The sociocultural theory of teaching and learning: Implications for the curriculum in the Australian context

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INTRODUCTION

The major portion of the paper provides an overview and analysis of the sociocultural theory of learning and its implications for the curriculum in the Australian context. The process of applying sociocultural theory can be likened to the process of remembering as described by Bartlett where certain features in the remembered text are omitted or given less prominence, and rationalisations are made that were not part of the

original. In particular, the concepts most closely associated with the sociocultural theory of learning, such as, scaffolding, reciprocal teaching, and collaborative learning, highlight the social basis of learning, and the interactive processes that promote development. While these practices are valid instantiations of sociocultural theory in my opinion, the focus on process to the exclusion of cosideration of the content of the curriculum reveals a partial misunderstanding of the sociocultural perspective. In addition, the restriction of the sociocultural perspective to the investigation of face-to-face interaction between teachers and learners, obscures the broader cultural and political concerns that are central to the perspective. I became aware of 'omissions and rationalisations' over a period of time while teaching courses on collaborative learning and supervising research students' theses on topics such as parental scaffolding and reciprocal teaching. I noticed that sociocultural concepts were often misunderstood, for example, as nothing more than social learning theory notions of modeling, practice, and feedback. Also the difficulty in interpreting the writings of Vygotsky in translation and distanced from the historical and cultural context of the Soviet Union of the 1920s and 1930s has been recognised recently (see Wertsch,1985; Kozulin,1990). However, it was my reading and analysis of the elementary mathematics curriculum proposed by Davydov that highlighted for me the way that the key sociocultural concepts of the content of the curriculum, and the broader social and political context of education had been largely ignored in applying the theory in the Australian context.

A BRIEF OVERVIEW OF THE SOCIOCULTURAL THEORY OF LEARNING

The sociocultural perspective suggests that learning is a process of appropriating 'tools for thinking', that are made available by social agents who initially act as interpreters and guides in the individual's cultural apprenticeship (Rogoff 1990). It is not just that the child learns from others in social contexts and during social exchange, but rather that the actual means of social interaction (language, gesture) are appropriated by the individual (internalised and transformed) to form the intramental tools for thinking, problem-solving, remembering, and so on (Wertsch 1985).

Vygotsky's explanation of the relationship between language and thought provides a compelling illustration of the process of appropriation. As Wertsch (1985) notes, the title of Vygotsky's book, Thought and Language, is more accurately rendered in the active voice as 'Speaking and Thinking', which captures the notion that speaking and thinking are ways of acting on the material and social world. In Vygotsky's analysis, the changing functional relationship between speaking and thinking is the most compelling example of the general process of development in which social tools (initially serving social functions) are appropriated and transformed into individual tools of thinking and problem solving. The movement from the social plane of functioning to the individual and internal plane of functioning, however, requires active engagement by children in social

interaction with peers and supportive adults. In social interaction, the child uses speech and gesture to regulate joint attention, to identify and label objects, to classify, to elaborate experiences, and to offer explanations. It is the socially situated use of language that enables the child at a later time to recapture, reflect on, and transform experience. Levina expressed this idea succinctly when she wrote, 'Vygotsky said that speech does not include within itself the magical power to create intellectual functioning. It acquires this capacity only through being

used in its instrumental capacity' (Levina 1981, p.296). The opportunity to use speech as a means of making sense of experiences with other participants is a crucial step, therefore, towards independent intellectual functioning.

Vygotsky distinguished between two lines of development - the natural line of development and the cultural line of development. This duality is similar to a series of other concepts that he explored-everyday concepts and scientific concepts; rudimentary mental functions and higher mental function. These dualities were proposed and examined by Vygotsky to demonstrate that progress in thinking involved the transformation and interpenetration of more natural, spontaneous and elementary processes, by the cultural, abstract, organised and mediated processes. In describing the growth of spontaneous and scientific concepts, for example, Vygotsky wrote that "Scientific concepts grow downward through spontaneous concepts; spontaneous concepts grow upward through scientific concepts "(Vygotsky, 1986, p.194). The elements proposed in the dualities are seen by Vygotsky as meshing together, as intertwining to form a single thread of development. The more natural and elementary processes are viewed as providing the necessary but not sufficient conditions for progress toward more powerful thinking tools. It is culture that has the crucial role in driving development forward. Vygotsky expressed this view in the following way:

An organism internally prepared, absolutely requires the determining influence of the environment in order to enable it to accomplish that development... The organic maturation plays the part of a condition rather than a motive power of the process of cultural development (Vygotsky 1929, p.423)

The relationship between the spontaneous and scientific concepts provides a window onto the relationship between education and the development of the child. At any given developmental moment, Kozulin (1990) suggests there is a proportion between scientific and spontaneous (everyday) concepts. Education involves focussing on contexts of collaborative thinking where a child's everyday concepts come into contact with the scientific concepts introduced by adults and other cultural ‘experts’ (Kozulin, 1990, p.169). Scientific concepts cannot be assimilated/appropriated by children in an automatic manner, as implied in a transmission model of teaching. A special social process, created by adults is required to bring together a

child's everyday representations with the more abstract scientific representations. To explore this issue in some detail, the application of Vygotsky's theory to the early mathematics curriculum will be described with particular reference to the work of Davydov.

Davydov's application of sociocultural theory to the mathematics curriculum. In the field of mathematics, Davydov (1975a, 1975b, 1991) elaborated and exemplified the theoretical position outlined by Vygotsky. For Davydov, the setting-up of a curriculum in elementary mathematics, requires a logical, psychological, and didactic analysis. Logical analysis is required to establish the fundamental mathematics concepts that can be used as a basis for subsequent conceptual development. The logical analysis conducted by Davydov was directed at supporting the view that “relations of quantity” are the fundamental concepts upon which the whole of the number curriculum could be built. This is in line with Vygotsky's view that instruction should begin with "the natural arithmetical endowment of the child" (Vygotsky 1929, p428). He wrote

"The first stage in the child's arithmetic ability is formed by the natural arithmetical endowment of the child, that is his operation of quantities before he knows how to count. We include here the immediate conception of quantity, the comparison of greater and smaller groups, the distribution into single objects where it is necessary to divide, etc" (1929, p.428)

Psychological analysis is required to establish the children's capacities -

their development of both rudimentary and higher-mental functions - that could be applied to the grasp of the fundamental mathematical concepts. Didactic analysis is needed to create instructional procedures powerful enough to build connections between scientific concepts (that is, the fundamental mathematical concepts) and the learner's everyday concepts. In the sections below I describe in more detail the psychological and pedagogical analyses.

Appropriation of general forms of mental activity. Davydov's psychological analysis builds on Vygotsky's account of the process of development. Davydov echoes Vygotsky's concerns particularly on two issues. First, regarding the process of appropriating cultural tools for intramental functioning, Davydov emphasised that appropriation is not "in place" of development nor simply "alongside" development. Appropriation is the process of development, but only under certain conditions, namely, when it involves the mastery of the methods and general forms of mental activity. The preoccupation (that Davydov's work reflects) with identifying the most fundamental and powerful concepts in mathematics, derives from his conviction that development cannot occur by the appropriation of any set of cultural tools - only by the appropriation of general tools of thinking, can new opportunities for growth be created. Such a viewpoint is similar to Bruner's claim that academic disciplines can be taught to even very young

children by making available to them the organising and key concepts in some meaningful form.

General to the particular. The sociocultural approach to learning suggests that the general and abstract come before the specific and particular. For example, a word is already a generalisation for a set of objects or experiences, and in using the word a child can name and give meaning to a whole range of as yet unseen objects and experiences. Davydov contends that the particular is made visible through the general. He writes,

"Succeeding in making the particular visible through the general is a characteristic feature of the kind of academic subject which awakens and develops the childs ability to think theoretically... (1975b, p.204)

This reversal of the common-sense assumption that higher-order thinking must be built up piecemeal by mastering lower order procedures, is reflected also in the work of Newman Griffin and Cole (1989). They worked with children on division and multiplication problems. The children who experienced most difficulty with division seemed to lack an understanding of the functional significance of the multiplication facts. Confronting the division algorithm organised the multiplication facts, according to Newman et al, giving the facts for the first time a clear functional significance for some children. They suggest a re-ordering of curriculum content where higher level actions (concepts) are taught prior to lower level operations (Newman Griffin and Cole, 1989, p.155).

Synthesizing the subjective and social practice. Like Vygotsky, Davydov was concerned about the subjective changes in the individual produced by appropriation. The appropriation of cultural tools creates novel mediational means that transform the relationship of the individual subject to the social and physical world. Thus Davydov (Davydov and Markova, 1983) argued that educational activity is not directed primarily at the acquisition of knowledge but at the change and enrichment of the individual. This implies voluntary engagement in activity and self-regulation in social practices where the individual not only accepts goals proposed by teachers and other adults, but generates his/her own goals. Thus to ensure development is not empty and hollow, Davydov argues it is necessary to create conditions to ensure personal meaning. He wrote,

It is necessary to ascertain and create conditions that will enable activity to acquire personal meaning, to become a source of the person's self-development, and comprehensive development of his personality, and a condition for his entry into social practice (Davydov and Markova, 1983, p.57)

Thus like Vygotsky, Davydov was concerned to synthesize the apparent contradictions between personal meaning and social practices. To achieve such a synthesis, he argued that particular pedagogical practices were

necessary. It is to this issue I turn now.

THE TEACHING EXPERIMENT OF DAVYDOV

The pedagogical analysis of Davydov (19756) entailed the planning and implementation of a "teaching experiment". The teaching experiment involved working closely with teachers and groups of children in order to devise materials, activities and collaborative tasks that enable children to grasp the most fundamental concepts of number. In his 1975 paper Davydov reported a teaching experiment that began with children making simple quantitative judgements of concrete objects and finished with them using algebraic notation to represent quantitative relations in an abstract and generalised manner. In examining the transcripts of the teaching episodes and the general design of the programme, a number of characteristics, consistent with a sociocultural approach to teaching, stand out. Given the remarkable success of the teaching experiment in awakening new intellectual powers in children, it is worthwhile considering the teaching practices in detail.

Connecting everyday and mathematical (scientific) concepts. Everyday concepts are imbued with personal meaning but are tied to concrete experiences and resist systematicity. Scientific concepts are systematic and general but are initially empty of personal meaning. Appropriation of the scientific concepts cannot occur automatically - a teaching process that builds connections between the everyday and scientific concepts is required. The teaching programme of Davydov achieved this by engaging children in a series of activities that required comparison of quantities, or the construction of quantitative relations of equality and inequality. These activities were within the children's capabilities, and they could use everyday comparatives such as shorter, thicker or heavier to describe the relations. The zone of growth (ZPD) was opened for children by showing that all these various comparisons involving different criteria, could be represented by the abstractions ">" "<" or "=". The abstractions were imbued with personal meaning, however, due to creative teaching strategies - these are described below.

Teaching strategies that encourage engagement and joint-regulation of the activity. The transcripts of various teaching episodes reveal a number of strategies that encourage children to be actively engaged in thinking through problems with the teacher and their classmates. The characteristic teaching strategy was leading questions:

> "What might you say?
> How can you express that more precisely?
> What does that mean - heavier? That the black weight weighs less than the white one?
> The white weight is lighter - how else might you say that?"

(Davydov, 1975, pp. 150-151)

This sequence of questions (the children's responses and actions have been

omitted) was employed by a teacher to lead children to the conclusion that heavier means more in weight, and lighter means less in weight. The use of leading questions enabled the children to participate actively in formulating the conclusion.

A second strategy used by teachers was staging mistakes. For example, in representing unequal weights by the length of lines, a teacher remarks

Teacher I'll make them the same length, since one of the weights weighs less than the other.

Pupils (Many of them raise their hands immediately; there is a buzz of astonishment) Not that way...They shouldn't be equal.

Teacher Then what should I do? Can I use lines to show what the weights are like, or not?

The teacher invites the children to take over the decision-making in the lesson, so that within the framework established by the teacher, they become "the teacher of the teacher". At other times, children compared their representations of equality or inequality, or their choices of objects according to a particular representation, and were required to justify their choices. While less confident children may be inhibited in such public debates, the deliberate staging of mistakes by the teacher prepared the children to accept different answers as a productive part of teaching and learning, and to view each other as collaborators in the activity.

A third strategy was termed "clashing". Children were encouraged to compare and contrast their representations of quantitative relations. The "clashes" occurred when children drew lines of different sizes to represent a particular quantitative comparison. For example, equality of weight might be represented

A B A B

or

The "clashes" were managed by the teacher who challenged children to judge which was correct. The discussion revealed to children that each representation was correct since the crucial feature was not the actual length of the line (an empirical and concrete element) but the underlying meaning - that is, relations of equality. The use of "clashing" is an example of the way subjective representations are raised to be more

objective through social interaction. Each child could draw lines of any length or thickness depending on their idiosyncratic preferences for short of long lines, or indeed other visual means of representation, but the underlying meaning of the representation remained general and objective because the crucial feature was the comparative length.

A fourth strategy was the integration of spoken and visual representation of mathematical concepts. The connection between everyday concepts and the mathematical concepts was accomplished in the context of activities where objects were manipulated, selected, grouped, and drawn. In carrying out these overt actions, children were assisted to talk in mathematical ways about the visual representations of various quantitative relations. Thus, two aspects of their everyday forms of activity are being appropriated to accomplish the teaching goal. The everyday terms used by children to describe quantities were elaborated and made more precise and general. In addition, children's understanding of visual representation built-up in everyday activities of painting, drawing, cutting out patterns and so on, is appropriated by the teacher and applied to the representation of mathematical concepts. The talk of the children makes sense only in the context of the objects and representations that are referred to. The whole story is told neither by the words alone, nor by the visual representations - it is meaningful only through a process of co-referencing the words and the visual representations. Thus the mathematical talk scaffolded by teachers differs from everyday dialogue because it is not addressed directly to the other participants in the activity. The talk is directed at the objects and representations, and serves the purpose of conveying to the teacher and the other children the thinking behind overt actions. In this sense it has some properties that are similar to private speech, and like such speech it functions to organise and direct intellectual activity. One could assume also, that just as private speech declined in the presence of an audience perceived as unwilling to give assistance, so too mathematical talk requires the maintenance of a supportive community.

Intermediate means of representing relations of quantity

The teaching experiment demonstrated to Davydov the importance of forms of representation that stand midway between the concrete objects and the abstract relations encapsulated in the concepts of equality and inequality. At first the children were encouraged to draw the objects being compared, but in such a manner that the feature being compared was foregrounded. Later, comparisons of various objects based on different criteria, were represented more abstractly using lines such as = or > . The notion of an intermediate form of representation is similar to Vygotsky's view that between the abstract scientific concepts characteristic of cultural experts, and the preconceptual representations of children (syncretic representations based on feelings; complex representations based on complementarity and everyday factual and concrete relations) stands the "pseudo-concept" which in many situations functions like a scientific concept but actually has a less abstract and general substructure. For Vygotsky, pseudo-concepts were crucial in enabling children to join in episodes of instruction with teachers. The apparent similarity of the

pseudo-concept and the scientific concept enables a teacher to act toward the child as if he/she were further advanced in understanding the concept than actually is the case. The teacher interprets the child's actions in terms of a higher level of development but in so doing reveals to the child the path toward cultural expertise. Some misunderstanding may occur, but

in the context of instruction, it can be productive because it reveals to the teacher and the child the underlying structure of the concepts and creates conditions for a more deliberate and reflective grasp of concepts.

In Davydov's teaching experiment, the intermediate representation of the relations of equality and inequality was achieved by using various visual forms such as the following.

Simple line drawing	<
Geometric shapes	>
Everyday objects	=

These visual representations are abstract and have an equivalent form to the algebraic representation A < B. At the same time they retain a concrete and empirical character because the symbols themselves differ in size. A child may appear to understand the abstract nature of the representation but in fact be centred on the concrete and empirical features of the representation. Such intermediate representations are analogous to pseudo-concepts. For example, at a particular time a child and teacher may co-ordinate their interactions and productively engage in teaching-learning episodes on the assumption that they have a similar understanding of the representation. In fact, the teacher may see the intermediate representation in abstract algebraic terms, while the child is focussed on the empirical visual features of the lines. To encapsulate the notion, one could say that the child is looking back while the teacher is looking forward in cultural development.

In Davydov's account of the teaching experiment, he provides evidence that supports the scenario described above. He noted that

One other odd matter shall be mentioned. At first some children (as a rule, several in each class) would record the results of comparisons using letters of different sizes; that is, they would carry over the principle of using models of the objects as symbols [A > b; c < D; E = E]*. The teacher would show that this is unnecessary in a formula since the relationship is indicated by the symbol for inequality (Davydov, 1975b, p.170). *Example added to the original.

The children's records revealed that their representations of the relations of quantity retained earlier traces of concreteness, yet it had not

prevented them from engaging productively in teaching episodes, and moving toward the teacher's understanding of the concept. The misunderstandings that surfaced along the way were windows of opportunity to systematise and extend the child's concepts. Teachers acted as if children's symbolic representations of quantities were equivalent to general algebraic formulae, whereas the children were still tied to some extent to a more concrete and factual understanding of the representations. Nonetheless within the context of the instructional dialogue, the teacher was able to move the children progressively toward greater abstraction and generality. The teacher opened up possibilities for growth by appropriating the children's actions into a more general cultural frame of reference. Thus, it is not the creation of high fidelity or noiseless communication channels that produces effective teaching and learning but the intersection of differing perspectives. As Newman et al note, dialogue in the ZPD is a dialogue not with the past but with the child's future (Newman Griffin and Cole, 1989, p.64).

Participating in the mathematical discourse. The episodes of teaching that Davydov reports in his research on early mathematics curriculum, show that the teachers are socialising children into the social discourse of mathematics. Children arrive at school with a variety of discourses that they might call on in order to participate in classroom talk. What the teacher does is to demonstrate a particular way of talking, and guide children into "ventriloquating" (speaking with) her voice as they become familiar with the speech patterns. This can be seen in the following episode

Pupils: They can be compared by weight (they point to the scales), by height, or by their bottom (they mean the size or area of the base).

Teacher: What might you say?

Pupils: They are unequal (in weight or height).

Teacher: How can you express this more precisely?

Pupils: The black weight is heavier, higher, bigger, thicker than the white one.

Teacher: What does that mean - heavier? That the black weight weighs less than the white one?

Pupils: (They laugh). No, not less, but heavier...It weighs more!

Teacher: The white weight is lighter - how else might you say that?

Pupils: (About half the class raise their hands). The white weight is less, lighter in weight than the black one.

This episode was designed to help children move away from their use of comparatives (thicker, larger, heavier, or the same). Children preferred these words to the more abstract "less than" in width, or "more than" in length, "equal" in weight. The children's use of comparatives was derived from their everyday conversations, whereas the teacher's purpose was to prepare them to participate in speaking about and representing mathematical ideas. In the episode above, the teacher used leading questions (What might you say?) and hints/suggestions (What does that mean - heavier? That the black weight weighs less than the white one?) to support the children's production of mathematical discourse. In later episodes, the children ventriloquate the teacher as they discuss "having an equality" or choosing pencils "equal in length". This is illustrated in the dialogue below.

The pupils raise their hands. The class is animated.

Teacher: We won't help him for the time being! Now think.

Misha V: (after a short pause) The letters tell me about the length of the pencils -this one and this one.

Teacher: Is that all? If the letters tell about the length, then I'll take a pencil of this length - this is A, and one of this length - this is B: What I get is that A is less than B.

Pupils: You can't take those - then you have a different formula.

Misha V: We have an equality - there is an equal sign there. We have to take pencils of equal length and then it's right.

Teacher: Then what tells about the equality itself?

Pupils: The symbol between the letters - the whole formula.

Teacher: Now I'm changing the symbol in my formula to read A is less than B. Can you find objects to show what this means?

The mathematical voice was not simply imposed in an authoritarian manner by the teacher. Rather the teacher began with the words that the children brought with them, and she assisted the children to see that there were other words - more precise, more abstract and more general - that could be used in place of their everyday words.

Privileging the mathematical voice. The episodes of teaching that I have analysed briefly demonstrate that the adult scaffolds the children's performance of the mathematical voice. This does not imply, however, that the other voices have been eliminated. Rather the children were learning

that the privileged voice in the activity was not their everyday form of speaking. The children were encouraged to speak with their everyday voice (by making qualitative judgements of quantity and using familiar visual representations) but the teaching episodes introduced the new voice and systematically privileged it. The concept of privileging is defined by Wertsch (1991, p.124) as addressing the organisation of mediational means in a hierarchy of status. The hierarchy is not a static structure, however, since it changes across settings, and even in the one setting it is possible for the participants to introduce extraneous voices, and to move back and forth between voices. The dynamic interaction of voices and the social-situatedness of voices is illustrated below in reference to the innovative practice of encouraging children to keep mathematics journals. The journals are a device to engage children in self-directed thinking and exploration of mathematical concepts. The task that children confront is to acquire the appropriate way of writing in the journal - that is, to acquire the privileged voice. Pengelly (1990) provides evidence that some children do not know how to produce such writing, as illustrated in the following entries

"I did maths today and it was fun"
"In maths today we did polydrons. I like polydrons".
"I like doing maths with Sally"
"Number 12 is the most fantastic number. I would say the number 12 is the best number in the whole wide world". (Pengelly, 1990, p.14)

The children are not employing the mediational means of language or visual representation that might enable them to think mathematically. They are using the voice of a "personal diary" that records the ebb-flow of emotional states. In this case, the extraneous voice predominates, intrudes into the activity and replaces the potential mathematical voice.

CONCLUSION

Organisation of the curriculum content. Davydov's work and that of his colleagues (e.g. Minskaya, 1975) has been concerned with identifying the fundamental concepts upon which the number curriculum could be based. As noted previously in this paper, he argues that it is insufficient for mathematicians to complete a logical analysis to identify such concepts. The concepts have to be made available to children in a meaningful fashion, and this requires both psychological analysis of the capabilities of the child, and pedagogical analysis to identify the procedures that can bring about the desired growth in the child's reasoning. The teaching experiment conducted by Davydov (1975b) convinced him that the mathematics curriculum should begin with examining the relations of quantify (<>=) because an understanding of these relations, and the representation of such relations in algebraic form, enabled a smooth transition to be made to the operations of addition and subtraction even before children applied their knowledge of counting to such operations. Thus children could be made aware of the inverse nature of addition and subtraction by considering how quantities

can be made equal, as in the following example where equality can be achieved by either adding or subtracting a specific amount - a.

$$c > b$$
$$c = b + a$$
$$b = c - a$$

Furthermore, work by Minskaya (1975) demonstrated that children's understanding of the relations of quantity could be used to introduce both whole numbers and fractions to children. The notion of number

$$n = \frac{K = \text{Some quantity}}{a \quad \text{Unit of Measure}}$$

facilitates the use of concrete materials to demonstrate that number varies according to the unit of measurement that is employed, and that at times some portion of the unit of measurement will be left over when a quantity is measured with that unit - that is, children work from the beginning with whole numbers and fractions.

Davydov's conclusion about how the curriculum should be organised may not receive endorsement from other researchers. What is important to highlight, however is not his conclusion but his general approach to the issue. He seeks to build the curriculum from a few central concepts, that are made available to children in a meaningful but abstract form. It is important to highlight as well that Davydov, like other sociocultural theorists, has a dynamic view of curriculum, because as children's capacities for reasoning are extended through effective pedagogy, new challenges are posed for educators in satisfying the children's new interests. To quote him,

In their work with the simplest letter formulas the children showed that they have a lively taste for reasoning, making mental comparisons and giving a logical appraisal of various relationships. The designers of academic subjects face the task of satisfying this awakened interest. (Davydov, 1975b, p197)

This indicates that the organisation of curriculum is an ongoing and reflexive process that cannot be preordained for all children. It requires consideration of the capabilities and potentialities of children as revealed in pedagogical practices, and adaptation of the curriculum content to meet the needs and interests of the children.

Davydov’s position on the organisation of the curriculum is similar to the “structure of knowledge approach” that was advocated during the 1960s. While I have given a sympathetic account of Davydov’s position by highlighting his concern to ensure personal meaningfulness of the abstract mathematical concepts, and the creative use of such concepts to pursue self-generated goals, there are deficiencies that need to be noted. As Confrey (1991) argued Davydov provides no means for the resolution of

differences between theoretical views - cultural knowledge as encapsulated in domains such as mathematics takes on an overly absolutist quality. To deal adequately with these issues more explicit analysis of the role of power relationships, the negotiation of conflicting assertions of 'truth', and the process of knowledge invention has to be attempted.

Pedagogical practices. In the description of Davydov's teaching experiment, I extracted certain teaching strategies that exemplify aspects of the sociocultural approach. The role of teacher was central in scaffolding children's use of language and visual representation. The teaching strategies included leading questions, hints, staging mistakes, and discussing representations. In general the teacher maintained an active role in the classroom dialogue but ensured that the children participated in formulating answers and solving apparent contradictions. The sociocultural approach to instruction suggests that as competence grows the teacher withdraws support and encourages children to self-regulate their activity (see for example Tharp and Gallimore, 1988; Rogoff, 1990; Renshaw, in press b). It was not clear from the description of the teaching experiment, how the movement to self-regulation was handled by teachers, nor the procedures that were employed to encourage children to

proactively engage in self-directed problem finding and problem solving. It is clear Davydov assumes that such self-initiated activity is an outcome of effective teaching - I noted above his view that instruction is not directed at the appropriation of knowledge per se, but at the change in the child and his/her relation to the social and material world. Without such an elaboration of the movement toward self-regulation and independent investigation, Davydov's account of teaching can be interpreted as thinly disguised transmission of an accepted position rather than the opening-up of new possibilities for personal meaning-making in concert with ones companions.

Social and political context of education. Sociocultural theory locates all human activity in a particular historical, cultural and institutional context. Human behaviours cannot be understood by focussing on the individual in isolation nor by considering the individual only in face to face interactions with social agents such as parents or teachers. Episodes of social interaction need to be located in more encompassing political, cultural, and historical contexts (see Leontiev, 1981; Wertsch, 1985; Renshaw, in press a). With regard to school mathematics, the episodes of teaching that I analysed previously in this paper, occurred in the context of a school and an educational system that was designed for a specific societal and cultural purpose. In Leontiev's terms, this purpose can be described as the motive - the overriding sociocultural purpose that gives meaning to diverse institutional structures and practices. With regard to schools, it might be assumed that the motive system that gives purpose to classroom activities is "learning for the sake of learning" (Wertsch Minick and Arns, 1984). If such a motive system were taken-for-granted, assumed by all participants in a given society, one would predict that

institutional resources would be directed at supporting children's learning regardless of their geographic location, sex, cultural background, or any other characteristic. The motive system of education, however, as it is instantiated in modern societies, is a very complex and contested notion. Schools operate only partially to facilitate learning in all children; in addition schools operate to sort children into categories that articulate with further education and employment opportunities. Schools also operate to sustain and reproduce social privilege that is structured by social class, ethnicity and gender.

Sociocultural theory suggests that these diverse and conflicting features of the education motive will influence pedagogical practices in all classrooms - to some extent. Thus when a teacher is scaffolding the children's mathematical talk and visual representation, she is engaged in a social practice that is not only extending their reasoning capacity, but also has implications for the child's identity as a member of a particular social and cultural group in society, and for the child's prospects for future education and employment. To use Wertsch's term of voices, children may hear not only the mathematical voice when the teacher talks, but traces of other voices that (in this particular society and historical period) are associated with the mathematics voice. These traces may indicate that to enter the mathematical conversation one must be male rather than female, or from a high status social or cultural group, or aspire to a particular role in society. To resist or appropriate the mathematics voice, therefore, is not simply a matter of intellectual potential but involves issues to do with one's personal identity. This may be what Davydov had in mind when he wrote:

It is necessary to ascertain and create conditions that will enable activity to acquire personal meaning, to become a source of the person's self-development, and comprehensive development of his personality, and a condition for his entry into social practice (Davydov and Markova, 1983, p.57)

What sociocultural theory assists us to achieve, I believe, is some sense of the articulation between the micro-level processes of face to face interaction in schools and the macro-level practices of the culture. For this reason, it is worth further exploration and application in the local

Australian context.

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tiuˇ~ˇÄ My purpose in this paper is not to critically analyse the worth of Davydov’s view compared, for example, to a constructivist position. My main purpose is exposition, but where certain limitations are obvious they will be discussed.
nearlygical analysis of Davydov (1975b,

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btracting a specific amount - a.

$c > b$

$c = b + a$

$b = c - a$

Furthermore, work by Minskaya (