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A Legitimate Place for Intuition and Other A-logical Processes in Research and Hence in Reports of Research

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Given the view presented in this paper, that knowledge is "effective action" (Maturana & Varela, 1992) or "practice" (Lemke, 1995), rather than something which can be represented once and for all, I wish this to be an evolving, dialogical document, and I reserve the right to update and annotate it on my own web site

http://www.fed.qut.edu.au/staff/mste/mhanraha/pub_html/advpamh.htm

in response to discussion both prior to and during its presentation at the conference.

Abstract

I would like to propose, from a social semiotic (cf. Lemke, 1990; 1995; 1996) or ecological perspective (Maturana & Varela, 1991; 1992), that intuition, tacit knowledge, and feelings may be signs of personal and social meaning-systems which, although generally below conscious awareness, may significantly affect a researcher's work processes and meaning-making. I will argue that investigating, analysing and reporting such signs in oneself and others should enhance the resolution of inconsistencies between meaning systems and practice. They may also play a significant role in processes involved in problem solving and creativity. I believe, therefore, that they have a legitimate place in both research and research reports.

"I believe that matters of meaning and matters of social relationship are so interdependent that we must understand both to understand either." (Jay Lemke, 1995)

"La théorie, c'est bon, mais ça n'empêche pas d'exister." [Theory is well and good, but this doesn't keep things from existing.] (Advice to Freud by Charot, French psycho-analyst. (Gay, 1988, cited in Blades, 1994)

Although intuition and insight are generally admitted to play a significant part in achieving progress in research, they are not so easily admitted in the research report itself as a significant part of the reported methodology. Importantly, for my current purpose, the expectation of the purely cognitive in this form of reporting has largely set a convention for the absence of a-logical processes in reporting research in science education and indeed for science education itself. I believe that this is unfortunate and hope to show why.

I am proposing in this paper that intuitions and emotions are signs of tacit knowledge of personal and social meaning-systems which, although generally below conscious awareness, are an integral part of one's practice and meaning-making. I would like to argue that the model of learning presented in many education research reports, a model which excludes intuition, and insight and any indication of the physiological processes accompanying them, gives readers, including novice researchers, little vicarious experience of processes which may be essential for achieving insight and understanding in any area, but particularly in a social science. I believe that a change in emphasis is needed in research reports so that a-logical processes get more recognition as part of achieving understanding and cognitive change in a social science field like science education research.

I am assuming that research in education is ultimately about change with respect to teaching and learning, and I believe that there is considerable evidence that such a-logical processes may be crucial for significant conceptual change. Hence, continuing to conceive of learning as being almost entirely cognitive may prevent the optimisation of the conditions necessary for significant change. My beliefs are supported in the research literature from a number of areas, including social learning (e.g., Bandura, 1965; Vygotsky, 1966/1991), conceptual change (see Hanrahan, 1994 for a review of particular influences), and organisational change (especially Argyris & Schön, 1974, Dick, 1998; Robinson, 1993). However, in this paper, I am going to focus particularly on the literature on knowledge as the result of the adaptation process between an individual and his or her environment, backed up by the literature on insight. I also have considerable evidence from a case study of my own experience of informal writing during my PhD, but will only refer to this briefly, as it is the subject of another paper being presented at AARE 1998.

In the view of learning which I have come to hold, what is generally called the cognitive part cannot be separated from tacit knowledge, including affective and physiological processes. If these are separated an impoverished theory of learning results which does not sufficiently explain why academic learning in schools and tertiary institutions is so often poorly transferred to the world outside school, and why research often does not seem to go far enough towards helping to solve educational problems (cf. Robinson, 1993).

The two biosocial system theories which have been recent influences in my seeing things this way are Lemke's ecosocial system theory (Lemke, 1990, 1995) and Maturana and Varela's ecological system theory (Maturana, 1991, Maturana & Varela, 1992). These will be my main focus in this paper. However, part of the reason that such theories have appealed to me is because they are compatible with, but more comprehensive than most of the learning theories which have convinced me in the past, including social learning theories, conditioning theories, psychoanalytic theory, constructivism, language and literacy learning theories, humanistic, organisational, and counselling psychology theories, theories about problem solving, insight processes and expert learning, as well as theories about consciousness-raising and social change. They also tie in well with what I know about biochemistry, physiology and psychopathology.

All these theories focus to some extent on learning as part of a person's history in their social and material environments, although they differ in the extent to which they see knowledge as social practice, and also in the extent to which they allow that learning may be a subconscious process. Both the biosocial system theories, however, assert strongly that knowledge is social practice, and that learning is not necessarily under conscious control, but agree that learning is an active interaction between an individual and his or her environment, with successful adaptation and change depending on such activity. In the following section, although I shall certainly not be able to do the biosocial system theories justice, I hope to provide enough detail to explain why I believe the definition of learning in research as elsewhere should embrace a-logical processes.

Part I. Behaviour as Biological and Social Practice

Even though social semiotic theories such as that of Lemke (1990, 1995) and biological theories such as that of Maturana and Varela (1992) have essential differences, for me they are complementary theories, with each expanding on something of what the other glosses over, to allow me to understand more fully the nature of learning and change, from both a social and an individual perspective, and how change has come about in my own knowledge during my PhD study. Lemke's theory of meaning-making concentrates on linguistic and social practice, while Maturana and Varela emphasise the biological basis of human understanding as it occurs in systems living in biological balance with each other. Both theories see knowledge as practice, practice which has been learnt/constructed over a lifetime, in interaction with the social and physical systems of which one's practice is a part. Knowledge depends on (and is limited by) the tools one has at one's disposal and these are determined by one's social and physical history (cf. Piaget, 1969/1991, Vygotsky 1966/1991).

Lemke's Ecosocial System Theory (1990, 1995, 1996)

Lemke is not concerned with explaining individual differences but with explaining the systematicity of the social practice of language and associated communication systems which result in learning. For him, "learning is essentially social" (Lemke, 1990, p. 76), in the classroom and elsewhere. In his social semiotic system, knowledge is seen as emerging as part of particular situations of social practice, rather than as something which could somehow be detached from the contexts in which it occurs. According to Lemke (1990),

Social semiotics includes formal semiotics [the systematic study of the systems of signs themselves] and goes on to ask how people use signs to construct the life of a community...trying to unite the study of human behavior, especially meaning-making behavior (talking, writing, reasoning, drawing, gesturing, etc.) with the study of society." (p. 183)

Among important components of social semiotics he would also include learning from critical sociology, which "explains social processes without assuming the way they are is the way they have to be, or the way they ought to be" (p. 184), and aspects of ethnomethodology, and social constructivism.

Building on Halliday's systemic functional grammar, Lemke explains language practice as having many semiotic functions simultaneously, all tied to some extent to features of the context (Halliday, 1994; Lemke, 1995). As well as having a function of communicating ideas (what Halliday, 1994, terms the *ideational* function and Lemke, 1996, the *presentational*), interpersonal communication has features relating to the *interpersonal* function of the situation (e.g., the relationship and evaluative stances the actor takes towards the addressee and his or her own content respectively), and the *textual* function (including how the content is logically interrelated and how the structure of the whole is to be understood).

Another part of Lemke's theory which is relevant for my purposes in this paper is his distinction between *meaning-systems* and *interaction systems*. "We always do more than we recognize that we do" (Lemke, 1990, p. 213). He wrote of "potential meaning" and "inarticulable interests", and distinguished between "social action analyzed as semiotic practice and as material process" (Lemke, 1990, p. 213). A *meaning system* is the knowledge a particular social group has about its practice as expressed consciously or subconsciously in its practice, including its cultural activities such as language and art. (As such it is similar to Gee's broad definition of a Discourse which Lankshear (1994, p. 6) explains as a particular "socially constructed and recognised [way] of doing and being in the

world, which integrate[s] and regulate[s] ways of acting, thinking, feeling, using language, believing, and valuing.").

An *interaction system* is a different way of accounting for the same material system which supports the meaning system(s). It contains all the material interactions that are taking place in situations whether or not they are accounted for by the meaning system(s) at that particular time, either because they have not been noticed, or because they have been thought irrelevant to the meaning of that situation. For example a choreographer's intentions in planning a dance sequence may be consistent with a known theory of dance but there may be other knowledge existing in the relationship between the dancers and the dance context which needs to be taken into account in practice. At first the extra elements may be seen by the wider dance community as accidental and unnecessary, if they are noticed at all, but it is conceivable that such elements could come to be seen to be essential to the functioning of the system and be incorporated into the meaning-system. A meaning system is thus the interaction system as a particular cultural group perceives it to be, plus their practice based on such perceptions, whereas the interaction system is what people actually do, given their meaning-system beliefs, as well as other factors of which they may have little awareness.

Meaning systems and interaction systems are thus interdependent with each limiting the possibilities of the development of the other. This is similar to Maturana and Varela's explanation of knowledge as what we "bring forth together" but places less emphasis on the limits of the nervous system, which are not seen as necessary for a theory of social semiotics.

The Biology of Human Understanding (Maturana and Varela, 1992)

Maturana, a biologist who has specialised in studying nervous systems, and Varela, a neuroscientist and former student of Maturana's, together have developed a theory of human understanding from neurophysiological and wider biological phenomenology perspectives. Briefly they see all living organisms (from single-celled to the most complex) as having achieved internal autonomy (*autopoiesis*) at the same time as necessary effective coupling with other systems in their environment. Knowledge is seen as "effective action, that is, operating effectively in the domain of existence of living beings" (p. 29), and can be summed up in two aphorisms, "All doing is knowing and all knowing is doing" and "Everything said is said by someone" (p. 26).

They argue against a representational view of knowledge as "information" which is held and used for action. Rather they see "animal and environment as two sides of the one coin" (p. 253), mutually dependent with neither being able to be defined effectively in isolation from the other. Knowledge is the result of both history and present circumstances.

They have elaborated their theory of the biology of human understanding progressively, beginning with the origin of unicellular life on earth, and tracing it through the history of its development into multicellular organisms and thence to complex organisms with nervous systems to more complex systems which may have developed logical accounting, cognitive acts, social and cultural phenomena, language and reflective consciousness, and finally reflexivity and ethics.

Knowledge in humans, therefore, is not restricted to conscious cognitive activity, but represents the sum total of their recurrent behaviour in relation to their environment, whether they are conscious of it or not. Moreover, there is no way that they can know outside of their interactions with their environment, and "what counts as relevant" (p. 253) in this relationship is predetermined by the limits of their senses and history. In fact the world that they "know"

is really a world which they "bring forth" ("bringing forth is the burning issue of knowledge" (p. 27). Because understanding the dynamics of a system requires adopting a certain distance from it, this is difficult for living beings as "their genesis and their history are never directly visible and can be reconstructed only by fragments" (p. 58).

Understanding the part played by components in a system involves understanding that no environmental or even internal factor is ever a "cause" of change in the organism; the most it can be is a trigger for a chain of events whose outcome will depend on structure and functioning of the system which itself will depend to some extent on the presence of other elements in the organism's environment. In this way, even genes cannot be seen as "stored information".

Knowledge as Both Systemic and Individual

So sum up the differences between these theories, for Lemke (1995) the emphasis is on the part played by one's cultural system in determining language (and hence thinking) practices, with the part being played by the individual being down-played to counteract a popular belief that an individual is largely responsible for and in control of his or her own thinking. For Maturana and Varela (1992) the emphasis is on the co-determination of practice by an organism and its environment as they co-adapt, and the way this is allowed for or limited by that organism's history and structural dynamics (its ontogenic and phylogenic adaptations to its environment). As such the latter theory allows a greater emphasis on the individual (organism) and the way its knowledge is limited by its biological structure (particularly its nervous structure) as well as its history. That is, an individual's behaviour is seen as the result of the history of interactions between that particular organism and its environment but, as in Lemke's theory, an individual is not seen as acting independently of the social system to which he or she belongs, nor is behaviour seen as having meaning outside the system to which it belongs.

There are many implications of such theories for any theory of change and any attempts to produce change in practice, whether in teaching and learning, in curriculum development, or organisational development at the systemic level. Either way, research itself is implicated, whether its goal be to produce knowledge or to produce change. These biosocial system theories have helped explain for me the phenomena of intuition, tacit learning and insight and the important place these may have in learning through research. Since knowledge as practised goes far beyond or even differs from what we have made explicit in our theories, it may sometimes only be grasped intuitively and insight may be longer in coming. Yet these may have an important place in research as in other learning.

The notion of knowledge as practice makes possible recognition of knowledge used outside conscious awareness, knowledge which is not necessarily part of logical processes. Once it is allowed that logical means are not the only means of acquiring new knowledge, then we can begin to look more openly at other processes involved in learning and change and see that they go far beyond analytic thinking.

Part II. Defining Tacit Knowledge, Intuition and Insight

Tacit Knowledge

Given the above biosocial system theories, and also my reading of Polanyi (1962, 1963/1983), I would define *tacit knowledge* as knowledge which is available and which may be used, but which is outside conscious awareness or control¹. Polanyi (1993/1983, p. 40) wrote, "we can know more than we can tell". Some components of such knowledge are almost entirely outside conscious control but could be brought to awareness to some extent

if required. These include (a) prior knowledge which has become automatic, for example, ways of perceiving and ways of interrelating interpersonally, which will include both ordinary and technical language use as well as non-verbal behaviour, (b) assumptions about what is or is not of particular value for problem solving in the area, (c) generalised beliefs about oneself and one's capabilities, and also about how others are likely to behave.

Other components of tacit knowledge may enter awareness in an incomplete form such as (a) compelling intuitions, and (b) dissonant emotional or other behavioural reactions. Given the assumptions of biosocial system theories above, it will, I hope, become clearer why I see these as part of tacit knowledge when I go on to examine some of the literature on insight processes. Rather than seeing these as irrelevant to thinking processes, I believe that giving such experiences explicit recognition should increase the possibility that the tacit knowledge which lies behind them will be brought to conscious awareness and examined for both its accuracy and its appropriateness to a particular situation.

For theoretical knowledge within a particular domain, this tacit component may not be very obvious, with most attention going to conscious processing. For practical knowledge, on the other hand, where a person must adapt to and interact with both their physical and social environments, more of their knowledge is likely to be held at a subconscious level, with most conscious attention being given to novel features of a situation.

Insight

Insight is sometimes used as a synonym for significant learning, especially when summing up experience over a considerably period of learning or over several situations (e.g., Pressley, 1985; Raymond, Butt, & Townsend, 1992; White, 1993). As such, it can mean the first successful attempts to make knowledge conscious in terms of the meaning systems available to one.

At other times, especially in the context of a discussion about creativity (see particularly Poincaré, 1913) it is used in the singular ('an insight') to mean "seeing and understanding the inner nature of things clearly, especially by intuition" (Webster's New World Dictionary, as cited in Seifert, Meyer, Davidson, Patalano and Yaniv, 1995). As such it would seem to simplify and explain a collection of data which was previously seen as somewhat unconnected, nebulous or inexplicable. Poincaré stressed that an important aspect of such creativity is period of intermission from conscious work on a problem, thus implying that three stages are involved: a period of exhaustive work on the problem, a complete break from it, and then a "sudden illumination". He saw that the insight arrived with "brevity, suddenness and immediate certainty", which he was convinced, at least in the case of mathematical invention, was incontestably a "manifest sign of long-unconscious work" (Sacks, 1998, p. 13). Sacks agreed that it is a kind of illumination characterised by "suddenness, clarity and immediate certainty", after a long period of unconscious work, of incubation in what Galton called the "antechamber of consciousness". He associated it with playfulness and contrasted it with analytical thought, asserting that it had to do with perception which is necessarily an unconscious process.

Seifert et al. (1995) agree with the characterisation of insight as a three-stage process, with the final stage involving perception, but question the notion of "unconscious work", preferring to see that most of the analytical work has been done, like a jigsaw with only one or more missing pieces being needed to reach a new gestalt of the whole, with fortuitous associations providing the occasion for opportunistic assimilation.

Giving such importance to associative processes is supported by another theorist concerned with the apparent restlessness of the mind. Lear (1988) posits that an important property of

the mind is the making of associations which, although random, can be recruited for one's purposes. This may begin to explain the phenomenon of insight, especially if we agree that another characteristic of human beings is to want to solve problems and puzzles and to have rational explanations for all experienced phenomena. Sacks (1998) also noted the importance of the latter reflective processes, noting that for genuine creativity, although it can capitalise on "instant powers of improvisation and invention and imitation" (which can be found in those who have Tourette's syndrome or autism), there is also a necessity to go deeper into the unconscious, including into the "depths of the personality" (p. 5) (cf. his comment, p. 8, that recollection involves "effort and responsibility", p. 8), and this requires a "level of mind" which may be absent, at least to a considerable extent, in those with autism, or those who have suffered brain damage. The "antechamber" or the "back of the mind" phenomena seems to suggest that when we are motivated to solve unsolved problems or to resolve cognitive conflict, then cues for such problems are held within reach, just outside consciousness but easily available for associative thinking.

The Importance of Feelings in the Process of Insight

Feelings are cited as being an important part of the insight process (Gick & Lockhart, 1985; Gruber, 1995; Poincaré, 1913; Seifert et al., 1995), and similarly for less complete scientific intuitions (Fensham & Marton, 1992). Gruber, in presenting his evolving systems approach to insight, asserted that a stream of affect was part of the process, along with a stream of thought and a stream of purpose, all three streams continually interacting over the period of time leading up to an insight.

Seifert et al. (1995), largely agreeing with Poincaré about the three-stage process, even while they disagree with the notion of prolonged unconscious work, also propose that the emotions are crucial for the entire length of the process of insight. Firstly, there is the preparation stage wherein an impasse is reached in a problem-solving venture in spite of one's having tried every avenue possible. At the emotional level, one needs to be motivated to solve a problem and thoroughly explore all the data available, and to feel frustrated at failure to do so, to the extent that failure indices are set down in long term memory that they may easily be triggered by fortuitous associations. The second stage is a long incubation stage in which there is stimulation from external (or occasionally internal, as in the case of dreams) events during which there must be ongoing motivation (albeit in the absence of conscious intention and effort), to get beyond the impasse.

The third stage is the illumination stage in which, stimulated by the appropriate cue, there is interpretation and assimilation (or accommodation) of the new data with comprehension of a new representation. This is accompanied by the 'Aha!' sensation, where pleasure is strongly felt, which Seifert et al. suggested may be important for reinforcing such a process of learning. (Gick & Lockhart, 1995, note that chagrin at failing to perceive what later seems obvious may also be experienced). Seifert et al. also point out that the accompanying physiological arousal (increased heart rate, blood pressure, breathing and neural activity) may make it more likely that one will focus all one's attention on the solution, just as a high level of frustration facilitated the first stage. However, if the emotional level becomes too high, this could be dysfunctional. Seifert et al. found that a feeling of being overburdened with unsolved problems was likely to decrease the likelihood of insight being achieved in any of them.

Contrary to the way emotional involvement has been seen by some in the past as being either irrelevant or a hindrance to the objectivity supposed to be important for critical thinking, such theories suggest that the emotions may be crucial to learning especially when significant conceptual change is sought. As Lave (in press, cited in Collins, Brown & Newman, 1989) found in her study of apprenticeship, emotional involvement and intrinsic

motivation were integral to the development of the desired task. Tasks which were seen as meaningful and valued in the cultural community in which they were learnt, were seen as achievable by all, which, as Collins, Brown and Newman point out, is in contrast to school learning, where it is more likely to be accepted that native ability is a constraining factor.

Intuition

Intuition is a term which is often used interchangeable with insight as defined above, but with more emphasis on the incompleteness of the insight. Seifert et al. (1995), using the most often cited illustrations of creativity from Poincaré, illustrate the fact that he still had several hours of work to do to verify and demonstrate the results of his "satisfying resolution to the original problematic situation" (p. 75). Intuition is probably reserved for situations in which, although there is insight into a new way of perceiving the original problem, the verification phase is likely to be considerably longer, and success is not guaranteed. Intuition is seen as a belief that something has coherence, is the right way to act, or is meaningful, in spite of the fact that one cannot articulate one's reasoning fully at the time one has the intuition. Fensham and Marton (1992, citing Bruner 1965) explain intuition in terms of implicit knowledge that operates at a holistic level:

Bruner set out to describe the nature of intuition by contrasting it with the characteristic feature of analytic thinking of proceeding a step at a time. Intuitive thinking, on the contrary, does not advance in that way. It tends to involve manoeuvres that seem to be based on an implicit perception of the total problem'. He further suggests that the immediate apprehension associated with intuition contrasts with the 'mediated' cognition that follows formal methods of analysis and proof. (p. 115)

Because intuitions consist partly of unexamined tacit knowledge, such intuitions need to be held in question until one is able to articulate them more fully and hence examine them for their consistency and appropriateness. They have been found to be an important feature of the way scientists work (e.g., Clement, 1991, Fensham & Marton, 1992; Tweney, 1991). Hence, as with the insight process, neglecting to acknowledge and report the place of intuition in research may lead to a belief that learning in research is principally about being analytical and logical and to ignore the very intuitions and feelings which may be vital for change in one's conceptual frameworks/insight.

Other A-logical Processes

Studies of traditional apprenticeship, such as that of Lave (in press, cited in Collins, Brown & Newman, 1989) suggest that holistic processes such as observation, and the learning of global before local skills, play a surprisingly key role in learning in such settings. Lave hypothesised that these processes seem to allow for the development of a conceptual model which provides an advance organiser or an interpretive structure for the earlier stages of learning and an internalised guide facilitating reflection for later, more autonomous learning. Hence tacit learning is seen to be tied up with conceptual development.

Similarly, Nonaka (1991) hypothesised that successful "knowledge-constructing companies" in Japan were more likely to solve problems in holistic ways by "tapping the tacit and often highly subjective insights, intuitions, and hunches of individual employees and making those insights available for testing and use by the company as a whole" (p. 97), by "expressing the inexpressible" in figurative language which could embody both the vision to be developed and the collective sense of identity of the organisation, uniting the ideals at the top with the practical realities at the bottom of the organisation. Nonaka summed this up by saying that effective learning in the organisation was more about ideals than ideas, and about the creative use of tacit knowledge and human resources, in contrast to Western industrial

thinking which seemed to prefer machine-like information processing methods of problem-solving.

The above review of the literature on tacit knowledge and insight gives further evidence of the importance of intuitive and even subconscious knowledge in problem solving, as well as of the important role played by the emotions. This would seem to support biosocial theories of learning which define knowledge as practice which may sometimes be outside awareness and which very often does not seem to be controlled by conscious logical processes. If we are to accept such evidence that a-logical processes play a significant role in conceptual change and insight, then we must also face the implications of this for classroom teaching and learning, and, as I want to stress in this paper, for research, both in the doing and reporting stages. As Walkerdine (1994) said for subjectivity, if it is unavoidable, then it needs to be consciously addressed as part of the research process.

Part III. Discussion

Since I wrote the above two sections, I have written the expected scholarly section on the implications arising from a synthesis of the literature on ecological theories of learning and the theories on tacit learning. [[Link here for those who think they would prefer to read the alternative conclusion to the paper.](#)] I wrote it with a certain misgiving, however, and became increasingly dissatisfied the further I went with it. This was so, even though I found it validating more than I could have imagined, both the kind of critical collaborative research practices to which I was already committed, and a strong focus on personal knowledge and research relationships during research and when writing about it. My misgiving arose because taking such a course would have seemed to imply that successful communication was merely a matter of leading or being lead via a set of reasonable premises to a logical conclusion. This assumption seemed to fly in the face of the position I have been trying to present in this paper: that the kind of learning which could affect anyone's practice is a much more personal process.

So I'm not even going to try to systematically convince you that my theories lead naturally and logically to conclusions that conceptual change of the kind expected of students or of teachers in classrooms and of researchers in research studies needs to involve social change within ecosocial systems. In any case, it is gradually dawning on me that this would be superfluous, given that many of you (especially ethnographers, critical action researchers, action scientists, social constructivists, post-structuralists, cognitive scientists, and socio-semiotic linguists) understood this already many years, even decades ago, and have been trying to convince people like me ever since.

Nor will I try to lead you to the logical conclusion that personal knowledge, intuition, and, just as importantly, emotional involvement, are integral parts of the way we know since they have resulted from the fact that each of us is a living organism in biological balance with a larger biosocial system. Again, it would be superfluous because, even though this is a recent discovery for me, many of you have been saying this for years, admittedly a different group from the first, though there may be considerable overlap, since it seems more typical of feminist researchers, humanist and cognitive behavioural psychologists, whole language theorists, adult learning theorists, psychotherapists and psychoanalysts, and some cognitive psychologists, especially those dealing with insight, motivation or information processing.

Similarly, although I am tempted to, I won't develop the idea that research reports should represent and model the range of types of thinking and feeling which go into learning, both to be consistent with their own learning theories, and to illustrate to teachers and prospective researchers that learning and conceptual development should not be conceived of simply as step-by-step logical processes, especially when conceptual and perceptual leaps are

required. Nor will I lead conventional dissertation supervisors/committees step-by-step towards a conclusion that there are richer ways of learning, knowing, creating and communicating knowledge than the impersonal, systematic ones they seem to most encourage; nor thesis examiners towards a conclusion that these more personal ways should be revealed in theses, and used creatively for more effective and engaging communication of the insights reached during the research.

What I will do, instead, is to try to give some idea of what this all means for me in my life, and of why it has consumed all my time and energy for the past few weeks--though it must be admitted that it has also generated this same energy, as well as much delight, and even, at times, joy. Nevertheless for those most comfortable with their commitment to unproblematic epistemological beliefs and the security of traditional conventions for research and academic writing, I feel I owe some explanation.

My original goal in writing this paper was to justify, at least to myself, my own way of going about learning from (and in) my research. Right throughout my PhD, I have been writing a reflective journal, and I have become convinced that all the significant learning during my PhD took place in this journal. And yet, I have found that I have tended to keep it as a somewhat shameful secret, only bursting out with it when I had a new audience whom I thought might give me a new hearing. I continued to explain my main methodology for my research as regular systematic processes of quantitative analysis, grounded theory analysis, interpretive research, text analysis and action research, without giving too much away about the unsystematic processes which lay, in my case, beyond the hypotheses and conclusions provided in these studies.

It was my guilty secret that my journals consisted mainly of what some would no doubt refer to scathingly as "stream of consciousness" writing. Even though I agree that there was little conscious effort at systematic analysis, I myself did not find that my thoughts streamed from my brain directly on to the computer screen through my fingers. I had to stop and choose the words to express what was as yet inchoate, and was usually surprised at what ended up in the typed document, as it was usually something of which I was not aware previously. In fact, although I did also use my journal regularly to recall where I had been and to recount what I had been doing and what I had observed, especially when I was doing field research, my most urgent need to write in my journal came when I felt confused or blocked.

Often this involved feelings of depression, guilt, shame, or hopelessness and these might be associated with relationships with others involved in my PhD research, or with past experiences which somehow connected up with my research. This would lead to much soul-searching, some reflecting about earlier periods of my life which had remained unexamined until then, and some (self) talk therapy in which I interrogated myself on my irrational behaviour, trying to lead myself back to a reasonable position--which probably meant one in which feelings weren't involved. Sometimes it took several sessions but almost invariably I would achieve some new insight into whatever was troubling me, and new ways ahead would seem to open up, and new reserves of energy and enthusiasm to appear.

For much of my PhD, I saw such writing as an indulgence, something which was not a legitimate form of research work, but something which I had to do because I had this particular disability of having feelings which "interfered" with my thinking, which, it seemed to me, normal people did not experience (it should be remembered that my context is science education); apparently other people were easily able to separate thinking and feeling, and dismiss feelings as irrelevant.

I also did much reflecting on my reading in the research literature in my journals and found endless connections between what I found there and my own mental meanderings which

helped me considerably to clarify my thinking. I tended to let myself free-associate as I went along, not rejecting any ideas as irrelevant, so long as they enlightened the train of thought I was currently engaged in. Another source of associations was what I have called *memos*. There were generally hand-written notes made while I was reading or writing to remind myself to follow up some idea which might have some relevance to my own work. I entered all of these diligently into my journal, even though I often had little idea where they might fit. I was just acting on an intuition that they belonged in the larger picture I was trying to construct and that their place would become clear in time, which it often did. The more writing I did the more all these different pieces would connect up, until insights into new ways of framing my work would happen.

I said I originally saw my reflective writing, especially the part dealing with my feelings and relationships, as an indulgence. More recently, I have had to recognise the importance of this writing methodology, as my theories continued to develop in the absence of any visible systematic approach. I realised then that I was going to have to "own up to" it in my thesis. At first, I could not imagine how, when I stood up for my PhD oral examination, I would be able to justify this jumble of personal intuitions, therapy sessions, mental meandering, poems, story-telling, first drafts of personal letters, hypothesising, brain-storming, and soul-searching, and how I would justify why I used it in preference to supposedly more reliable and rigorous systematic analytic approaches. 'I used it because it seems to work', I would most likely mumble defensively. That might work: I had, after all, had four papers accepted for publication in international journals of some standing, not to mention one local publication. But I somehow suspected that more would be required of me.

It was then that I decided that I would have to analyse my personal writing systematically to find out what I was doing exactly and, if possible, why it did work. When I did this, I discovered some surprising facts. Firstly, the negative feelings were intimately connected to my thinking and learning--they weren't irrelevant detours. The process of dealing with them was also a process of unearthing the subterranean assumptions and beliefs that underlay them, and then analysing these rigorously using all the evidence I could muster from any other area of my knowledge. By the time I had finished dealing with them, my thinking would have changed irreversibly, and this would have repercussions for my research, opening up new possibilities, and closing down others which were now clearly no longer viable.

In fact, it became clear to me that my feelings were clues to problems in my thinking or in my situation, and that rather than being irrelevant distracters which must be removed, they were useful signposts to hidden knowledge or hidden problems. If I hadn't paid attention to them, or had simply sedated myself, I wouldn't have made the progress which then became possible. My former disability had been transformed into a gift!

Another thing which became abundantly clear was that without the more playful part of my journal writing--the collecting, turning over in my mind, and combining of associations, of fanciful hypotheses, of attempts at marrying ideas from different discourses, and of incomplete ideas--I would not have experienced the coming together of these into new insights. Although logical accounting was part of the processes resulting in learning, it was only part of the groundwork. For real advances in my conceptual frameworks, all the parts had to be there and there had to be something which helped trigger the new gestalt which appeared to coalesce out of the parts, without conscious reasoning and as an instant act of perception.

What had seemed a preposterous thought--that a consciously rational step-by-step approach was not as good for deep learning as a less organised, a-logical but personally and socially meaningful approach--now came to seem an indisputable fact, at least in my own case. A technical approach was certainly useful when one had all the facts and simply

needed to compute them to reach a conclusion, but, as Polanyi (1962) had pointed out, that was an essentially mindless activity in any case. Anything which required one to "change" one's mind seemed to require so much more. As I found in the literature, there was much evidence to support this: including of course the literature I have cited relating to biosocial systems, the literature on conceptual change in science and other school subjects, much of the literature on perception and cognition, and the various literatures on language and literacy learning, adult learning, psychopathology, insight and creativity; and, on research itself, the literature I was familiar with on critical action research, on teacher change, on organisational change and development, and on social movements.

It remains to be seen whether this attempt to connect with you personally has worked or not. I am hoping that it has enabled you to engage more deeply with the implications of the theories I have presented in this paper. I realise, however, that I need to remain open to the possibility that the more logical approach I have taken in the alternative version will be preferred and will affect you more powerfully, in which case, I wish you all the best with it.

To give me feedback, email me at m.hanrahan@qut.edu.au.
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Note 1. I would like to acknowledge the assistance of Peter Fensham in helping in the process of "bringing forth" the theory presented in this paper, from supporting me in its early stages in 1996 when it was little more than a bunch of intuitions, to suggesting the readings which were instrumental in my seeing that it could be justified theoretically, to giving feedback to parts of earlier drafts of this paper.

Another very important part of the process, especially for refining and clarifying my understanding of tacit knowledge was ongoing email dialogue with Bob Dick, the moderator of the <Tacit-I@scu.edu.au> email list, who also helped me to appreciate the part played by subconscious knowledge in practice and the importance of addressing this in action research. Paul Wildman also assisted in this process.

Jay Lemke assisted me in my initial struggles to come to terms with an ecosocial system approach to learning, and then later with suggestions for further reading, and with constructive feedback on an earlier draft. Jan Wilson first put me on to some of the literature on insight which I have found most useful for clarifying my thinking in this area.

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[Alternative Development and Conclusion]

Link back to [first conclusion](#) to paper.

At the beginning of his inaugural lecture at the opening of the Centre for the Mind at the Australian National University earlier this year, Oliver Sacks commented,

"A great fuss is made about consciousness, as if consciousness is the top. I think that the top is creativity, and I will be saying that I think creativity involves the depth of a mind, and many, many depths of unconsciousness." Polanyi (1992, p. vii) went further in questioning the relative importance of so-called objective processes of thinking:

"Our theory of knowledge is now seen to imply an ontology of the mind. Objectivism requires a specifiably mindless knower. To accept the indeterminacy of knowledge requires, on the contrary, that we accredit a person entitled to shape his knowing according to his own judgment, unspecifiably."

In this paper, I have brought together many perspectives, all pointing to the conclusion that, contrary to the popular belief in the superiority of "objective" cognitive processes, intuitive processes are integral to conceptual change and to change in social practice. A significant component of such learning would seem to be emotional experiences, both to facilitate culturally valued practice, and to cue and reward the taking of appropriate action for successful problem solving.

There are many implications of such conclusions for a wide range of areas in which learning and change are involved, but I will only have the space here to focus on a few important implications for research and researchers in education, for example, for research intended to lead to change in school systems, for the choice of the best research methods for exploring theories of teaching and learning in mini-communities such as classrooms which exist in balance with larger social systems such as schools and education systems. There are also implications for the communication and dissemination of research if this is to facilitate further effective research and change.

The Difficulty of Achieving Change in Stable Systems

If, as Robinson (1993), claimed, the problems to be encountered in the social science of educational research are complex, ill-structured ones, then addressing such problems will require much more than technical reasoning. It will require researchers to seek ways of accessing the tacit personal knowledge underlying current beliefs and practice, in relation to both research contexts and research processes. Not until tacit knowledge is brought to awareness can there be any questioning of its taken-for-granted nature or any appreciation of gaps between practice and meaning-systems. The same intuitive processes of perception and feelings which are involved in insight, can be put to use in research,

Problem solving involving stakeholders with different views has been shown to benefit from surfacing, articulating, and addressing differences between the tacit assumptions of different stakeholders (Carr & Kemmis, 1986; Dick, 1998; Erickson & Christman, 1994), and the differences between a person's explicit theories or "espoused theories" and the same person's tacit theories or "theories-in-action" (Argyris & Schön, 1974; Dick, 1998; Whitehead, 1993).

Lemke (1995) in explaining the need for praxis in practice, argued that only a system which was open to discovering and responding to such disjunctions between its meaning system and the interaction system would be able to respond to changes in its environment in ways

which would allow it to continue to survive--something he was not convinced our own civilisation, so self-regulated in its meaning systems, was particularly successful at doing, a doubt also expressed by Harding when referring to traditional approaches to research (1998). However, he cautioned that achieving change in a meaning system was likely to be very difficult and suggested that a new theory was only likely to prosper when it filled a gap in an existing meaning-system, rather than when it suggested a new arrangement. Other research theorists have been more optimistic, particularly those engaged in collaborative action research, where theory is developed as practitioners do research while they are actively practising, in repeated cycles of responsive action and critical reflection.

Collaborative Action Research

Since the tacit knowledge such as interrelated beliefs about language and epistemology, interpersonal relationships and communication, and about what is to be valued and what is not, is, by definition, largely outside conscious control and is invisible to the practitioners using it, it needs first to be surfaced and investigated, and this requires the use of appropriate methods (Argyris and Schön, 1974; Erickson & Christman, 1996).

One family of research methodologies which has been widely recognized as having this capacity is action research, with its well-known cycles of planning, acting and observing, and reflecting. This is particularly likely to be the case when it combines such methods as ethnography, group discussion, and individual reflection, in a reflexive and responsive manner. The fact that an unreflective self-regulated system fails to adapt in a rational and just manner to changes or needs in its environment has long been recognized in the literature about action research based on critical theory (e.g., Carr & Kemmis, 1986; Fals Borda, 1979/1988; Kemmis & McTaggart, 1988) and action science (Argyris, 1983; Argyris & Schön, 1974). Given the need for keeping systems open to change, critical reflection on practice, both on the part of individuals and collectives is necessary for interrupting such over-regulation.

However, action research can be more or less collaborative, or even an individual enterprise. An ecosocial system approach to change in practice at any level of an education system would seem to call for a collaborative approach, since any individual effort at change is likely to be resisted by the inertia of the system with its practices which have co-evolved to fit in with each other. The more research is collaborative, however, the more tacit knowledge differences between the different stakeholders will need to be surfaced and articulated for the collaborative decision-making processes necessary for local commitment to change processes (Erickson & Christman, 1994). Methods such as ethnography and effective methods of individual and collective reflection would seem indicated.

Ethnography has been found to be practical and useful for observing and interpreting the tacit features of the culture of the research context. Moreover, Erickson and Christman (1994) wrote that an ethnographic approach provided a safe environment for collaborative research because it assumed that "differences in perspective are normal within a social group", and that all participants were "active and making sense" (p. 151).

Group processes of decision-making. Such ethnographies may then be used as the observation phase of an action research cycle, providing evidence which is used in subsequent collective discussion, where the different participants can act as critical friends for each other as they collectively reflect and plan (e.g., Atweh, Kemmis & Weeks, 1998; Erickson & Christman, 1986; Kemmis & McTaggart, 1988). Such group processes are usually supported by individual reflective writing which is also believed to enhance the process and is usually encouraged as an additional source of data and insight to support group discussion (e.g., Beasley, 1983; Kemmis & McTaggart, 1988).

Individual reflective writing. Not only is tacit knowledge important in research in that it is an integral part of the practice in the context being researched, but it is an important part of the researcher's own practice. If action research is to be true to its praxis approach, it must not only be critical of what has become taken for granted in the systems it is researching, it must also be critical of its own taken-for-granted processes. Not surprisingly, then, some schools of action research make reflexive practice by individual researchers the main focus (e.g., McNiff, Whitehead, Laidlaw, & Members of the Bath Action Research Group, 1992; Newman, 1997; Schön, 1983). However, this is most often in the context of research on some practice other than research itself.

The importance of such reflection for improving practice within the professions, and particularly in teaching has often been recognised (e.g., Baird, Fensham, Gunstone, & White, 1991; Grimmer & Erickson, 1988; Loughran, 1996; Ryan & Somekh, 1991; Schön, 1983; Schön, 1991; Weeks, 1994) but the notion of academic social science research as a type of professional practice requiring self-critical reflection is less often recognised (Noffke, 1998), perhaps because such research has its own formal methodologies and methods, which have their own inbuilt safeguards for achieving rigour.

A positivistic position has been largely discredited in social science research (e.g., Carr & Kemmis, 1986; Erickson, 1986; Guba & Lincoln, 1989) but perhaps it has left its residue in an attitude that research is a matter of using prescribed methods on clear-cut questions (cf. Robinson, 1993). Such an attitude that research is a straight-forward analytical process would require researchers to place accepted formal methods in the foreground of research reports, and informal personal reflection and processes used to achieve insight, even where it has been most productive and creative, in the background. Hence critical reflection and creative processes which go beyond analysis in terms of a particular methodology may be undervalued or even discouraged even though they may be crucial for solving such complex educational problems.

Harnessing Intuitive Processes

As asserted above in Part II, one of the creative and apparently a-logical processes which has implications for research is the natural tendencies of human beings to make random associations, and to use them opportunistically in problem solving and insight processes. Insights in research as elsewhere can be explained by allowing that an individual learns partly by using such processes which are beyond conscious control and whose result may only become conscious once a new level of organisation of previously disconnected data is reached. Rather than being a trivial and irrelevant characteristic of human (and other living) beings, biosocial theories and insight theories (see also Lear, 1998) seem to suggest that the tendency to make associations is more likely to be an integral part of the survival process which has evolved in response to a history of interactions between a species and its environment, a way to prevent systems from becoming rigid and unresponsive to environmental changes.

If learning in research is seen as involving insight processes, then, given the evidence from the literature cited in this paper, one might expect it to recruit intuitive and associative thinking and to capitalise on feelings which help one to take advantage of such useful associations. The emotions can then be seen as significant ways in which intuitive interpretations present rather than as a source of distraction to be ignored or repressed (cf. Mandler, 1975). Creative use of such intuitive processes is a feature of many forms of research, where it can be found in either or both of the investigation and representation stages.

Such methodologies include phenomenological research (van Manen, 1990), narrative inquiry and other personal experience methods (Clandinin & Connelly, 1994), fictional-critical writing (Winter, 1988), artistic methods (Eisner, 1997), and, of course, a great deal of feminist writing (e.g., Ellis, Kiesinger & Tillmann-Healy, 1997; Erickson, 1997; Haug, 1992; Harding, 1997; Lather, 1991, 1996; Olesen, 1994; Richardson, 1994; Walkerdine, 1994). However, in mainstream research such as that found in science education, admitting to such sources of insight is generally seen as much less acceptable and a great need is still seen to argue the case for it in public forums (e.g., Eisner, 1997; Erickson, 1996; Harding, 1997; Walkerdine, 1994). Yet, if intuitive processes are essential for good research, it would seem dishonest to continue to preserve the myth that research is an objective process requiring only impersonal, logical processes. Counteracting this myth, however, would require more widespread changes in both the content and the style of research writing. The personal would need to be re-admitted and the need for an impersonal and supposedly objective style of writing reassessed.

If the personal--what is particular about an individual--is a part of the system which produces knowledge/practice, and hence is necessary for a full understanding of that knowledge, then the personal body (as experienced by oneself and others), and not just one's cognitive faculties, become the instrument of research. Hence acknowledgement of the tacit data this implies should appear in the methodology or other relevant section in as far as it is relevant to the research process and can be ascertained or at least guessed at. For similar reasons relationships are crucially important in social science research and their part in the meaning-making should be taken into account. Educational research is a social practice, and as such it involves interpersonal relationships in an important way (Grundy, 1996; Noffke, 1994), and these too involve tacit knowledge.

How Research is Represented in Research Writing

Another reason for changing expectations about the way research is should be reported has to do with communication. A scientific approach to writing about research is usually restricted to a concern with the ideational and allows the interpersonal and textual functions to be fixed by convention. This precludes writing about personal aspects of research in a way which critiques one's own position as being inside the practice of the context. It also precludes taking a critical stance towards the philosophical assumptions underlying one's research.

I see the conventions of writing impersonally as a major disadvantage in social science research where a researcher is inevitably in a complex social relationship with the other participants while doing the research, and where I believe any significant change in any part of the system will affect all other parts of the system to a greater or lesser degree, and hence will necessitate some reflection on value assumptions by all participants, including the researcher, as part of the meaning-making process.

Revealing personal contextual factors and relationship variables with co-researchers and with readership has another advantage for research reports. I believe it is more likely to lead to useful engagement with the text and subsequent productive dialogue than an impersonal approach which tends to distance the reader (cf. Lemke, 1990). Some may object that "personalising the issues can make it harder to discuss ideas and arguments" (KS, personal email communication, 17/8/98). However, quite apart from the fact that I can no longer agree that personal factors should be kept out on the grounds that they are just distracters, I subscribe to the theories of those (e.g., Blades, 1994; Bruner, 1990; Strube, 1995) who believe that narrative is the way that human beings tend to make meaning most naturally and easily. This is, of course, compatible with meaning-making as making sense within the historical practice of one's community or communities.

Another point of presentation has to do with the level of figurative language to be used. If learning has as much to do with grasping new perspectives as to do with logical processes, then it makes sense to communicate research findings in a way which can capture the kind of content to be communicated. As van Manen,(1990) has written, "The experience of something that appears ineffable within the context of one type of discourse may be expressible by means of another form of discourse" (p. 113). For example, Blades (1994) used allegory and metaphor in his dissertation to communicate the post-modern nature of the problem he was investigating (an attempt at curriculum change in a particular science education system), since he did not believe it could be communicated as powerfully in customary academic prose.

Research writing often involves times of inertial and discouragement. I believe these can be addressed with the help of a perspective which treats them, not as unfortunate detours, but as a natural part of the learning process, as the following paragraphs will explain.

Energy level and engagement in learning. The point that there is significant physiological arousal with insight may allow deeper understanding of the place played by motivation in learning and research, especially in prolonged and often solitary processes such as doctoral research. I noted in an earlier research report (Hanrahan, 1998) that energy levels and engagement in learning seemed to be closely related to teacher support for autonomy in learning and to learning beliefs which value the personal role of students in their own learning. Perhaps, doctoral students could also be helped to enjoy more of the pleasure and surge in energy levels which come from developing personal insights, if there was less concern that they conform to impersonal forms of research and writing. Similarly, Nocerino (1991) commented on the joy to be had by action researching teachers when they achieved insights into personally challenging pedagogical situations, and seemed to suggest that such teachers found this rewarding enough to keep them motivated to continue to reflect on their practice..

Opening impasses. Thinking of analysis in new ways may also be helpful for addressing a perennial problem encountered by researchers: overcoming writing blocks. It is possible that writing blocks may be caused by invisible barriers to progress in analysing a situation, and hence may be removed by exploring ways to surface such barriers, which may include emotional barriers and unexplored assumptions. If educational problems are seen as ill-structured problems and hence not easily solvable by simple analytic processes--as they might be if all the limits of a problem and its definition were clear (cf. Robinson, 1983)--then recognition that tacit knowledge may be missing from an analysis might allow new reframing of problems which could allow impasses to be opened up.

The Functions of Language

Language and its multiple functions become a very important focus in research based on an ecosocial system approach both because of its origin in the development of an ecosocial system and its integral place in practice. This has implications both for the practicality and rate of change likely to result in and from research. When language is seen only as communicating content, the complex role it plays in practice is not likely to be understood, which may lead to unrealistic goals for change. Because any change in the communication systems involved will require adaptation in all associated parts of the ecosocial system, any change is not likely to be an easy or rapid process. However such change might be facilitated by a recognition that language has multiple functions, and as well as presenting ideas and accomplishing activities, it is also about negotiating or maintaining interpersonal relationships (and power structures) and framing and maintaining organisational structures (cf. Carr & Kemmis, 1986; Lemke, 1995).

Quite apart from the place language often plays in maintaining the status quo or, alternatively, facilitating change, in systems which are the subject of research, the question of maintaining unproductive relationships and structures can also apply to research paradigms. For those who are well-socialised to a particular paradigm to the extent that they are oblivious to its special linguistic features, a text belonging to the discourse of that domain seems to have only an ideational function--to be concerned with communicating content. The other features, because they are more or less automatic, will not be noticed (except where they are absent or where implicit rules about them have been transgressed). This has the advantage that it allows for easy and quick communication--the assumptions underlying the domain do not need to be re-explained at every juncture. However, this also allows a considerable part of knowledge to remain implicit and hence forgotten and not open to re-examination, and this is a disadvantage when the system is becoming less well adapted to achieving its educational goals. A system whose language practice allows it to reflect on its own assumptions and long-term goals, and to critique its own taken-for-granted methods is likely to be more successful in the long run.

Creativity

Finally, given the literature on insight, it seems likely that thought processes which are normally below conscious control are critical to creativity in research. In my own research while completing my PhD, I have found that paying attention to my intuitions and feelings during my informal writing has greatly improved my insight into my tacit knowledge and assumptions, and has helped me find creative solutions to apparent impasses. Part of this process involved fluctuations in emotions and energy levels, which seemed to signal and facilitate the process.

Conclusion

In this paper I have used theories from a range of perspectives to make the point that knowledge and practice involve many processes outside normal consciousness and control, processes which are an individual's adaptive response to the systems to which he/she/it belongs, and hence involve tacit beliefs and assumptions. Such theories provide an explanation of the barriers to and possibilities for change, and suggests that if human beings want to live in overall harmony with their social and material environment, then they need to examine and understand their taken-for-granted relations with other systems and to find ways to keep their own systems open to change. Research methods which allow for subconscious ways of knowing would seem to be better equipped to deal with the full complexity of the ecosocial systems in which they operate.

Omitting mention of methods which deal with personal experience and relationships when writing reports of research would seem to imply that research is a technical matter only and to foster research which operates only on a technical level. I believe, therefore, that a-logical processes such as those discussed in this paper have a legitimate place in both research and research reports and that expectations about research writing should change to accommodate such beliefs. The success of mainstream research ventures may depend to a large extent on a change in the culture of research from one which largely sees objective (conscious, impersonal and systematic) thinking as the only valid means of accessing knowledge and which acts as though change in practice can be achieved using only conscious, logical processes.