

Commentary 2 on Reflections on Theories of Learning

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One of the great clashes of ideas of our times is that between psychology and sociology. Sociologists accuse psychologists of being narrowly technical, supporters of what the critical theorists term instrumental rationality. Psychologists have also been stereotyped as apolitical and closed minded about social and political issues and social/political influences on human life in general and on learning in particular. In return, psychologists accuse sociologists of sacrificing scientific truth and accuracy of detail for broad politically motivated generalizations that do not help people with their interior lives and their learning. Ironically, both sets of accusations are both true at times and false at others. Because both psychology and sociology are broad areas of thought housing many ideas and schools. Sociology can be mechanistic, on the one hand, focusing on structural mechanisms that leave the individual relatively without agency or an internal life. On the other hand sociological explanations can be rich and multi-faceted exploring individual agency and power in the construction of knowledge and institutions.

Similarly psychology encompasses a broad range of schools from the behaviourism and experimental psychology, at one extreme, to discursive psychology and socio-cultural theory, at the other. Somewhere in between these extremes lies the range of constructivisms I explored with respect to their role in the learning of mathematics. I contrasted four positions referred to under the titles of simple constructivism, radical constructivism, enactivism and social constructivism. These four learning theories, or learning philosophies as they should more accurately be termed,¹ constitute a sequence in this order, and in accord with this order they become increasingly radicalized in terms of their epistemology, become more embodied in terms of the learner's physicality and context, and shift from a primarily individual focus to the inclusion of the social. Although this characterisation in broad brush strokes is more or less correct it is not fully accurate not least because radical constructivism and enactivism do not differ much in these dimensions. Both theories acknowledge the embodied nature of the learner, but prioritize the individual over the social.

¹In my original paper I argue that learning theories are better termed learning philosophies because they are not specific or testable enough to be theories, strictly speaking. Nevertheless, I shall follow common usage in using the description 'learning theory'.

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However, as this discussion of the breadth of psychology shows, my choice of theories to comment on in Ernest (2006) represents a limited selection of learning theories that are current in psychology. They all fall within what Wegerif (2002) terms the cognitivist/constructivist orientation to learning. The one exception is that of social constructivism, which has two formulations, Piagetian/radical constructivist and Vygotskian (Ernest 1994). The former fits within the cognitivist/constructivist orientation, whereas the latter sits closer to Wegerif's 'participatory' orientation to learning.

Wegerif (2002) contrasts four orientations to learning, as he terms them, thus sidestepping the theory/philosophy issue I noted above.² These are the Behaviourist, Cognitivist/Constructivist, Humanist, and Participatory orientations. For each of these orientations he considers the best known learning theorists who are founders or adherents of the position, the view of the learning process from this perspective, the locus of learning, the view of transfer, the purpose of education, and the educator's role. These are summarized in Table 1.

The Behaviourist orientation is an important one to include for two reasons. First it is historically important. It was a if not *the* leading theory of learning for at least half of the twentieth century. Secondly, it represents one of the extreme anchor points for the range of psychological theories. It constitutes one end of the spectrum that goes from the hard-nosed individualistic and scientific through to, at the other extreme, fully social theories of learning represented here by the participatory orientation. Although much pilloried and used as a 'straw person' against which to argue for constructivist and other theories of learning, modern neo-behaviourist theories of learning as formulated by such scholars as Gagne and Ausubel in fact incorporate many of the insights of cognitivist/constructivist theories.

It is also an irony that behaviourism shares one of its main characteristics with the latest participatory or socio-cultural theories, thus confirming the popular (and only partly humorous suggestion) that two the two extreme poles of any continuum meet up 'around the back', as it is claimed do extreme left and right wing political ideologies. For both extremal learning theories reject the characterization of learning as an 'interior' activity that takes place within the learner. Behaviourism sought to be a scientific theory focussing on objectively observable as opposed to subjective phenomena. Socio-cultural theory likewise focuses on social behaviour between persons. Socio-cultural theory rejects the model of learning in terms of the internal accumulation of knowledge, described by Freire (1972) as the 'banking model' and by Sfard (1998) as the acquisition metaphor. Instead socio-cultural theory focuses on participation in social practices, the learning of social roles and behaviours. The emphasis is on tacit knowledge learned by osmosis through immersion in and participation in social practices, that is in socially organised productive activities of one sort or another.

Wegerif's characterization of Cognitivist/Constructivist orientations, the second column in Table 1, fits fairly well with my finer grained analysis of varieties of

²Wegerif acknowledges his indebtedness to Merriam and Caffarella (1991) in making these distinctions.

Table 1 Four orientations to learning (from Wegerif 2002: p. 10)

Aspect	Behaviourist	Cognitivist/ Constructivist	Humanist	Participatory
Learning theorists	Thorndike, Pavlov, Watson, Tolman, Skinner, Suppes	Piaget, Ausubel, Bruner, Papert	Maslow, Rogers	Lave, Wenger, Cole, Wertsch, Engestrom
View of the learning process	Change in behaviour	Internal mental process including insight, information processing, memory, perception	A personal act to fulfil potential	Interaction/ observation in social contexts. Movement from the periphery to the centre of a community of practice
Locus of learning	Stimuli in external environment	Internal cognitive structuring	Affective and cognitive needs	Learning is in relationship between people and environment
View of transfer	Common elements shared by different contexts	Over-arching general principles	Changes in self-identity as a learner	Transfer problematic
Purpose in education	Produce behavioural change in desired direction	Develop capacity and skills to learn better	Become self-actualized, autonomous	Full participation in communities of practice and utilization of resources
Educator's role	Arranges environment to elicit desired response	Structures content of learning activity	Facilitates development of the whole person	Works to establish communities of practice in which conversation and participation can occur

constructivism (Ernest 2006) so I will leave these theories out of my discussion for now.

Wegerif's third orientation summarized in Table 1 is the humanistic orientation. Although this has not figured largely in mathematics education research as such, it incorporates some useful emphases worth highlighting here. As is well known, it follows on from the humanistic psychology tradition founded by scholars like Abraham Maslow and Carl Rogers. It focuses on the whole person, rather than on isolated cognitive processes and mechanisms. Learning is seen as a personal act to fulfil an individual's own potential and thus to meet their affective and cognitive needs in the round. It focuses on changes in self-identity as a learner. Identity is a theme that is becoming increasingly central in mathematics education research even though its

roots in the humanistic tradition are rarely acknowledged.³ This perspective aims to enable students and indeed all persons to become self-actualized, autonomous human beings, thus facilitating the development of the whole person, that is, their overall fulfilment. There is still much to be learned from this perspective which has the unique emphasis of treating persons first and foremost as human beings. Such an emphasis inevitably brings with it a moral and ethical dimension, something that is regarded as irrelevant or secondary by most of the other learning theories.

The fourth and last of Wegerif's orientations he terms participatory. More commonly in mathematics education research this is termed socio-cultural theory, although in equating these titles I may be committing the same error that I wish to criticize about this orientation. A number of major contributing modern thinkers are listed including Lave, Wenger, Cole, Wertsch, and Engeström. Jean Lave is an anthropologist, who collaborated with her student Etienne Wenger to develop an account of situated learning and apprenticeship described as legitimate peripheral participation (Lave and Wenger 1991). Although much lauded, this account paid scant regard to the role of explicit knowledge in education and learning. Its main theoretical foundation lies in Vygotsky's Activity Theory. Wenger (1998) elaborated and extended these ideas in his treatment of Communities of Practice, focussing on sub-themes of learning, meaning and identity. This book also caused a great stir in the mathematics education research community and beyond, including studies of information and communication technology and learning, and learning in business communities. Although seductively rich in new concepts and models, as has been said in reviews of the work (e.g., Ernest 2002), as yet it lacks an adequate theoretical grounding. Vygotsky is no longer the central underpinning theorist, but he lacks a coherent replacement. Wenger is very eclectic in drawing from many disciplines, but ultimately this leads to a lack of a solid foundation, something that is shared by many publications addressing learning in ICT and in the area of business studies.

Michael Cole is a well established Vygotsky scholar, and James Wertsch also has his roots in Vygotsky although in developing his dialogical theories he also draws on Bakhtin and other Russians. Yrjö Engeström is a well known modern Activity Theorist. Engeström draws on Leont'ev's work, who is one of Vygotsky's leading followers. However Engeström extends Leont'ev's theorization by adding a third interacting entity, the community, to the two components, the individual and the object, in Leont'ev's original scheme.

What this account shows is that although all these cited theorists of the participatory orientation have at some point drawn on Vygotsky, they have diverged in applying his ideas. Furthermore, other theorizations not cited by Wegerif have been drawn on by participatory theorists, such as Foucault and other post-structuralists (Henriques et al. 1984).

Wegerif characterises the participatory orientations as sharing a concern with interaction in social contexts. Learners 'move' from the periphery to the centre of a

³Identity is also a theme in sociology which is another root source for this burgeoning area of research in mathematics education.

community of practice, in the sense of graduating from novice status to full participants. Thus from this perspective learning is in the relationship between people and a particular environment. From this perspective transfer of knowledge is problematic because on the whole knowledge is tacit and socially embedded rather than explicit and moveable in terms of semiotic/textual representations. Education is about full participation in communities of practice and utilization of its resources, and the aims of the educator are working to establish communities of practice in which conversation and participation can occur.

The trouble with this account is that it does not distinguish between learning mathematics in school or university, learning to process claims in an insurance company (one of Wenger's examples), learning the 12-step programme in Alcoholics Anonymous (one of Lave and Wenger's examples), or learning to be a garbage collector on a specific route in North London (something I did as a youth). While there undoubtedly is learning taking place if you are a member of any of the last three communities or workplaces there are also major differences with learning mathematics. For virtually all students of mathematics immersion in mathematical practices from the age of 7 or so until the break points at 16 years (high school graduation), 18 years (end of pre-university specialist studies in mathematics) or even 21 years (first degree in mathematics) does not constitute an apprenticeship in mathematical research. Rather it constitutes a training in certain forms of thinking that will be applied across the full range of studies and occupations. So we need to distinguish sharply between social practices that are a productive end in themselves and those that are simply a means to some other end, possibly undetermined during this preparatory activity. This is what education consists of.

Although this critique applies to the works of Lave and Wenger cited, the same cannot be said to some of the applicers of their theoretical perspective within the research community. Likewise researchers in mathematics education have drawn on Cole, Wertsch, and Engeström's work, as well directly on Vygotsky in accounts of social constructivism (e.g., Ernest 1994, 1998).

Undoubtedly the participatory perspective as put forward by Wegerif does offer something missing from traditional accounts of the teaching and learning of mathematics as simply the passing on knowledge via representations. For although not all of mathematical knowledge is tacit, embedded in social practice, some of it is. In all fields of study much of our professional judgement and professional practice is based on 'knowing how it is done' rather than explicit rules or procedures that can be applied thoughtfully or mechanically. Even in mathematics judgements as to the correctness of a published proof or a student's written solution to a problem are based on implicit professional 'know how' acquired from practice (Ernest 1999). Kuhn (1970) makes this point forcibly for all of the sciences. According to his account, at the heart of a scientific paradigm are examples of accepted reasoning and problem solving. It is the skilful following and application of examples rather than the use of explicit rules that constitutes working in the paradigm.

In Ernest (1998) (drawing on Kitcher 1984) I suggest that mathematical knowledge has a number of components that go beyond those traditionally identified. There are of course the traditional accepted propositions and statements of mathematics, as well as accepted reasonings and proofs. Together with the problems and

Table 2 Mathematics knowledge components and their explicitness

Mathematics knowledge component	Explicitness of component
Accepted propositions & statements	Mainly explicit
Accepted reasonings & proofs	Mainly explicit
Problems and questions	Mainly explicit
Language and symbolism	Mainly tacit
Meta-mathematical views: proof & definition standards, scope & structure of mathematics	Mainly tacit
Methods, procedures, techniques, strategies	Mainly tacit
Aesthetics and values	Mainly tacit

questions of mathematics these make up the mainly explicit knowledge of mathematics. But I also argue that to know mathematics involves knowledge of its language and symbolism, knowledge of meta-mathematical views including proof and definition standards, and the scope and structure of mathematics. Such knowledge is mainly tacit or craft knowledge, embedded in practice. In addition, knowledge is also needed of the methods, procedures, techniques and strategies of mathematics as well as the aesthetics and values that underpin judgements in mathematics. All of these are mainly tacit, acquired from working in the practice of mathematics. These knowledge components and their status as explicit or tacit knowledge are listed in Table 2.

Thus some formulations of what Wegerif terms the participatory orientation do support a valuable account of the mathematical knowledge needed for mathematical practices, both by research mathematicians and by the learners of mathematics. But the participatory orientation is a broad church encompassing differing and sometimes, if not conflicting theories of learning, uneasy bedfellows to put under the same blanket. This is not to criticize Wegerif's (2002) use of broad brush strokes to distinguish the cluster of participatory orientated perspectives from the other three learning orientations. It is simply to say that the loosely clustered together perspectives under such headings are far from identical, and of course the same criticism can be directed at the four theory clusters in Ernest (2006).

All of the learning theories distinguished by Ernest (2006) and Wegerif (2002) downplay what I now take to be a vital element, as I mentioned earlier. This is ethics and values. So why are ethics and values so central to learning theories in mathematics education? My claim is that ethics enters into mathematics education research in four ways. First of all, there is a vital need to be ethical in our research. As responsible and ethical professionals, it is incumbent on us at the very least to ensure that our research is based on the informed consent of any human participants, does not cause them any harm or detriment, and that we respect the confidentiality and non-identifiability of all individuals or institutions. Any research that does not fully conform to ethical standards is not only ethically flawed, but its claims to add to the sum of knowledge must be viewed as suspect. Unlike stolen money which is just as good in the shops as honest money, unethically derived knowledge is epistemologically as well as ethically tainted.

Second, as educational researchers we are participating in the great, age-old human conversation, which sustains and extends our common knowledge heritage. By sharing our thoughts, our findings both informally and formally, and through our publications, we are part of the public conversation from which others benefit. This great conversation, as Michael Oakshott called it, is not a means to an end, but an end in itself, and the conversation is inescapably moral and ethical. To participate you must value the contributions of others. You must listen with respect and humility, and when you have developed a voice, you contribute to the conversation, knowing it is much greater than you. The tacit values implied by participation are: valuing and respecting the voices of others, past and present; valuing the young who will get the chance to participate; not taking too seriously the trappings of power, earthly prizes, ego gratification, these will all be gone and forgotten as the great conversation rolls on; striving for excellence and high standards in oneself and others—both to be worthy of the great conversation, and to protect it; recognising that all human beings are part of this transcendent shared enterprise, and that all members of the human family deserve concern and respect. Mathematics education is one of the strands in the great conversation and we in its research community can be proud that our efforts and those of our predecessors have created and swelled one of the strands of this great shared enterprise.

Third, it is a self-evident truth that as human beings we are irreducibly social creatures. Humans as a species are essentially interdependent. We emerge into the world after our initial biological development within our mother's bodies. We must experience love and care from others in our early years to become fully functioning human beings. We must acquire language⁴ and acceptable behaviour with others to participate in social life and practices. Without such skills we cannot survive and further the human race. Our species depends for its very survival on our ethical and cooperative behaviour with regard to our fellow humans.⁵ In its highest form this dependency is expressed as the principle of reciprocity, embodied in all ethical belief systems and world religions as the Golden Rule: 'Do unto others as you would have them do unto you' (Wikipedia 2009). One source for this is the awareness that we are all the same but different (to paraphrase the title of Quadling's 1969 book on equivalence relations) and but for luck and contingency you and I as individuals could be in each other's situation.

Fourth and last, but far from least, prior to all such reflections, according to Levinas, we owe a debt to others that precedes and goes beyond reasons, decisions, and our thought processes. It even precedes any attempt to understand others. Levinas maintains that our subjectivity is formed in and through our subjectedness to the other, arguing that subjectivity is primordially ethical and not theoretical. That is to

⁴By language I include all complex systems of human communication such as signing for the hearing impaired.

⁵I am not so idealistic or unrealistic so as to ignore the recurring presence of competition and contestation in human affairs at all levels. However, my claim is that human cooperation, mutual help and care must exceed competition, contestation and antagonism or else as a species we would have perished in the past or will perish in the future.

say, our responsibility for the other is not a derivative feature of our subjectivity; instead, this obligation provides the foundation for our subjective being-in-the-world by giving it a meaningful direction and orientation (Levinas 1981). This leads to Levinas' thesis of 'ethics as first philosophy', meaning that the traditional philosophical pursuit of knowledge is but a secondary feature of a more basic ethical duty to the other (Levinas 1969).

Thus one can say that as social creatures our very nature presupposes the ethics of interpersonal encounters, even before they occur, and even before we form or reflect on our practices, let alone our philosophies. This is why Levinas asserts that ethics is the 'first philosophy' presupposed by any area of activity, experience or knowledge, including mathematics education. If we accept his reasoning, then ethics is also the 'first philosophy' of mathematics education. It precedes any theorizing or philosophizing in our field, and this constitutes a hidden underpinning that precedes any discussion of, for example, theories of learning mathematics.

Unfortunately ethics as the 'first philosophy' of mathematics education tells us little specific about mathematics or the teaching and learning of mathematics, other than to respect and value our peers, students and indeed all peoples. But acknowledging the primordial social character of human beings weakens the claims of theories like behaviourism, simple constructivism, radical constructivism, enactivism and even humanistic psychology that are expressed in individualistic terms. If such theories do not take into account our irreducibly social character, there is a strong case that can be made against them. Thus, for example, radical constructivism's account of the learner as a cognitive alien making sense of a world of experience, and constructing other persons as regularities in that world, in effect denies the social and ethical foundation of human being (Ernest 1994).

Learning is not something that takes place in a social vacuum by any account, and socio-cultural theory and social constructivism prioritize the social environment as a primary element in the learning and of course the teaching of mathematics, thus becoming, on the basis of my argument, irreducibly ethical theories. However, it would be naïve to finish without acknowledging a possible rejoinder from proponents of individualistic learning theories. Namely that such theories because of their deliberately narrower focus do not dwell on the social or ethical, but as thinking tools for humans, like any other theories, they must be applied ethically. All human activities must take place under an ethical umbrella and the fact that ethics is implicated in social theories (albeit at one remove) does not give their supporters any free ethical 'brownie points'. For sociologists to claim that their area of study is more ethical than that of psychologists, not that they do so, would be arrogant, laughable and simply false.

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