in need of greater exploration.

Conclusion

Over 20 years ago Mezirow introduced a theory of adult learning that has had significant impact on the field of adult education. There have been numerous studies exploring its viability as an explanation of how meaning of experience is constructed, revised, and transformed. One of the most discussed debates has been its over reliance on reason and rational discourse and its lack of recognition and appreciation for other ways of knowing to promote change (Taylor 1997a). Recent research has been quite supportive of the essentiality of exploring feelings in concert with reflection in order to foster transformation. Furthermore, it has revealed that the process of change can occur outside the awareness of the individual, on an implicit level. However, the methods and explanation for these conclusions have been poorly substantiated due to the limiting nature of naturalistic research methods. By exploring research beyond the narrow confines of the adult education field, much can be learned about how transformative learning takes place. In particular, by reviewing contemporary studies from the field of neuroscience and psychology, feelings are found to be the rudder for reason, without which it wanders aimlessly with little or no bearing in the process of making decisions. Also, research on memory reveals an active and nonconscious cognitive process that has been found to have a significant influence on how we make meaning of the world around us. Furthermore, this research provides the basis for encouraging greater creativity in the practise of fostering transformative learning.

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