The "Spirit" of FLM

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As a student in the early days of FLM, and subsequently as a research assistant to David Wheeler, I was occasionally asked to read an article submitted for publication. The "request" would often go something like this: "If you promise not to get too excited I'll let you read this." Now, at last, for this 50th issue, I have been given permission to abandon the requisite phlegmatic stance and express some of the excitement I felt over many of the contributions to FLM over the years. After sorting through back issues and discovering my "exciting" pile was far too high, I decided to pick three representative articles written about a year apart and with a thematic thread running through them that only became visible when I tried to tease out the source of my excitement. Written in 1990-92, they are articles to which I have returned on many occasions and come away with something I'd missed or forgotten and with a heightened energy and enthusiasm for mathematics education.

In 1990 Valerie Walkerdine's work was new to me but having delved into many of her publications since does not detract from — and in fact heightens — the excitement I feel when I read again "Difference, Cognition, and Mathematics Education" [FLM 10(3), pp. 51-56]. Walkerdine, a psychologist and former school teacher, takes a harsh look at Piagetian-based theory of cognitive development with its "assumed pinnacle of abstract reasoning." Her "germ of a suggestion" on page 52 still explodes on the page sending shivers down my spine. It is

> . . . that this simple sequence [of development] is itself a historical product of a certain world view produced out of European models of mind at a moment in the development of European capitalism dependent on the colonisation and the domination of the Other, held to be different and inferior. It was the European aristocratic and bourgeois male who was to become the model of a rationality founded upon a lifestyle in which economic necessity was not an issue and in which the domination of the Other was to become to a certain extent justified by a reading of difference as inferiority. That the position of those Others, the working classes and the colonised peoples, for example, was produced by their oppression and exploitation . . . is a feature which is rarely brought into question when attempting to understand the production of psychological aspects of development.

In this article she discusses the fantasies (of poor children, of mathematicians, of developmental psychologists), oppression and creation of the Other in the mathematics classroom, the construction of mathematical "truth," "reason," and the "natural child", giving us along the way a résumé of the conclusions in her *Mastery of Reason*, *Counting Girls Out*, and *Democracy in the Kitchen*. She argues that "we need to construct accounts which move away from the stagewise progressions of most First World developmental models to an understanding of development as specific to social and historical circumstances" [p. 55].

This critical — almost devastating — look at what goes on in and out of the mathematics classroom brings into play psychological and philosophical analytic tools that are rarely seen in the field of mathematics education — Klein, Freud, Rotman, Lacan, Foucault — and overwhelms with its energy and passion.

A year later, Rosamund Sutherland produced an article in FLM [11(3)] that was the source of much impassioned discussion among some of the students and researchers I was working with at Concordia University. *Research Issues in the Learning and Teaching of Algebra* (edited by Wagner & Kieran) had appeared in 1989 and was considered by many to be a state of the art portrait of research into high school algebra. Sutherland, in her article "Some Unanswered Research Questions on the Teaching and Learning of Algebra," challenged many of the statements and underlying assumptions of the authors — all key players in mathematics education.

Among the assumptions or shared beliefs of the "Research Issues" contributors, she identified first and foremost Piagetian cognitive development theory. Here the work of Küchemann, Herscovics, Collis, Booth and the whole of the literature on cognitive obstacles were set against the relatively new evidence coming out of her own and others [Tall & Thomas, Thompson] work in computer environments (Logo, spreadsheets, multi-representational software) where the classical cognitive obstacles seemed to dissipate. She concluded that "the idea of cognitive obstacle needs serious re-questioning" [p. 41] and "the view of teaching, inextricably linked to the idea of overcoming cognitive obstacles needs to be reassessed" [p. 41]. A second, and related, underlying assumption, the belief that language is grafted onto understanding, that students must understand a problem and then "translate" it [Booth, Kieran] into algebraic symbolism, for example, was also challenged with evidence from her research as well as readings from Vygotsky on the social interweaving of language and thought. The related syntax-semantic debate was discussed with quotes from Kaput who favoured an increased accent on semantics and Kirshner who believed that "the natural predisposition of the mind is to approach new, structured domains syntactically" [p. 45]. Her work with Hoyles on Logo convinced her that "if syntax is introduced within an accessible, motivating, and interactive problem solving situation then syntax is learned with surprising ease" — rather like a natural language — and that syntax and semantics cannot be separated but need to be welded together [p. 45].

Sutherland expressed some important challenges to the "truths" of the turn of the decade. It was an exciting article not only because it took a very solid poke at many of the basic paradigms in mathematics education but because it announced a new decade of research with computer technology that would continue to change our views on students and their mathematical possibilities.

Bauersfeld, a couple of issues later [FLM 12(2), 1992], reiterated Sutherland's expressions of discomfort with the pat Piagetian stance in mathematics education. While Sutherland's challenges came mainly from within mathematics education — research in computer environments which led her to question many of the shared beliefs and basic assumptions and to point to the inadequate nature of our central theoretical model — Bauersfeld, acknowledging the impoverishment of that model, introduced us to a barrage of exciting new models, research, and thinking that might provide rich "explanatory power and related educational influences." He drew from such areas as cognitive psychology, epistemology, linguistics, artificial intelligence, and neuroscience — situating these fields within the cognitivist, connectionist, and enactive paradigms (see map from Varela on page 20). He then pulled together a few "shared core convictions" from these diverse fields and indicated what they would mean for mathematics education, as for example, the first shared belief that

> Learning is a process of personal life forming, a process of interactive adapting to a culture through active participation (which in parallel also produces and develops the culture itself), rather than a transmission of norms, knowledge and objectified items. [p. 20]

and the last, that

> Teaching is the attempt to organise an interactive and reflexive process, with the teacher engaging in a constantly continuing and mutual differentiating and actualising of activities with the students, and thus the establishing and maintaining of a classroom "culture," rather than the transmission, introduction, or even re-discovery of pre-given and objectively codified knowledge, [p. 21]

with descriptors of meaning, languaging, knowing or remembering, mathematising, representations, and the use of visualisations between the two

Well over half the references in the bibliography and quotes in the text come from outside mathematics education and one is left breathless with the wealth of new input from sources such as Rorty, Wittgenstein, Heidegger, Durkheim, Hacking, Johnson, Maturana & Varela, Coulter, and Schültz.

Bauersfeld was exciting because he opened the curtain on a whole world of vibrant research and rich models that could, he felt, contribute greatly to mathematics education. He hinted that while we were clinging to Piagetian-based theories the world around us had moved on and come up with theoretical models that, if applied to mathematics education, would revolutionize what we "behold" in the learning and teaching of mathematics.

Thus the underlying thread running through these articles — though invisible to me at the time — and the source of much of the excitement I felt and still feel when re-reading them was a challenge to the Piagetian paradigm in mathematics education. That challenge came firstly from an outsider, Walkerdine, who took a very harsh look at mathematics and mathematics education from a radical psychological post-structuralist stance. Sutherland, very much an insider, then pointed to her own discomfort with that paradigm, how the basic assumptions in the field did not provide a basis for explanation and in fact contradicted newer research findings. Then Bauersfeld, an insider who through the scope of his reading and experience was able to take us outside mathematics education, gave us a glimpse of all the rich and wonderful things to be seen when one takes off the developmental psychology blinders we have been wearing.

When I mentioned in my opening paragraph that I was occasionally asked to read a submission to FLM, I did not want to leave the impression that I had any input whatsoever into the selection of articles for publication. On a number of occasions I remember writing several pages of comment on an article coming to the resounding conclusion that it should be summarily rejected only to be told that for this, that, or the other obscure reason it had already been accepted for publication. No one to this day, I am sure, can pretend to have even the vaguest fix on the criteria that guided the editor of FLM in soliciting and accepting articles — though when he announced his "retirement" we all jumped up immediately to say the journal must continue, and continue "in the same spirit."

The three articles I have reviewed here are, I believe, exemplars of that "spirit" — presenting voices from within, without, and on the fringes, questioning, surprising, shocking, asking us to "think again," allowing contributors to be provocative, to test new ideas, and readers around the world to share in the excitement of mathematics education — and this reader to express hers "enfin."