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DIALOGIC INQUIRY IN EDUCATION: BUILDING ON THE LEGACY OF VYGOTSKY

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The last twenty-five years have seen a number of changes of great significance in our thinking about learning and teaching.(1) Thanks, in large measure, to the work of James Moffett in the United States and of James Britton and the Royal Commission in England and Wales (HMSO, 1975), there is now a greater recognition of the central role of language in education, not only as a subject in the curriculum, but also as the medium in which the learning and teaching of all subjects is actually carried out. Arguments similar to those advanced by the Royal Commission have also underpinned the Whole Language movement worldwide (Goodman, 1987) and the emphasis on Writing Across the Curriculum, both in schools and in first-year university courses in the United States (Russell, 1991). During the same period, starting in the disciplines of science and mathematics, there has been a growing recognition of the constructive nature of learning (Bruner, 1990; von Glasersfeld, 1989) which, as one of its outcomes, has led to a renewed emphasis on the inquiry approach that Dewey advocated nearly a century ago (Dewey, 1900). And from a quite different direction has come strong support for cooperative learning and the importance of tasks carried out in small groups (Johnson, Johnson,& Holubec, 1993; Sharan & Sharan, 1992; Slavin, 1983).

However, this is not to say that the practices associated with these new conceptualizations of learning and teaching have been whole-heartedly adopted in the majority of classrooms, as large-scale studies carried out in the United States (e.g. Nystrand & Gamoran, 1991) and in Britain (e.g. Galton, Simon, & Croll, 1980) have shown. A number of reasons can be suggested for teachers' reluctance to abandon traditional whole-class instructional methods that rely on individual seat-work and what Tharp and Gallimore (1988) dubbed the 'recitation script'. Without doubt, a major influencing factor is the increasing pressure of accountability for delivering a centrally determined curriculum and for increasing students' scores on standardized tests of "basic" skills and memorized items of information. As Edwards and Mercer (1987) have argued, when there is a conflict between espoused beliefs and perceived external requirements, teachers' actual practices are likely to be swayed by the latter. It is difficult for them to adopt innovatory practices when these practices are not supported by educational administrators and by the wider community of parents and other interested stakeholders.

But equally important, I believe, is that the majority of teachers see these innovations as quite independent of each other, each being a 'fad' that will, in turn, be superseded by another. If

these new ideas about learning and teaching are to take hold in schools, therefore, a major effort will be required to explain them, not only to teachers and teacher educators, but also to the wider public, in order to win their informed support. This will certainly be no easy task, given the deep-rooted conservatism that pervades thinking about education by professionals and policy-makers alike. However, the contention of this chapter is that the various insights about learning and teaching that were briefly listed above are not at all unrelated. On the contrary, I shall argue that they each take on additional significance by being seen as essential components of a coherent overarching theory of human development and behavior that, if generally adopted and put into practice, could significantly improve the contribution that schooling makes to the well-being both of society as a whole and of its individual members.

The theory to which I refer is that first outlined by Lev Vygotsky, who, during the years immediately following the Russian Revolution, set himself the task of reconstructing "the human sciences", and in particular psychology, so that they would serve more effectively to guide attempts to make sense of, and create practical solutions to, the social and educational problems of his time (Wertsch, 1985). From the start, his intention was to create a theory that would not only help us to better understand what it is to be human, but also help us to act effectively to improve our human situation. Unfortunately, because of his untimely death, Vygotsky was unable to complete this ambitious program. However, he did succeed in sketching out its overall framework as well as in filling in much of the detail, particularly in the area of early intellectual development. From this it can be seen, as Bruner (1962) wrote in his introduction to the first of Vygotsky's works to be translated into English, "Vygotsky's conception of development is at the same time a theory of education" (p.v).

The translation into English of *Thought and Language* in 1962 was to see the start of a continuation and enlargement of Vygotsky's endeavor, as his ideas were taken up and extended, not only by his colleagues and followers in the Soviet Union, but in Europe and subsequently in North America and the rest of the world. Today, under the descriptors "sociocultural" and "social constructivist", the theory which he originated is coming to have a growing influence on those who are trying to envision and enact a form of education better suited to the increasingly diverse and changing world in which we live than the one that we inherited from the industrial age of the nineteenth and early twentieth centuries.

In the space of this chapter I shall be able to do no more than provide an outline of a social constructivist theory of education. However, my aim will be to show how the various innovatory practices that I listed at the beginning of this chapter belong together in a conception of education that is indeed revolutionary in its implications.

Vygotsky's Theory of Human Development

The puzzle that most preoccupied Vygotsky concerned the scope and rapidity of human development: How do humans, in their short life trajectory, advance so far beyond their initial biological endowment and in such diverse directions? To an educator, this is likely to be interpreted as a question about the development of individual human beings and about the role that formal education plays in the process. This was the focus of much of Vygotsky's

thinking and experimentation too. However, from the very beginning, he saw that, in order to arrive at an adequate answer, it would be necessary to look not only at individuals but also at the social and material environment with which they interacted in the course of their development. He saw, furthermore, that this environment was itself constantly changing, and that the history of an individual's development could therefore not be understood without also considering the history of the social group or groups of which the individual was becooming a member, on the one hand, and of the actual unfolding over time of the particular social events in which he or she successively took part, on the other. In other words, understanding the development of an individual human being requires that 'ontogenetic' development be seen, not as an isolated trajectory, but in relation to historical change on a number of other levels: that of the particular formative events in which the individual is involved (microgenesis); that of the institutions - family, school, workplace - in which those events take place, and of the wider culture in which those institutions are embedded (cultural history); and finally that of the species as a whole (phylogenesis).

However, in order to understand why Vygotsky placed so much emphasis on adopting a historical perspective - a "genetic approach" as he called it - it is necessary to consider a second fundamental feature of his theory, that of the mediating role of artifacts in activity. Human beings are not limited to their biological inheritance, as other species are, but are born into an environment that is shaped by the activities of previous generations. In this environment, they are surrounded by artifacts that carry the past into the present (Cole, 1996), and by mastering the use of these artifacts and the practices in which they are employed they are able to "assimilate the experiences of humankind" (Leont'ev, 1981, p.55). In other words, to the biological inheritance carried in the genes is added the cultural inheritance carried in the meanings of artifacts and practices in the individual's environment. Human development is thus not simply a matter of biological maturation; it is immeasurably enriched and extended through the individual's appropriation and mastery of the cultural inheritance, as this is encountered in activity and interaction with others. As Vygotsky put it, the intellectual abilities that make us distinctively human "are a copy from social interaction; all higher mental functions are internalized social relationships" (Vygotsky, 1981, p.164).

This brings us to the third key feature of Vygotsky's theory: the mutually constitutive relationship between individuals and the society of which they are members. This can best be understood by considering two interdependent perspectives. First, a society can be thought of as a set of overlapping activity systems with their associated communities of practice which, taken together, are the culture-specific means of producing and reproducing the conditions of human existence (Wartofsky, 1979). In contemporary developed societies, these involve activity systems of education, health care, the arts, law, etc. as well as the multifarious activity systems concerned with the exploitation of material resources for the production and distribution of the products required to support the society's way of life. Although they change over time, these activity systems have a continuity that is independent of the particular individuals who participate in them; nevertheless, their continued existence depends on the expert contributions of current participants and on a continual recruitment and apprenticeship of new members who will eventually take their place. Seen from this perspective, therefore, a society is maintained and developed by the particular individuals who contribute to its activity systems at any particular point in time.

Seen from the complementary perspective, the formation of individual persons, their identities, values and knowledgeable skills, occurs through their participation in some subset of these activity systems, starting with activities in which they are involved with family members, then in school and on into activity systems of work, leisure and so on. From this perspective, who a person becomes depends critically on which activity systems he or she participates in and on the support and assistance he or she receives from other members of the relevant communities in appropriating the specific values, knowledge and skills that are enacted in participation (Lave & Wenger, 1991).

From this brief account, it can be seen that it is in specific situated activities involving particular concrete individuals that both individuals and society are mutually produced and reproduced. It is here, too, that the four levels of history interact, since the way in which an activity is played out on a particular occasion depends on the affordances of the situation, including the cultural tools available, on the way in which the participants construe it, and on the resources of knowledge and skills they can bring to solving the problems that they encounter. However, both the way in which they construe the situation and the resources that they bring to bear depends, in turn, on the manner and extent to which, from their past experiences of participation in similar situations with others, they have appropriated the practices, tools, motives and values in terms of which the activity is organized within the larger society. These resources, in turn, have their own developmental trajectories, which are both constitutive of, and shaped by, the historical development of the culture; and this itself is conditioned by the stage reached in the phylogenetic development of the human species. When activities are viewed in this way, it is the continuity and reproduction of society that is highlighted - the past living on and informing the present.

However, it is equally important to see these same situated activities as the site of potential change and renewal. Every situation is to some degree unique, posing challenges that in some respects require the participants jointly to construct solutions that go beyond their past experiences. Each instance of joint activity is thus also an occasion of transformation: transformation of the individual participants and of their potential for future participation; of the tools and practices or of the ways in which they are deployed; and of the situation itself, opening up possibilities for certain kinds of further action and closing down others. Although usually only to an impercebtible degree, it is also through the novel solutions constructed on particular occasions of joint activity that transformations in society are brought about and, on an even slower time-scale, the transformations that constitute biological-cultural evolution (Donald, 1991). (2) From this perspective, particular occasions of situated joint activity are the crucible of change and development as well as the means whereby society is perpetuated. Here, history extends in both directions.

This latter perspective also allows us to gain a better understanding of learning. For when people's participation in a society's ongoing activity systems is seen to be the basis of the mutually constitutive relationship between individuals and society, learning no longer seems so mysterious. It is simply a way of referring to the transformation that continuously takes place in an individual's identity and ways of participating through his or her engagement in particular instances of social activities with others. (3) As Lave and Wenger (1991) insist, learning is not a separate and independent activity, but an integral aspect of participation in

any "community of practice". Seen from this point of view, all participants continue to learn throughout their lives, as each new situation makes new demands and provides opportunities for further development. Nor is learning dependent on teaching, if teaching is construed as deliberate instruction according to a set of preformulated objectives. In joint activity, participants contribute to the solution of emergent problems and difficulties according to their current ability to do so; at the same time, they provide support and assistance for each other in the interests of achieving the goals of the activity, as these emerge in the situation. In this way, newcomers are progressively inducted into the activity, its motivations, values and goals, and provided with models to imitate and assistance in playing their parts. Oldtimers, too, continue to learn, both from new situations and from their changing responsibilities within the community. Furthermore, it is not necessarily the most expert member(s) of the group who are most helpful in inducting newcomers; participants with relatively little expertise can learn with and from each other as well as from those with greater experience. Indeed, in many situations, there is no expert and in the case of the invention of radically new tools and practices, this is self-evidently so.

I believe that it is in the context of this broader conceptualization of learning that we should interpret Vygotsky's construct of the "zone of proximal development" (zpd) - the zone in which an individual is able to achieve more with assistance than he or she can manage alone. As I have noted elsewhere (Wells, in press), this construct was relatively late to appear in Vygotsky's writings and his thinking about it seems to have been still in the process of development at the time of his death. The two expositions of the zpd in his published work arose from two different immediate concerns: the assessment and placement of children who were "learning disabled" (Vygotsky, 1978, chap.6); and the role of instruction in the development of scientific concepts (Vygotsky, 1934/1987, chap.6). It is only in the section of the former chapter - in which he sketches the applicability of the zpd to the child's learning of the mother tongue - that one can see how Vygotsky might have developed a more expanded account of the role of the zpd in human development. Since his death, however, others have taken up this task, and the zpd is now seen as providing a way of conceptualizing the many ways in which an individual's development may be assisted by other members of the culture, both in face-to-face interaction and through the legacy of the artifacts that they have created. Also emphasized in recent work is the identity-forming effect of assistance in the zpd, since the whole person is involved in joint activity, not merely an artificially segregated component called 'cognition' (Penuel & Wertsch, 1995).

About one feature of the zpd, however, there is probably complete agreement. And that concerns the central role of language - and, more generally, of all modes of shared meaning making - in the coordination and interpretation of joint activity. For, in addition to its function of facilitating the negotiation of joint action and interpersonal relations, language also provides a conventional means for construing and reflecting on present, past and potential future actions, on the persons and artifacts involved, and on the relationships between them. Thus, as Halliday puts it, "language is the essential condition of knowing, the process by which experience becomes knowledge" (Halliday, 1993, p.94 , original emphasis).

In *Thinking and Speech*, Vygotsky devoted several chapters to the question of how social

speech comes to function as the medium for individual as well as inter-individual thinking. As is well known, he proposed - in opposition to Piaget - that the phenomenon of egocentric speech, which appears at about the age of three to four years and "disappears" a few years later, provides the key to this puzzle. Initially, speech is learned as an integral part of interaction with caregivers and other members of the child's immediate community and is almost entirely other-oriented and embedded in social activity. In learning to talk through talking with others, the child takes over the culture's historically developed theory of experience, as this is encoded in and through the language in which they construe their shared activity. Egocentric speech, or "speech for oneself", originates as part of the gradual differentiation of the self from the collective and the transition from other-control to self-control. In function, speech for self is "inner" directed; it serves as a means that "facilitates intellectual orientation, conscious awareness, the overcoming of difficulties and impediments, and imagination and thinking" (Vygotsky, 1934/1987, p.259). As the child's control of these intramental functions strengthens, the structural differentiation of egocentric speech from social speech increases; it also becomes internalized as inner speech - the means for individual thinking and problem solving - and is no longer directly observable.(4)

However, this does not mean that, from then on, social speech ceases to be important as a resource for intellectual development. On the contrary, with the differentiation of speech for self from speech for others, there opens up the possibility of dialogue, that is to say a form of collaborative meaning making in which both individual and collective understandings are enhanced through the successive contributions of individuals that are both responsive to the contributions of others and oriented to their further responses. As I shall explain in more detail below, it is by attempting to make sense with and for others, that we make sense for ourselves. Before developing that theme, though, I want to consider the more general implications of Vygotsky's ideas for the organization of formal education.

Some Implications of Vygotsky's Ideas for the Organization of Education

Socialization or enculturation of each new generation has always been an integral aspect of human activity, but the creation of a separate activity system devoted to the provision of systematic instruction is, in the history of the species, a fairly modern invention. Almost certainly, it owes its origin to the invention of writing and the need to train people with the scribal skills required in the administration of states, whether lay or religious. But at least from the beginnings of the Greek 'academy', education has also been intimately concerned with the 'creation of knowledge' as well as with the formation of personal identity. Until very recently, however, only a small minority of each generation was educated through attendance at schools and universities; most young people learned what they needed to know and be able to do through participation in the activities of community life and through various forms of apprenticeship (Lave & Wenger, 1991).

Against this background, universal public education through mandatory attendance at a separate, encapsulated institution called school can be seen as a temporary aberration - a historically and culturally localized activity system that owes more to models of industrial mass production than to that of development through assisted participation in social activity that was sketched above.(5) As was emphasized there, learning is not dependent on

teaching, still less is it dependent on participation in the activity system found in most contemporary schools. Indeed, as is increasingly being recognized, with their emphasis on transmitting cultural knowledge and skills through the delivery of decontextualized curricula designed independently of the needs and aspirations of the recipients, these institutions often impede rather than facilitate learning by mistakenly conceptualizing and evaluating learning as the product, or outcome, of instruction. Moreover, in this transmissional process, schools have a strong tendency to cultivate conforming, risk-avoiding identities in those who are successful in fitting the rules and expectations of the activity system, while simultaneously cultivating alienated and either self-doubting or rebellious identities in those who are unsuccessful. Furthermore, since the proportion who can be successful is systematically reduced at successive stages by the pyramidal structure of opportunity, this activity system called formal education can hardly be defended as either just to individuals or even effective in enriching and transforming society.

At the same time, it is clear that the educational practices that served well in pre-industial societies are no longer appropriate for ours. On the one hand, local communites are no longer organized in ways that easily afford opportunities for apprenticeship(6) and, on the other, prior to entering the activity systems in which they hope to make their careers, many young people will need to master ways of acting and thinking that are not transparently evident in the behavior of experts, but are nevertheless prerequisite for full participation.(7) In addition, given the increasing scale on which societies are organized and the increasing diversity within them, it is important for young people to develop an understanding of the complexity of contemporary life, of how it came to be as it is, and of the ethical as well as the practical issues that we need collectively to grapple with. In other words, provision needs to be made for young people to develop the understanding and dispositions that enable them to participate fully and democratically as informed, critical and responsible members of the many overlapping communities and interest groups that constitute contemporary society. Last, and by no means least, they need the opportunity to explore alternative possibilities for the development of fulfilling personal identities in settings that are supportive and relatively free of serious risk.

Increasingly, efforts are being made to envision alternative forms of education in which these requirements might be better met, in many cases through greater use of the technologies that allow virtual as opposed to face-to-face communication. Valuable though these efforts are, however, they are unlikely to be successful unless they take full account of the history of the societies and institutions they are intended to transform and of the individuals - their identities, dispositions and aspirations - whose participation will necessarily be involved in bringing about the desired changes. In other words, since change necessarily starts within the activity systems currently in place, in particular classrooms, schools and school districts, it is just as important to encourage the participants in these local communities to become agents of change through trying to improve the activity systems in which their development takes place.

It is here, I believe, that Vygotsky's legacy can be of greatest value in suggesting directions in which to proceed. Central to his theory, as I have already emphasized, is the concept of artifact-mediated joint activity, which involves change and transformation of participants and

settings over time. From this follow a number of important implications for the way in which we think about learning and teaching:

• The Classroom is Seen as a Collaborative Community: Joint activity, by definition, requires us to think of the participants, not simply as a collection of individuals, but also as a community that works towards shared goals, the achievement of which depends upon collaboration.

• Purposeful Activities Involve Whole Persons: Transformation of the participants occurs as a function of participation in activities that have real meaning and purpose; learning is not simply the acquisition of isolated skills or items of information, but involves the whole person and contributes to the formation of individual identity.

• Activities are Situated and Unique: Any activity is situated in place and time; although there may be common features across activities and settings, each activity is unique, since it involves the coming together of particular individuals in a particular setting with particular artifacts, all of which have their own histories which, in turn, affect the way in which the activity is actually played out.

• Curriculum is a Means not an End: If the aim is to engage with particular students in productive activities that are personally as well as socially significant, 'covering' the curriculum should not be thought of as the ultimate goal of education. Instead, the specified knowledge and skills that make up the prescribed curriculum should be seen as items in the cultural tool-kit which are to be used as means in carrying out activities of personal and social significance.

• Outcomes are Both Aimed For and Emergent: Outcomes of activity cannot be completely known or prescribed in advance; while there may be prior agreement about the goal to be aimed for, the route that is taken depends upon emergent properties of the situation - the problems encountered and the human and material resources available for the making of solutions.

• Activities Must Allow Diversity and Originality: Development involves "rising above oneself", both for individuals and communities. Solving new problems requires diversity and originality of possible solutions. Without novelty, there would be no development; both individuals and societies would be trapped in an endless recycling of current activities, with all their limitations.

Vygotskyan theory, or social constructivism as we might call its application to education, thus calls for an approach to learning and teaching that is both exploratory and collaborative. It also calls for a reconceptualization of curriculum in terms of the negotiated selection of activities that challenge students to go beyond themselves towards goals that have personal significance for them (Vygotsky, 1978, chap.8). These activities should also be organized in ways that enable participants to draw on multiple sources of assistance in achieving their goals and in mastering the means needed in the process. As I have suggested elsewhere (Wells et al., 1994), this means reconstituting classrooms and schools as communities of

inquiry.

Inquiry as the Organizing Principle of Curricular Activity

As I have already argued, learning is not an end in itself, but an integral aspect of participating in a community's activities, and mastering the tools and practices that enable one to do so effectively. The questions that need to be considered, then, are: What should be the nature of classroom activities and to what object should they be directed?

As a start to answering these questions, it would be difficult to improve on the ideas propounded by Dewey in *Experience and Education* (1938). As is well known, Dewey proposed starting with "ordinary experience", emphasizing the importance of involving students in "the formation of the purposes which direct [their] activities" (p.67) and in selecting "the kind of present experiences that live fruitfully and creatively in future experiences" (p.28). One of the clearest examples of what he envisaged is found in *The School and Society* (Dewey, 1900) where, having described a group of upper elementary students making a practical comparison of working with cloth made from different types of fiber -cotton, flax and wool - he wrote:

> I need not speak of the science involved in this - the study of the fibers, of geographical features, the conditions under which raw materials are grown, the great centers of manufacture and distribution, the physics involved in the machinery of production; nor, again, of the historical side - the influence which these inventions have had upon humanity. You can concentrate the history of all mankind into the evolution of the flax, cotton and wool fibers into clothing. (pp.21-2)

The significance of such investigations, that start with first-hand exploration of familiar aspects of the students' experience is that, as Dewey emphasizes:

> the occupation supplies the child with a genuine motive; it gives him experience at first hand; it brings him into contact with realities. It does all this, but in addition it is liberalized throughout by its translation into its historic and social values and scientific equivalencies. With the growth of the child's mind in power and knowledge it ceases to be a pleasant occupation merely and becomes more and more a medium, an instrument, an organ of understanding - and is thereby transformed. (p.22)

In our age of high technology, Dewey's panegyric on natural fibers may seem somewhat dated. However, it would not be difficult to find contemporary examples, such as film production, air travel or waste recycling, that would afford the same sort of opportunities for a broad range of significant inquiries.(8) As more recent writers in this tradition have made clear, the key characteristic of investigatory activities of this kind is that they take as object the influential and often problematic features of the students' experience and environment and have as their intended outcome a growth in the students' understanding, where this is taken to mean, not simply factual knowledge, but knowledge growing out of, and oriented to, socially relevant and productive action (Cohen, McLaughlin, & Talbert, 1993) .

It is not only Dewey who places inquiry at the heart of the curriculum, however. The same emphasis on first hand investigation, both through "hands-on" experimentation and through the use of reference material, is found in the school-based projects of such cognitive scientists as Brown and Campione (1994), Gardner (1989), Palincsar and Magnusson (Palincsar et al., in press), and Scardamalia and Bereiter (Scardamalia, Bereiter, & Lamon, 1994). In each case, a major purpose of the activities in their classroom communities is to cultivate a general stance with respect to the world of experience that might be characterized as a disposition to engage in systematic inquiry about the questions or topics in which one is interested. From this perspective, then, inquiry is as much about being open to wondering and puzzlement and trying to construct and test explanations of the phenomena that evoked those feelings as it is about mastering any particular body of information although, of course, the two facets of inquiry are ultimately interdependent.

As was argued above, the choice of experiences that provide the topics for investigation is critical. Not only must they be such as to arouse student interest, engaging feelings and values as well as cognition; but they must also be sufficiently open-ended to allow alternative possibilities for consideration, thus providing challenges appropriate to individual students' current abilities while at the same time encouraging them to collaborate with others in constructing shared understanding that is both practical and theoretical. In other words, they need to be experiences that generate real questions.

What I mean by "real" questions is captured in the following quotation from a paper by Bettencourt (1991), entitled "On understanding science".(9) He writes:

> Understanding starts with a question; not any question, but a real question. Said in another way, a real question expresses a desire to understand. This desire is what moves the questioner to pursue the question until an answer has been made. Desiring to understand opens ourselves to experiencing what is new as new, and the already known under new aspects.

One particularly memorable example of the energizing power of a real question occurred in a presentation to classmates, in a sixth grade unit in which I participated, on the theme of time (Wells, 1993). Nir had struggled hard to understand the principles on which the international time-clock is based and had made use of adult assistance as well as of works of reference. In order to explain what he had finally understood, he made two small sun-dials which he placed on a large globe, at the locations of Greenwich, England and Toronto. Taking a powerful flashlight to represent the sun, he held it above the 'equator' in a position due south of Greenwich. As everybody could see, the sundial at Greenwich registered twelve noon, while that at Toronto showed seven in the morning. Then, when he rotated the globe until the sun was due south of Toronto, the time shown on the sundial at Toronto became twelve noon, while at Greenwich it was five in the afternoon. As he explained, the time in Toronto is five hours 'behind' that at Greenwich because it takes five hours for the earth to make that part of its daily rotation corresponding to the distance between Greenwich and Toronto.

The key feature of activities of this kind, I would contend, is that, for the students, the goal of inquiry is making not learning. Motivated and challenged by real questions, their attention is

on making answers. Under these conditions, learning is an outcome that occurs because the making requires the student to extend his or her understanding in action - whether the artifact constructed is a material object, an explanatory demonstration, or a theoretical formulation.

However, in arguing for an approach to curriculum that is organized in terms of questions for inquiry, two further points need to be made. First, although for a question to be real, the student must really care about making an answer to it, it does not follow that the only real questions are ones that are first asked by students. Teachers' questions or questions suggested in texts that students are reading can become equally real, if they correspond to or awaken a wondering on the part of the student. What is at issue here is the student's attitude to the question, rather than where it originated; for it to motivate genuine inquiry, the question must be taken over and "owned" by the student. The second point is that inquiry does not have to start with a clearly formulated question. In fact some of the most absorbing questions arise only after some preliminary work on the topic has been carried out, or as a by-product of trying to answer some other question. They may also occur quite spontaneously and unexpectedly in the course of reviewing work carried out to date.

The more general point, then, is that inquiry is not a "method" of doing science, history, or any other subject, in which the obligatory first stage in a fixed, linear sequence is that of students each formulating questions to investigate. Rather, it is an approach to the chosen themes and topics in which the posing of real questions is positively encouraged, whenever they occur and by whoever they are asked. Equally important as the hallmark of an inquiry approach is that all tentative answers are taken seriously and are investigated as rigorously as the circumstances permit.

However, inquiry should not only be the principle in terms of which students' activity is organized. It should also characterize the teacher's mode of participation in the classroom community. Here, we need to distinguish two levels at which the teacher needs to be involved (Wells, 1995). First, the teacher should be involved as a co-inquirer with the students in the topics that they have chosen to investigate. To be able honestly to say, in response to a student's question, "I don't know. How could we find out?" is probably more important, in creating an ethos of collaborative inquiry in the classroom, than always being able to supply a ready-made answer. Even for the most well-informed teacher there are almost certain to be aspects of the topic that s/he does not fully understand. To be able to wonder aloud about these and to be seen to take action to understand them better not only provides an excellent model for the students to emulate, it also demonstrates the authenticity of the teacher's commitment to inquiry.

The second level concerns the teacher's role as leader and organizer of the community's activities. While the responsibility for deciding on the topics to be investigated and on the manner in which the investigations should proceed should be shared as far as possible with the students, the teacher cannot avoid the ultimate responsibility for the selection of activities to be undertaken and for ensuring that, in the process, time and resources are used both productively and safely. Quite apart from his or her accountability to parents and administrators in this respect, to provide the best possible opportunities for both individual and community development is one of the moral imperatives of teaching.

What I am suggesting is that this responsibility also be approached in a spirit of inquiry, with increased understanding and improved practice as the intended outcomes. As with the students, however, these outcomes cannot be separated from engagement in particular purposeful activities undertaken with others. One aspect of this has already been touched on above, when considering the teacher as co-participant with the students in investigating the chosen curricular topic. I now want to propose a second mode of participation, namely that of the teacher researcher who not only reflects on his or her practice (Schön, 1983; Schön, 1987) but also systematically makes changes and collects and critically evaluates evidence about the consequences (Carr & Kemmis, 1983). In this context, Vygotskian theory can serve as a tool for action research by providing a framework within which to make sense of the current situation, to identify contradictions, and to consider ways of making improvements (Engeström, 1991). Here, it is teacher colleagues who constitute the co-participants in the community of inquiry, both teachers in the same school and kindred spirits in other institutions, both school and university. It is in such professional communities of inquiry that some of the most productive transformations of schooling are being carried out, often using a social constructivist framework to assist them. In a later section of this chapter, I shall describe some specific examples.

On Knowledge and Knowing

As I hope I have made clear in the previous section, inquiry is not to be thought of in terms of isolated projects, undertaken occasionally on an individual basis as part of a traditional transmissionary pedagogy. Nor is it a method to be implemented according to a preformulated script. On the contrary, it is the stance that pervades all aspects of the life of a classroom community that is based on the social constructivist belief that understanding is constructed in the process of people working together to solve the problems that arise in the course of shared activity. Organization of classroom resources, resolution of interpersonal disputes, planning of field trips, as well as curriculum-based activity, are all approached in the same open-ended and exploratory way in an inquiry-oriented classroom. Equally important is the dialogic mode of interaction that is pervasive in the life of such a community. Dialogue necessarily plays a central mediating role since it is the principal means of arriving at a common understanding of whatever question is at issue.

Unfortunately, however, in most classrooms this is not generally the case. As several studies have noted (Galton et al., 1980; Lemke, 1990; Nystrand & Gamoran, 1991), there is a dearth of dialogue throughout the years of schooling. One of the principal reasons for this, I believe, is to be found in the misconceptions that exist about the nature of knowledge that can be seen in many state and district policy statements. There the prevailing view is that knowledge is a commodity that is stored either in individual minds or in texts and other artifacts. Like other commodities, it can be transmitted from one person to another; it can also be itemized, quantified and measured. On this transmissionary view, classroom dialogue is, not surprisingly, seen as an unnecessary waste of time; all that students need to do is to read and listen attentively to the knowledge conveyed through authoritative texts and lectures and absorb and remember it for subsequent reproduction.

However, there are several reasons for rejecting this "banking" conception of knowledge

(Freire, 1970), not least being the evidence from classrooms that what students understand does not have a straightforward correspondence to what they have been told or have read. As has been cogently argued, minds are not containers of knowledge propositions (Bereiter & Scardamalia, 1996); nor can knowledge be directly transmitted through talk or text (Reddy, 1979), since it must be constructed by each individual knower (von Glasersfeld, 1989).

But, in my view,the most serious problem with the prevailing view is that, in treating knowledge as some thing that people possess, it loses sight of the relationship between knowing and acting and of the essentially collaborative nature of these processes. Knowledge is created and recreated between people, as they bring their personal experience and information derived from other sources to bear on solving some particular problem. What we refer to as knowledge is thus both the enhanced understanding of the problem situation gained by the participants, on the one hand, and the representation of that understanding that is produced in the process, on the other. Furthermore, neither the participants' understanding nor the knowledge representation can be appropriated by others unless they too engage in some comparable problem solving. This point is made very clearly by Popper, when discussing theoretical knowledge:

> We can grasp a theory only by trying to reinvent it or to reconstruct it, and by trying out, with the help of our imagination, all the consequences of the theory which seem to us to be interesting and important ... One could say that the process of understanding and the process of the actual production or discovery [of theories] are very much alike." (Popper & Eccles, 1977, p.461)

Not all knowing is theoretical, however, even though, in our highly literate and technologically-oriented society, there is a strong tendency to privilege theoretical knowing over those modes of knowing that are more typically involved in the "practical" activities of everyday living. As Wartofsky (1979) has argued, different modes of knowing have emerged over the course of human history as a result of the increasing range of types of activity in which people engaged and of the types of artifacts that entered into those activities.
The most fundamental mode is the instrumental knowing involved in transforming the material world for the purposes of survival; such knowing is inherently involved in the making and using of the primary artifacts that are involved in these activities. However, joint activity in which instrumental knowing needs to be shared and coordinated with others requires a further mode, that of procedural knowing which, in turn, depends upon the use of communicative representations, or secondary artifacts. Initially, these were probably mimetic in form and involved demonstrative action, gesture and facial expression (Donald, 1991). Then, with the invention of language with its potential for representing not just objects and actions, but also the relationships into which they enter and the conditions under which these relationships are observed, there emerged the third, substantive, mode of knowing. It was in this mode that joint planning and reflecting became possible, and the consideration of alternative, hypothetical actions and states of affairs.

However, it was with the creation of aesthetic artifacts, in the form of myths, rituals and visual art, that humans first attempted to construct overarching explanations of human existence in the world as experienced. This aesthetic knowing, as we might call it, can thus

be thought of as the first mode in which knowing became self-conscious and deliberate, with myth serving as the prototypical, integrative tool. As Donald argues, "The importance of myth is that it signaled the first attempts at symbolic models of the human universe, and the first attempts at coherent historical reconstruction of the past" (Donald, 1991, p.267).

These four modes of knowing mediated all the activities of early human societies and, although the artifacts and technologies we now use are vastly more complex and diverse, they still underpin the majority of activities in which we habitually engage. It is against this large-scale historical background that we need to consider theoretical knowing, the last - and as some would have it, the most powerful - mode of knowing to emerge.

In fact, theoretical knowing, as we currently understand it, was not to emerge for many millenia. It seems to have required, first, the availability of visuographic means of giving a permanent representation to the meanings expressed in speech (Olson, 1994) and, second, an ideological shift towards the scientific 'objectification' of the material world. Thus it was only from the time of the European Renaissance, with the conjunction of three inventions, the controlled experiment (Hacking, 1990), the register of scientific writing (Halliday, 1988), and the technology of printing (Ong, 1982), that theoretical knowing, with its attendant artifacts in the form of scientific reports, theories and models, began to achieve its current supremacy.

Nevertheless, although very different in important respects, myths and theoretical models are both examples of what Wartofsky (1979) calls tertiary artifacts. In describing them, he writes: they "can come to constitute a relatively autonomous 'world', in which the rules, conventions and outcomes no longer appear directly practical" (p.208). However, although they are, in that sense, 'bracketed' from practical activity, they are not cut off from it. They provide possible ways of seeing and understanding and so "can come to color and change our perception of the 'actual' world, as envisioning possibilities in it not presently recognized" (p.209).

There are several important points to be made about the historical sequence I have just sketched. First, it is developmental, in the sense that each mode of knowing builds on those that went before, although without displacing them. Thus, theoretical knowing, the latest to emerge, should not, for that reason, be treated as superior in all situations (Wertsch, 1991). Second, this developmental trajectory is also relevant at the ontogenetic level. Of course, this is not a matter of simple recapitulation, since the conditions in which children grow up are always relative to the stage reached in the development of the culture to which they belong. In contemporary developed cultures, all the modes of knowing distinguished above are involved, to varying degrees, in most if not all of the activities that make up everyday living. They are therefore available to be appropriated and do not have to be invented anew in each generation - as Vygotsky was well aware (Scribner, 1985). Nevertheless, there are strong grounds for treating the sequence itself as developmentally accurate, with theoretical knowing emerging only in the school years, along with mastery of the genres of written language and the other modes of representation by which it is mediated.

One obvious implication of this is that the development of theoretical knowing should be

given high priority in the middle years of schooling and beyond, once basic literacy and numeracy are well established. And, indeed, this is already the case. However, there is a second implication which is equally important. Just as, in human history, theoretical knowing arose on the basis of knowledge derived from a broad base of practical activity, so the same sequence should hold in school. In one sense it might be argued that this, too, is already the case: the early years of schooling provide ample opportunities for practical experiences of many kinds. However, what I am proposing is that this should be the pattern for each new area of study: there should, wherever possible, be opportunities for gaining first-hand, practical experience of tackling problems in the relevant domain so that there will be a perceived need for the theoretical constructs that provide a principled basis for understanding those problems and making solutions to them. By the same token, since theoretical knowing should not be treated as an end in itself, there should also be opportunities to put the knowledge constructed to use in some situation of significance to the students so that, through bringing it to bear on some further problem, they may deepen their understanding.(10) It is this interplay between theory and practice, involving different and complementary modes of knowing, that is one of the key features of the inquiry approach to classroom activities that I proposed above.

The final point I wish to make about the development of the modes of knowing concerns the different kinds of artifact by which they are mediated, and the different roles that language plays. Following Wartofsky, we can distinguish three categories of artifact: material tools and the social practices in which they are employed; representations of these tools and practices by means of which activities are organized, and their motives, goals, and knowledgeable skills passed on to new participants; and the imaginative representational structures in terms of which humans attempt to understand the world and their existence in it.

Viewed from different perspectives, language figures in all of them. In the form of spoken and written words and utterances, language is a primary artifact that is materially produced, together with gestural and other non-verbal behavior, as a means of interacting with others. As secondary, representational artifacts, utterances enable people to coordinate their perceptions, beliefs and intentions with respect to their shared situations; here it is the referential function of language that is most salient. Finally, as a shared system of interrelated meanings, or "meaning potential" (Halliday, 1978), language provides a resource for the construction of the tertiary artifacts that mediate knowing in the aesthetic and theoretical modes.

Whichever perspective we take, however, it is discourse - the situated, purposeful use of the phonological/graphological and meaning potential of language - that needs to be focused on if we wish to understand how knowledge can be created and appropriated in and through participation in joint activity. This is the question to which I now turn, in the remaining sections of this chapter.

Dialogue and the Construction of Knowledge

An important clue in my own search for an answer to this question came during a recent conference in Toronto on the "Ecology of Mind", which was chaired by Ursula Franklin, a

doyenne of Canadian science. In introducing one of the speakers, she proposed that knowledge is created and recreated "in the discourse between people doing things together" (Franklin, 1996). In these words, she brought together three important features of knowledge building:

- it is an intrinsic part of "doing things"
- it is created between people•
- it occurs in their collaborative meaning-making through discourse.

Another way of putting the first point would be to say that knowledge is situated: it is (re)created in a specific activity setting, involving particular individuals who have a common goal, or at least a set of overlapping goals, to which they are all orienting. This goal we might call the "object" of their activity, with a quite deliberate play on the dual meaning: the object to which their actions are directed as well as the intended outcome - the transformation of that object by means of those actions. Scardamalia and Bereiter nicely capture this, in their work on knowledge building, when they speak of the need for an "improvable object" as the focus of the activity (Scardamalia et al., 1994).

The situation also contains other potential, non-human, participants in the form of artifacts of various kinds that can be used as the mediators of the activity. These include material tools, from hammers and saws to chalkboards and computers; they also include intellectual tools, such as "scripts" for constituent tasks, mathematical operations, or principles of experimental design, to the extent that one or more of the participants can bring them to bear on the object. In this sense, the most important mediational means is the participants' current understanding of the object and of possible artifacts to use in effecting the desired transformation.

The second feature of knowledge building is that it takes place between people. This is related to the joint nature of the activity to which it is related. It is sometimes objected that significant advances are often achieved by individual "knowledge workers", as they experiment with a machine in their garage, for example, or ponder on an intellectual problem in solitary silence. Certainly, advances in most of the different modes of knowing can occur when people are working alone. However, the critical issue is not whether they are alone or in the physical presence of co-participants at the time, but that the project on which they are working is one that is shared with others.

In one sense, this is always the case, since they are linked to the wider community, past and present, through the artifacts that they use. The problem that preoccupies them, too, is likely to be one that arises out of a broader sphere of activity, in which many other people are involved, and to whom the solution will ultimately be addressed. Knowledge building, whether conducted alone or in company, is thus always situated in a discourse in which each individual contribution both responds to what has preceded and anticipates a further response.

This principle of "responsivity" is one of the defining characteristics of the dialogue of knowledge building, the mode of discourse in which a structure of meaning is built up collaboratively over sucessive turns. To some extent, as Bakhtin (1986) pointed out, all

discourse is dialogic. Not only are the meanings of words and expressions "borrowed" from the speech of others, but each "utterance is a link in a very complexly organized chain of other utterances" (p.69); in both these ways, it is "filled with *dialogic overtones*" (p.92). Not all discourse is concerned with knowledge building, however, nor is there any reason why it should be. There are many other important functions that discourse serves in any activity system, even in one devoted to knowledge building. Nevertheless, as I shall try to show, the dialogic principle is a necessary feature of any discourse that aims to be "progressive" (Bereiter, 1994; Nystrand, 1997).

Bereiter (1994) proposed the term "progressive discourse" to describe the process by which the sharing, questioning and revising of opinions leads to "a new understanding that everyone involved agrees is superior to their own previous understanding" (p.6). Such discourse is based on four commitments that all participants make:

- to work toward common understanding satisfactory to all;
- to frame questions and propositions in ways that allow evidence to be brought to bear on them;
- to expand the body of collectively valid propositions;
- to allow any belief to be subjected to criticism if it will advance the discourse.

(excerpted from Bereiter, 1994, p.7)

Although intended to characterize the discourse practices of, for example, a scientific community, similar commitments can apply, in principle, to any setting in which knowledge building is intentionally made part of the activity. They are therefore equally relevant in the classroom. As Bereiter argues:

> ... classroom discussions may be thought of as part of the larger ongoing discourse, not as preparation for it or as after-the-fact examination of the results of the larger discourse. The fact that classroom discourse is unlikely to come up with ideas that advance the larger discourse in no way disqualifies it ... The important thing is that the local discourses be progressive in the sense that understandings are being generated that are new to the local participants and that the participants recognize as superior to their previous understandings. (1994, p.9)

With the twin notions of progressive discourse and improvable objects, we now have a partial explanation of how knowledge is co-constructed in dialogue. But it might still reasonably be asked how exactly participation in this sort of dialogue leads to a growth in the understanding of indivdual participants. In an attempt to answer this question, I should like to recall an earlier quotation from Halliday: "language is the essential condition of knowing, the process by which experience <u>becomes</u> knowledge" (Halliday, 1993, p.94, original emphasis).

One of the characteristics of utterance, whether spoken or written, is that it can be looked at as simultaneously process and product: as "saying" and as "what is said". In uttering, the speaker's effort is directed to the saying - to producing meaning for others. To do this, s/he has to interpret the preceding contribution(s) in terms of the information it introduces as well as the speaker's stance to that information, compare that with her or his own current

understanding of the issue under discussion, based on her/his experience and any other relevant information of which s/he is aware, and then formulate a contribution that will, in some relevant way, add to the common understanding achieved in the discourse so far, by extending, questioning or qualifying what someone else has said. It is frequently in this effort to make his or her understanding meaningful for others that the speaker has the feeling of reaching a fuller and clearer understanding for him or herself.

But in uttering, the speaker is also producing "what is said", a material utterance to which s/he can respond in very much the same way as those to whom it is addressed: by interrogating the meaning of what is said, evaluating its coherence and relevance, and by beginning to formulate a further response. This is the second way in which speaking can enhance understanding. It was partly this function of uttering that Wertsch and Stone had in mind when they wrote that young language learners: "can say more than they realize and [that] it is through coming to understand what is meant by what is said that their cognitive skills develop" (1985, p.167).

In contributing to a knowledge building dialogue, then, a speaker is simultaneously adding to the structure of meaning created jointly with others and advancing his or her own understanding through the constructive and creative effort involved in saying and in responding to what was said. And, since a similar constructive effort is required to listen responsively and critically to the contributions of others, that too provides an opportunity to advance understanding. It needs to be emphasized, though, that it is the joint attempt to construct common understandings "that the participants recognize as superior to their previous understandings", as Bereiter put it above, that makes dialogue such an effective means for participants to enhance their individual understandings. Certainly, dialogue of this kind involves both the internalization of the meanings created in the inter-mental forum of discussion and the externalization of those intramental meanings that are constructed in response; it also constitutes a particularly clear instance of Vygotsky's insight that "the individual develops into what he/she is through what he/she produces for others" (1981, p.162).

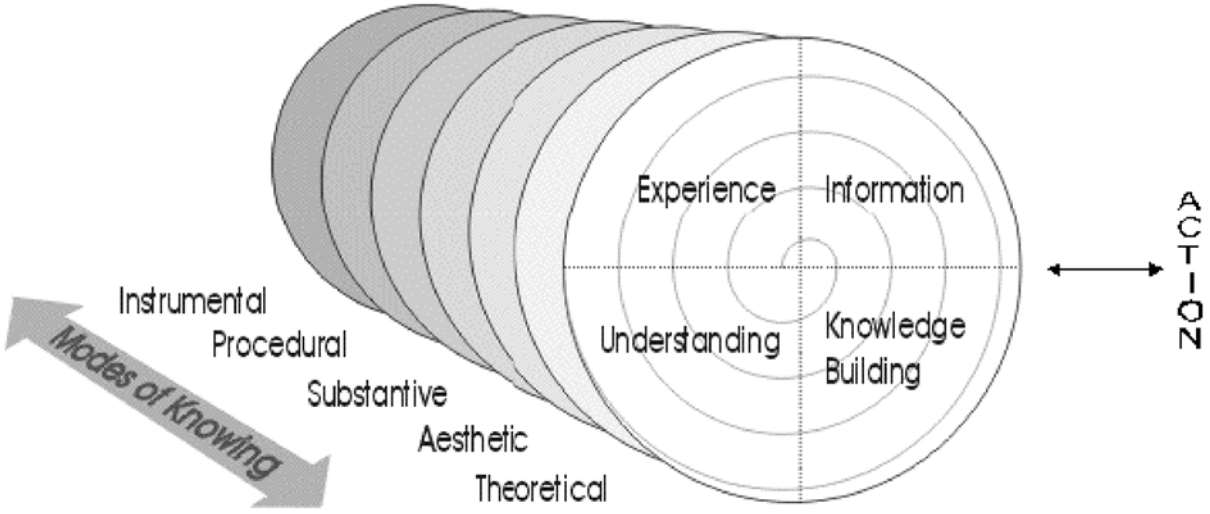
The Spiral of Knowing

I have tried to bring together the preceding ideas about the central role that dialogue plays in the construction of knowledge and the development of understanding in an inquiry-oriented curriculum with the construct of the "spiral of knowing" that is represented in figure 1 (Wells, 1999). Here, I want to draw attention to some of the key features that I have attempted to capture in this diagram.

Following Dewey, I shall start with the segment labelled "experience", meaning by this an individual's first-hand engagement in activity, whether undertaken solo or in collaboration with others. The second segment represents the addition of "information" from others, either gained through observation or speech or through the medium of print and other visuographic artifacts. However, for this information to contribute to a growth in "understanding", which is the goal of knowing and the fourth segment in the diagram, it must be transformed through the process of "knowledge building", that is to say, through the sort of dialogue that I have

been calling "progressive discourse". This is dialogue that is focused on the object of the activity and aimed at making an answer to a question or solution to a problem to which the activity has given rise.

Figure 1: The Spiral of Knowing



(from Wells, 1999)

The term dialogue most typically refers to face-to-face interaction using the resources of spoken language. This is certainly the mode in which dialogue is first experienced and it remains the most ubiquitous and versatile. However, the means for knowledge building are not limited to speech. On the one hand, the solving of problems of a practical nature often depends as much on the coordination of skillful action as on speech and, on the other, theoretical knowledge building may be carried on across time and space through a dialogue that uses writing and other visuographic modes of representation. Across all these modes, however, two features of the dialogue that supports knowledge building are paramount: responsivity and the attempt to achieve enhanced understanding. By pursuing this line of argument further, it also becomes clear - as Vygotsky argued - that a similar sort of dialogue can take place when one is alone, using the resources appropriated from engaging in dialogue with others.

So far, the focus has been on a single cycle. However, the understanding attained through knowledge building dialogue at the end of one cycle provides the basis for making sense of further experience and information in the next. This is one of the senses in which there is a spiral of knowing over successive engagements with the object of the activity which the knowing serves to mediate. I have used a two-headed arrow to represent this dynamic interaction between the cycle of knowing and 'action' with respect to the object/outcome of the activity.(11)

However, there is a second kind of spiral that the diagram attempts to represent. This is the relationship between the different modes of knowing distinguished above. As was suggested

there, there is a sense in which each individual's ontogenetic trajectory recapitulates the emergence of the different modes of knowing in the history of the species, as understanding gained in one mode provides the basis for appropriating those later to be mastered.

Stated in these schematic terms, the spiral of knowing is undoubtedly over- simplistic. In particular, the form of the representation seems to imply that it is theoretical knowing that is the endpoint to which all engagement in the spiral of knowing should aspire. However, it is sufficient to look closely at any complex activity, whether inside or outside the classroom, to dispel this misapprehension. As quickly becomes clear, most activities are mediated by more than one of the modes of knowing so that, in practice, there is a convoluted spiralling backwards and forwards between them as attention is focussed on the different kinds of object involved in the component actions through which the goals of the activity are realized. Thus, although formal education may provide the setting in which most young people first systematically engage in theoretical knowing, as Vygotsky (1934/1987) suggested, it is important that this does not become an end in itself, but that the understandings gained be directed to effective and responsible action in the world of practical activity.

Knowledge Building Through Dialogue About Texts

As I have just pointed out, in discussing the spiral of knowing, dialogue is not restricted to the spoken mode. Indeed, powerful though it is as a means of engaging participants in a joint activity, dialogue in the oral mode has one serious disadvantage as a medium for knowledge building: it leaves no record of what has been jointly constructed. It is for this reason that the rise of theoretical knowing had to wait for the invention of technological means that made knowledge representations independent of oral memory, in the form of writing or such other visuographic forms of representation as maps, diagrams and graphs. The particular advantage of such relatively permanent representations of meaning is that they can be responded to by readers who are not present in the same time or place; they can also, by both writer and readers, be critically re-viewed and revised and, in this way, deliberately improved and developed. For this reason, as Lotman (1988) argues, a text can serve a dialogic function, becoming what he calls "a thinking device" and "a generator of meaning" (p. 40)

On the basis of arguments of this kind, much has been made in recent years of the potential of writing as a means of learning and, certainly, "expert" writers will attest to the fact that, for them, "writing shapes thinking" (Langer & Applebee, 1987; Murray, 1982). However, few students, even at the undergraduate level, seem to have discovered that writing can function as "a thinking device". Because the emphasis in many assignments calls for the accurate reproduction of information from the textbook, many student writers habitually adopt a strategy of "knowledge telling" (Bereiter & Scardamalia, 1987). This strategy corresponds to the assumption that texts serve only a transmissional function and it often involves no more than the transfer of information from memory or the source text to the assignment, without any constructive or critical engagement with it. Expert writers, by contrast, typically treat each writing assignment as an occasion for "knowledge transformation", as they try to organize the information at their disposal in a rhetorical structure appropriate both to their purpose and to the audience in view. In terms of the argument developed above, writing approached in this manner is an occasion for knowledge

building, as the writer both tries to anticipate the likely response of the envisaged audience and carries on a dialogue with the text being composed.

Not surprisingly, sophisticated strategies of this kind are not developed simply through carrying out individually undertaken writing assignments - particularly those that require no more than a restatement of what is known or remembered. As Vygotsky's concept of the zpd makes clear, such strategies are most readily appropriated from situations in which they are demonstrated and collaboratively deployed in the joint construction of written texts. This is the principle underlying such initiatives in literature-based reading and writing programs as Book Clubs (McMahon, Raphael et al., 1997) and Literature Circles, in which students meet to discuss the books they have been reading and, on that basis, go on to create further texts in response. Writing conferences, in which writers are able to discuss their developing texts with their peers or teacher, provide another setting in which such strategies may be made overt, and so available for appropriation.

However, it is not only by focusing on texts as end products that the dialogic potential of written texts can be realized. In the work of the 'Developing Inquiring Communities in Education Project' (DICEP)(12) to which I belong, teacher members have been exploring a number of ways of enabling their students to use writing as a tool for making sense of information or for problem solving in the course of some other activity and, in every case, this has involved spoken dialogue about texts of various kinds.

With her grade 1 and 2 students, Mary Ann Van Tassell asked the parents to engage in shared book reading with their children and to write down the children's responses to the stories on 'post-it' notes and to affix them to the relevant pages. These written notes then became the 'seeds' for a discussion between the teacher and all those who had read a particular story in which, together, they created a web diagram on which the post-it notes were arranged to represent the similarities and differences between their responses. In this way, the teacher used the brief written texts scribed by the parents as the basis for a group exploration of the aspects of the story that the children had found particularly significant. In this process, one of their most important discoveries was that, like post-it notes, 'ideas' could be combined and arranged in different ways, depending on the writer's purpose.

Extending the scope of "text" to the domain of mathematical problem solving, Gen Ling Chang posed a problem to her grade 6 and 7 class in the context of preparing for a simulated landing on Mars as part of an international project in which they were involved. The forthcoming task, on the day of the landing, would be to construct a habitat from clear plastic sheeting in the shape of a rectangular prism of dimensions 3.5 x 3.5 x 2.5 meters. In preparation, the teacher had bought a roll of thin plastic sheet, 4 metres long and 3 metres wide, folded in four so that the width of the roll was 75 cms., in order that each group of three students could make a scale model of the habitat one tenth of the eventual size. The problem that was posed was to find a way of cutting the roll of plastic so that each of the ten groups received enough material to make their model habitat. After twenty minutes or so, in which each group worked at the problem, the teacher asked a representative of each group to write or draw their proposed solution on the blackboard. Then, one by one, the representatives explained their proposals and each was critically discussed by the rest of the

class.

One group, in particlar, was fascinating to watch. While the designated group member was writing on the blackboard, the remaining pair was scanning the various alternatives proposed by other groups when one of them suddenly saw the flaw in their own proposal. She quickly did some further calculations and, satisfied that the new proposal would work, she discussed it with her partner and then went to the blackboard to substitute it for the solution they had originally proposed. In due course, the group representative explained the annotated diagram in which the new proposal was presented and it was eventually accepted as one possible way of solving the problem. In this example, proposed solutions inscribed on the blackboard served as thinking devices for other students and then as the basis for a consideration of alternative ways in which the probem could be solved.

The third example is taken from an investigation of light carried out by a class of grades 6 and 7 gifted students. Following a period in which the students explored a range of relevant materials that had been provided, the teacher, Karen Hume, invited the students to propose questions for further study both by means of experimentation and through the use of reference materials. Of the many questions that were proposed, the 30 or so that were judged worthy of investigation were then posted on the "knowledge wall" - a large notice board occupying almost one entire wall of the classroom - and students were encouraged to continue the dialogue started by each question by posting further notes on the knowledge wall.(13) After two or three days, when the wall was almost covered in notes, the teacher asked those students most interested in each question to prepare a summary of the written dialogue on that topic to date. The following is an extract from the discussion around the preparation of the summary of the discussion on the question: Why does light travel at the speed of 300 000 km/sec?

Ian: I have a thought . I don't know if it's true . Maybe light would go slower if it were underwater, or faster, or maybe-

Eren: But Ian, no . Do you know how light travels? It goes through the molecules of the water

Ray: But what about in outer space? Maybe the molecular structure is different . maybe it's just one big molecule

Eren: It goes through a vacuum, I know that

Steve: Eren, I think it was Nikki said up there [on the wall] that if you shine the light through a glass it slows down

Eren: Yeah, I know (thoughtfully)

Ian: Maybe light would go faster in a black hole because there's nothing in it .. Maybe if there's something in it then that's not good

Eren: I'm not really sure

Ian: Maybe there was this alien planet and a black hole, and we're on the other side of the black hole .. Well I don't know (in response to quizzical glances from E and S)

Eren: That would be very impossible to trace, and even if it were-

Steve: So are you saying that on the other side of black holes, there's an alien planet?

Ray: Okay, this is my theory (He says something, mostly inaudible, about the density of molecules in other galaxies)

Steve: You said that light goes through the molecules .. If we can prove that glass affects the speed of light ...

Eren: It does

Steve: So glass does affect the speed of light?

Eren: Yes

Ray: So then the molecules must-

Steve: The molecules must affect it

Eren: No I don't think so

Ray: You're contradicting yourself

Steve: But Eren, something in the glass affects it . and if there's nothing inside of the glass, then it must be the molecules of the glass

Ray: I'm thinking of the density of the molecules

Steve: I know, that's what I think too

Ray: Okay, light can go (draws diagram showing light refracting through glass and slowing down in the process)

Eren: Okay, it says here (referring to a book he got from the public library) "In a glass light travels only two thirds as fast as through air. Why?" Oh nooooo, it leaves out the why . We have to figure out the why

Here, the discussion of the topic already carried on through the medium of the written notes posted on the knowledge wall pushes the four boys to reconsider their question. Prompted by the quotation Eren reads from the book, they go on to reformulate it in terms of the effect of the medium through which light passes on the speed at which it travels.

In presenting these three vignettes, my first intention has been to illustrate different ways in which texts of different kinds can provide objects to be interrogated and improved through dialogic knowledge building, thereby enabling participants to increase their individual as well as their collective understanding of the topics investigated. At the same time, my intention has been, through these three examples, to show how teachers can, through inquiries focusing on their own practice, significantly extend the scope and depth of the opportunities that they provide for their students to appropriate these cultural tools for knowledge building and simultaneously increase their own understanding of the critical features of classroom activities that make this development possible. What we have found is that, just as our students benefit from participation in a dialogic community of inquiry, so too do we, their teachers. Whether through opportunities for discussion and analysis of data at our regular meetings or through our ongoing email conversation, it is the opportunity to engage in collaborative knowledge building with fellow educators that is the key to the gains we have each made in our own understandings. And it is the sense of empowerment that we gain as whole persons, and not just as professionals, that provides the motivation to continue to engage in these inquiries (Chang-Wells & Wells, 1997). Finally, these vignettes and those cited earlier make it clear that this is no utopian vision that I have been proposing, but a reality that is already being created in DICEP classrooms and others like them, where teachers are exploring the possibilities for practice of a social constructivist theory of education.

Conclusion

In this chapter, I have tried to show how Vygotsky's theory of learning and development, with its core concept of artifact-mediated joint activity, can integrate some of the most important insights that have been gained in recent years from research in education. Building on his ideas, I have proposed that, by conceptualizing the classroom as a Community of Inquiry, we can see how collaborative group work, dialogic knowledge building, and an inquiry-oriented curriculum are essential and interdependent components of a vision of education that, rising above the age-old conflict between traditional attempts to transmit basic knowledge and skills and progressive emphases on individual discovery, recognizes that both convention and invention are necessary for the development of society as well as for its individual members.

Of course, communities of inquiry do not exist in a vacuum; what happens within classrooms is both facilitated and constrained by institutional and societal values and expectations as much as by the material surroundings and the availability of appropriate resources. To realize the vision that I have proposed will require more than a change in the practices through which education is enacted within the classroom. Nevertheless, since individuals and society are mutually constitutive of each other, though on different time scales, it is on the nature and quality of the particular activities in which teachers and students participate together, and through which learning occurs, that I believe our attention now needs to be focused. For it is in the formation of individuals' identities and dispositions through their collaborative engagement with others in worthwhile and intrinsically motivating activities, carried out thoughtfully and with commitment to the quality of the artifacts that are produced and used, that we can most effectively make these the values of the wider society.(14) It is this

understanding that I believe to be Vygotsky's most important legacy to us and the means for transforming the institution of schooling so that it better serves both society and its individual members.

Notes

1. The preparation of this chapter, which is based on an invited presentation at the Annual Conference of the National Council of Teachers of English, Detroit, November 1997, was supported, in part, by a grant from the Spencer Foundation to OISE of the University of Toronto. In thanking the Foundation for their encouragement and support, I wish to make it clear that the views I have expressed are not necessarily those of the Foundation. I should also like to thank the teachers and students whose work I have quoted and from whom I have learned so much.

2. Although no confirming evidence will ever be available, it seems clear that the evolutionary transformations brought about by the use of stones as tools, fire for cooking, and pointed sticks or bones for creating visual representations, must have had their origins in particular situated activities.

3. Change may not always be in a direction that is either socially acceptable, or empowering for the learner. Negative experience with others can also be identity forming in the sense of disposing the individual to withdraw from involvement and to resist rather than welcome the assistance of others. However as Litowitz (1993) points out, resistance can also be an important means of development.

4. Although Vygotsky refers to "inner speech", the mediational means of mental activity are not limited to those derived from speech but include all the semiotic systems that are used in intra-mental meaning-making (John-Steiner, 1987).

5. In a presentation to the Telelearning Conference recently held in Toronto (broadcast on 7 November 1997 in Forum, CJRT Radio, Toronto), Seymour Pappert described the organization of schools in terms of age-related grades and subject-based curricula as a 'fad' that would almost certainly be replaced in the foreseeable future.

6. I am thinking here of the fact that, on the one hand, many young children have to spend the day in some form of segregated institution because their caregivers are at work outside the home and, on the other, that the work in which most adults are involved is either highly specialized and/or of limited challenge, in either case making it inappropriate for a traditional form of apprenticehip.

7. This is most obvious in activity systems that assume mastery of scientific and technological knowledge and practices, such as medicine and engineering; but it is also true, to a lesser degree, of many others in which technologically advanced equipment plays an important mediating role.

8. See, for example, the first issue of *Primary Voices* and Gallas (1994).

9. Bettencourt, A. (1991) On what it means to understand science. Michigan State University (unpublished paper).

10. In Vygotsky's terms, there should, wherever possible, be opportunity to establish a firm basis of "everyday" concepts with which the learning of "scientific" concepts can connect (1934/1987, chap.6).

11. Such action may take a variety of forms, not all of them overt. In many situations the action may be restricted to discourse and, in some cycles, it may be in the discourse that Vygotsky referred to as inner speech.

12. DICEP is a collaborative action research group made up of school-based and university-based educators. Supported by a grant from the Spencer Foundation, the project has as its goal to promote an inquiry-oriented approach to learning and teaching and to seek to understand and improve the role of discourse in this process. Reports of some of the inquiries carried out by the group can be found at the project's homepage: http://www.oise.on.ca/~ctd/DICEP/

13. The idea for the knowledge wall was inspired by the CSILE project (Scardamalia et al., 1994), in which students create a database for the topics they are investigating by typing notes into one of the 15 or so networked computers with which the classroom is equipped. Since Karen's classroom has no computers at all, her inquiry was to discover how far the benefits of CSILE could be achieved by technologically less sophisticated means.

14. It may be argued that the values of inquiry, dialogue and community are relevant only to the 'western' cultural tradition. However, I would contend that they are a necessary prerequisite, in any culture, for educational change to be truly inclusive of all the interests involved. While proposing a general approach to education, the values themselves do not prejudge what topics should be focused on in particular situations of learning and teaching nor how they should be approached, since these are properly the subject of inquiries in the relevant communities. It is to be expected, therefore, that, where these values are espoused, the particular classroom practices through which they are realized will vary both between and within cultures.

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