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## **Dialogue, Inquiry, and the Construction of Learning Communities**

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Perhaps more than at any other time in human history, the world is changing so fast that it is difficult to imagine what demands will be made in their adult lives on the children who enter school today. Globalization of manufacturing and economic activity, the increasing pace of knowledge development and technological advances in computerized information processing and, not least, the consequences of these developments for our fragile ecological environment, all mean that it is difficult to know how to educate children today in order to equip them to live productive, responsible and fulfilling lives in the century ahead. Of one thing we can be certain, though: In order to serve our children well, we need to make substantial changes to the traditional ways in which schooling has been organized for the last two or three hundred years. However, for these changes to be really beneficial for our children's and our societies' future, we need to start with some fundamental questions: What is the relationship between children's learning in school and their overall development? What part does teaching play in promoting learning? And what is (or should be) the function of schooling in our society? In this chapter, I shall try to suggest some answers to these questions by drawing on the ideas of Vygotsky and the theory of learning and development to which his thinking has given rise.

### **Learning and Development**

For much of the twentieth century, three views about the relationship between learning and development predominated (Case, 1996, p. 9). The first is behaviourist in origin and modelled on the industrial assembly line with quality management. At the same time, it assumes that each individual has a fixed potential – often expressed as IQ – which is said to account for differences in educational achievement. The second view grew out of Piaget's early work on the universal stages of cognitive development, which led to an

emphasis on readiness and child-centred, discovery learning. The third is modeled on the mind as a computer with innately given cognitive modules. This latter view has tended to be expressed in terms of inputs and outputs, with thinking conceptualized as processing information that is stored in memory like files in a large computer.

However, none of these views does justice to the role of learning in human development. The first ignores what goes on in the mind, treating education as the reinforcement of associations and habits that can be assessed in purely quantitative terms. While the second view emphasizes the constructive nature of learning, it largely ignores the fact that human infants grow up as members of historically ongoing cultures, which strongly influence their development (Donald, 2001). Finally, the third view comes close to reducing the human mind to a machine and, in so doing, ignores the interdependence of bodily action, thinking and feeling and interaction with others in the activities through which learning occurs. It also has very little to say about development (Nelson, 2007).

In the place of these three inadequate theories, I wish to propose an alternative view, which not only envisages development as ongoing transformation, but also treats it as involving a mutually constitutive relationship between the individual and the society in which she or he is growing up, and between biological endowment and the cultural practices in which, from birth, he or she is continuously involved. Known as cultural historical activity theory (CHAT), this explanation of the relationship between learning and development was first formulated by Vygotsky in post-revolutionary Russia and has since been extended and refined by researchers and educators from many different countries. In summary form, the key points of CHAT can be stated as follows:

- The basic 'unit' of human behaviour is purposeful activity jointly undertaken with others in a particular time and place and in relation to a particular culture.
- In all major domains of human activity, goals are achieved by people carrying out actions mediated by tools, both material and symbolic, of which the most powerful and versatile is language.
- Individual development (cognitive, social and affective) results from participation in joint activity with more expert others, in which the individual masters the culturally developed tools and practices and 'appropriates' them as resources for

acting and thinking, both alone and in collaboration with others.

- Learning is greatly facilitated by guidance and assistance that is pitched in the learner's "zone of proximal development."

While appropriating ways of acting, thinking and feeling from caregivers and other community members, the child does not passively copy their knowledge and skills. On the contrary, learning is an active and constructive process that involves a triple transformation: of the learner's repertoire for action; of the tools and practices involved, as the learner constructs his or her unique version of them; and of his or her relationship with others and thus of his or her identity. As a result of these transformations, all the individual participants, as well as the cultural situations in and on which they act, are in a constant state of change and development that is the continuously emergent outcome of their actions and transactions. In other words, the developmental relationship between society and its individual members is one of interdependence and co-construction.

The validity of this way of conceptualizing the relationship between learning and development was vividly brought home to me in the course of the Bristol Study of Language Development (Wells, 1986), in which a representative sample of 128 children was studied longitudinally, some of them from one to ten years of age, as they learned to talk and, through talk in context, appropriated the culture's ways of making meaning. One of the most significant findings from this study was the relationship between the rate of children's language learning and the quality of the interactions with others in which they participated. Children who developed rapidly had more experience of interaction in which their conversational partners were interested in what they wanted to communicate, took pains to understand what they meant, and built on their contributions, extending the topic in which the child was interested or encouraging them to do so themselves. I have used the term 'contingent responsiveness' to capture this quality of adults' behaviour as they support children's desire to make sense of their experience. Here are two very clear examples.

In the first, Mark, aged nearly 24 months, is standing by a hot water radiator, from which he can feel the heat.

Mark: Hot, Mummy?

Mother: Hot? Yes, that's the radiator.  
Mark: Been- burn?  
Mother: Burn?  
Mark: Yeah  
Mother: Yes, you know it'll burn, don 't you  
Mark: [putting hand on radiator] Oh! Oh !  
Mother : Take your hand off of it

A few minutes later, when Mark is looking out of the nearby window, he sees a man working in a nearby allotment.

Mark: A man 's fire  
Mother: [not looking] Mummy's flower?  
Mark: No  
Mother: What?  
Mark: [emphasizing each word ] Mummy, the man . fire.  
Mother: Man's fire?  
Mark: Yeah  
Mother: Oh yes, the bonfire  
Mark: [imitating] Bonfire  
Mother: Mm  
Mark: Bonfire . oh, bonfire . bon- oh fire . bo- bonfire  
Oh, hot, Mummy . Oh, hot . it hot . it hot.  
Mother: Mm. It will burn, won't it?  
Mark: Yeah . burn . it burn

(Wells, 1986, p. 46-47)

The first point to note about this extract is the way the mother checks to make sure she has understood the child's meaning before responding; the second is the way she builds on the child's topic so that, between them, they create a more complex meaning than the child could manage alone. Here, Mark is not only learning new words but is also building up the conceptual as well as pragmatic relationship between things that are hot and their ability to burn.

Elizabeth, in the second example, is four years old. She is watching her mother

shovel wood ash from the grate into a bucket.

Elizabeth: What are you doing that for?

Mother: I'm gathering it up and putting it outside so that Daddy can put it on the garden

Elizabeth: Why does he have to put it on the garden?

Mother: To make the compost right

Elizabeth: Does that make the garden grow?

Mother: Yes

Elizabeth: Why does it?

Mother: You know how I tell you that you have to eat different things like eggs and cabbage and rice pudding to make you grow into a big girl?

Elizabeth: Yes

Mother: Well, plants need different foods too. and ash is one of the things that's good for them

(Wells, 1986, p.59)

Several features of this brief episode are worth attention. First, the conversation arises out of an event in which both Elizabeth and her mother are involved, even though Elizabeth is not performing the action herself. Second, for the mother, the material action she is carrying out is more than simply cleaning the grate; that is to say, the wood ash is not simply something to be cleared away; it also has value in the activity of growing plants, in which, as a type of fertilizer, it can mediate their cultivation. Third, the conversation is initiated by Elizabeth who, assuming her mother's action has a purpose, asks questions in order to learn about the means-end relationship of what she observes. And finally, in answering her daughter's questions, the mother tries to give an explanation that will make sense to Elizabeth in terms of her existing knowledge. This is clearly a learning opportunity for Elizabeth that is mediated both by discourse and by the material action that the mother is carrying out. Although spontaneous rather than preplanned, it is also an excellent example of teaching in the child's zpd.

These examples also illustrate a second feature of the children's conversational experience that provides strong support for Vygotsky's theory. As parents take up their

children's conversational topics and talk with them about the activities in which they are involved, they not only provide multiple occasions for language learning but, through the very same conversations, they demonstrate how to make sense of those activities in terms of the culture's linguistic categories that are used to construe experience. And as the children appropriate these cultural meaning-making tools, they construct for themselves those personal resources for thinking, valuing and decision-making that Vygotsky (1987) referred to as "the higher mental functions" - the characteristically human mental abilities that distinguish us from other species. Thus, in everyday conversations, children are simultaneously learning both the language of their community and their community's theory of experience. As Halliday emphasizes: "Language has the power to shape our consciousness; and it does so for each human child, by providing the theory that he or she uses to interpret and manipulate their environment" (1993, p. 107).

However, no two individuals have exactly the same experiences: they do not belong to identical cultures, and still less to identical families; nor do they take part in identical conversations in the context of identical activities. All these differences mean that, over time, each child traces a different trajectory through the universe of possible experiences and constructs different ways of giving meaning to them (Nelson, 2007). To a very great extent, it is these cumulative differences in experience that account for the different patterns of individual development and, if they go to school, for the different levels of performance that children of the same age manifest on the tasks that they are asked to perform.

Very simply, then, the arguments that I have been attempting to develop in the preceding paragraphs can be summed up in the following mantra: *Who we become depends on the company we keep and on what we do and say together.*

### **The Roles of the Teacher**

Every occasion of joint activity provides a potential occasion for learning, and by the same token, assistance given to a learner in his or her attempt to participate is an occasion of teaching. Most often, however, such teaching occurs incidentally and without deliberate intention - as in most parent-child conversations, such as those quoted above. But conversation about an activity in progress is nonetheless helpful to learners in their

attempts to master the cultural ways of acting and thinking that the activity involves.

There are, however, many occasions when an adult or a more knowledgeable sibling or peer deliberately helps a child with a task, particularly when they judge that the child cannot yet manage on his or her own. Vygotsky (1978) described assistance given in this way as working in the "zone of proximal development." In any task we undertake, there is frequently a limit to what we can achieve alone. In such situations, help from another with what is proving difficult both allows us to complete the task and models for us what we need to add to our resources so that, in the future, we shall be able to manage the task unaided. Indeed, in traditional cultures, this is how children learn most of what they know and are able to do.

This kind of situated learning 'on the job' has been described as 'cultural apprenticeship' (Lave & Wenger, 1991; Rogoff, 2003). However, while learning through apprenticeship provides an essential spur to development towards full membership in all cultures, on its own it is insufficient to equip young people today with all the knowledge and skills they need to participate fully in technologically advanced cultures (Lemke, 2002). It is to fulfill this role that educational institutions exist – as they have since it first became necessary to provide a setting for some members of each generation to learn to read and write (Cole, 1996). In the last few centuries, however, as written language and other semiotic systems, such as mathematics, scientific formulae and procedures, graphs, maps and diagrams of all kinds, have come to play an increasingly important role in the development and dissemination of 'formal' knowledge, schools and universities have come to play a more and more significant role in the development of 'higher mental functions.' It is in this relatively novel context that we need to consider the part that deliberate teaching plays in young people's learning.

Schools, as we know them, differ from settings for informal and spontaneous learning-and-teaching in several important ways. First, attendance is compulsory between certain ages (5 or 6 until 16-18 in most cultures); second, there is a prescribed curriculum that sets out – increasingly, in considerable detail – the knowledge and skills that students are required to learn in each year and for which they will be held accountable through tests and other forms of assessment; and third, in each age-based class there is typically a ratio of 25 or more students to each teacher. Furthermore, although the students are all

approximately the same age, they vary very considerably in terms of their interests and aspirations, as well as in their physical and intellectual strengths and needs, as the result of their very different backgrounds and life trajectories. Every school class, therefore, is characterized by diversity on a variety of dimensions that need to be taken into account.

Throughout most of the history of schooling, this combination of constraints has led to a transmissionary approach to education, aimed at ensuring that all students acquire the same set of knowledgeable skills that are considered most useful and important for their future roles in the work force. With this end in view, the goals of teaching have been those of organizing what is to be learned into appropriately sized and sequenced chunks and of arranging optimal methods of delivery, together with opportunities for practice and memorization. In this approach, little or no attention is given to students' diverse backgrounds, interests, and expertise, nor are they encouraged to show initiative and creativity in formulating questions and problems and in attempting to solve them in collaboration with their peers and teacher. Instead, students' success is largely evaluated in terms of their ability to recall what they have been taught and to reproduce it on demand in response to arbitrary questions, often divorced from any meaningful context.

If this pattern were not so historically engrained, its inappropriateness would surely have led to its demise long ago, given the high proportion of students who, each year, fail to master the required curriculum and how little the remainder remember of what they learned a few months after the test. Its one merit is that, from an administrative point of view, both teacher and students can be held accountable for what has to be 'covered', whether or not the actual teaching-and-learning is of long-term value to the learners. With the current preoccupation with efficiency, it is perhaps this administrative convenience that ensures the continuation of practices that, if considered in terms of their effective contribution to student development, would be clearly seen to be unacceptable.

However, these criticisms of the prevailing organization of schooling are not intended to suggest that there should be no guidance given as to what activities students should engage in and as to what they are expected to learn; nor is it intended to suggest that there is no role for deliberate teaching. But teaching certainly cannot be reduced to telling and testing and to maintaining the control necessary to keep students to this externally imposed agenda.

What, then, is the alternative? In the final part of this chapter I shall suggest that learning-and-teaching should be seen as complementary aspects of a single collaborative activity that I refer to as 'dialogic inquiry' in a community of learners. In this approach, the teacher has two important roles: as leader, to plan and organize the community's activities; and as facilitator, to provide contingently appropriate assistance to individuals and groups to enable them to achieve goals that they cannot achieve on their own. At the same time, there is a third role that is equally important. As the more expert member of the community, the teacher should also model the dispositions and actions of learning by conducting his or her own inquiries aimed at improving the quality and effectiveness of the community's activity (Wells, 2001).

Before addressing these issues, however, I believe it is worth giving some consideration to the third overarching question.

### **What should be the function of schooling in our society?**

Since the beginning of universal education, there has been an ongoing debate about the appropriate balance between two overarching goals: to equip each student with the knowledgeable skills necessary to play a productive role in the workforce; and to encourage them to discover and develop their own individual interests and talents and, by exercising initiative and creativity in their chosen activities, to achieve their own individual potential.

Unfortunately, these goals have often been seen as mutually exclusive: emphasizing one is thought to be necessarily at the expense of the other. As a result, in the public debate about how schools should be organized and about what should be taught, there has been a tendency for people to adopt opposing stances and for policy to swing from one extreme to the other. However, in the interests of economic growth rather than of improving the quality of life for all, it is the first goal that almost always tends to prevail, as in the case of the National Curriculum in the U.K. and of the 'No Child Left Behind' Act in the U.S.A., which have resulted in most of the school day being monopolized by lock-step work on 'basic knowledge and skills' (Galton, Hargreaves, Comber, Pell, & Wall, 1999; Myhill & Warren, 2005) at the expense of engagement with topics that relate to the challenging issues confronting the world today.

However, as we rethink the function of schooling in our present context, it is important to recognize that the conditions that obtained in the nineteenth and twentieth centuries have changed significantly. On the one hand, opportunities for employment in technologically developed countries are now predominantly in professional and service occupations, for which simply having mastered 'basic skills' is insufficient; and, on the other hand, the pace at which the 'knowledge revolution' is increasing the amount of information available in almost all fields of human activity means that we all need to become lifelong learners, whatever the nature of our employment. At the same time, as nations have become more interdependent as a result of globalization and of the internet-based access to information, we all need to be aware of what is happening in other parts of the world and, as global citizens, to recognize the extended nature of our responsibility. What is clear, therefore, is that the traditional conceptions of education that have underwritten what Freire (1970) referred to as the 'banking' approach to education and the related 'transmissionary' style of teaching are totally inadequate to the needs both of society and of today's young people.

At the same time, a purely child-centered approach is equally unsatisfactory, for where the traditional approach has tended to restrict the curriculum to the authoritative presentation of the accrued wisdom of the past, the approach that emphasizes creativity and personal fulfillment has too often emphasized rejection of the constraints that are imposed on individual creativeness by adherence to tradition and has, as a result, failed to provide the sort of 'teaching that leads development.' In addition, it is important that students be introduced to be introduced to issues of global importance that they might not discover if left to follow their own interests.

Fortunately, in many current reform efforts, a more integrated approach seems to be winning support, as the unsatisfactory consequences of adopting either extreme position have become apparent. On the one hand, it has been recognized that the practice of memorizing information to pass a test or to obtain good grades does not lead to students developing the deeper understanding of the topics they study that would make their learning useful in activities outside the classroom. Equally, student dependency on teacher organization and evaluation of their learning does not encourage the development of independent and critical judgment and of imaginative but responsible action (Barnes,

1976; Myhill & Warren, 2005). On the other hand, to leave students to their own devices, encouraging them simply to follow their own inclinations and to focus only on what interests them is not sufficient either. For it does not adequately prepare them to participate fully in the world beyond the school, where the mastery of a range of culturally valued knowledge and skills is a prerequisite for further education and for most forms of productive employment. Nor does it necessarily prepare them to take on their responsibilities as global citizens. Ideally, therefore, the enacted curriculum needs both to introduce students to new areas of study and investigation in a systematic manner and at the same time to provide opportunities for them to take initiatives in developing their own particular interests and areas of expertise.

From a CHAT perspective, however, the two goals referred to above are not in conflict. Indeed, they are interdependent. Since who we become depends on the company we keep, it is vitally important that we have the company of those who can model and provide assistance in relation to the skills and knowledge that have enabled our culture to reach its current stage of development. Without this heritage, each of us would have to reinvent the procedures to cope with the demands of contemporary life and find solutions to all the problems that are routinely encountered. More importantly, it is only by appropriating these culturally valued ways of thinking, feeling and acting, and the tools and practices by which they are mediated, that we develop our individual abilities. At the same time, since progress in the past has always been made by seeing new uses for existing ideas and technologies and by finding applications for novel ideas and inventions, it is important to encourage each new generation to adopt an innovative and creative stance. And this they do by individually building upon, and going beyond current know-how and understanding, and by constantly critiquing the status quo in order to develop alternative possibilities that, potentially, may enrich society as a whole.

However, there is a further feature of CHAT that needs to be incorporated into the way in which we think about education. Put very simply, it can be captured in the well-known saying that ‘two heads are better than one.’ Traditionally, classrooms have been organized as if they were no more than a collection of discrete individuals who receive instruction from a teacher and compete with each other to score the highest grades on assignments and tests. Diversity of interests, aptitudes and experience is neither

recognized nor valued; instead, all students are expected to work alone on the same tasks and to arrive at the same outcomes. Alternative ways of proceeding and divergent points of view are not seen as enriching the understanding of the class as a whole; students helping each other in carrying out tasks is treated as 'cheating'.

From a CHAT perspective, this emphasis on individualism and competition is completely misguided. Furthermore, in the world beyond the school, people do not work or solve problems in this way. Most activities are undertaken by groups of people – families, work units, or sports teams – whose members make different contributions to the tasks involved and frequently differ in their levels of expertise; collaboration is a requirement for the successful achievement of the group's goals and competitive individualism is a hindrance rather than an asset. Collaborative pooling of individuals' different forms of expertise is also how existing knowledge is made available to, and appropriated by, novice members of the group. But, equally important, as is increasingly recognized, collaboration on new and challenging problems is the manner in which *new* knowledge is created, as can be seen in the many successful enterprises that have emerged in the 'knowledge economy.' In sum, as Franklin (1996) so clearly put it, "Knowledge is constructed in the discourse among people doing things together." In other words, sharing cultural knowledge and skills and transforming them to serve one's own as well as the group's and societies' interests and goals is an inherent part of engaging in significant joint activities with diverse co-participants, in which all learn with and from each other.

Furthermore, recognizing the importance of diversity of participation is particularly important as societies become more multicultural. Unless the experiences, ideas and values of students from non-mainstream backgrounds – class-based as well as ethnicity-based – are given equal consideration in planning activities and engaging in discussion and their contributions recognized as enabling all to achieve a more comprehensive understanding of the topic under consideration, increasing numbers of students will be marginalized and led to see themselves as incompetent, with the likely consequence of their failing to achieve their potential. But, in addition to the harmful consequences to those who experience such exclusion, the failure to appreciate the value of the diverse perspectives they can contribute is disadvantageous to the classroom

community as a whole and, in the longer term, to the solution of the pressing problems facing society at large.

### **Updating the Model of Learning as Apprenticeship**

As mentioned earlier, learning can be seen as a cultural apprenticeship, in which learners receive assistance that enables them to go beyond their current level of action and understanding. And, as in the ideal version of the craft apprenticeship, they not only receive assistance from peers as well as old-timers as they master the knowledge and skills they encounter in use, but also gradually develop their own unique style and often add to the repertoire of tools and products of their craft. The same process of apprenticeship applies today in many professions – the science lab, the law office or the hospital operating theatre, for example – for, here too, novices develop their knowledge and skills as collaborating members of ongoing professional teams, working together to get the job done. But, as Moll and Greenberg (1990) have shown, the same is true of many lower-class neighbourhoods, where families share their “funds of knowledge” for their mutual benefit and, by including their children in the skilled tasks they carry out with and for each other, they create informal apprenticeships in which the children learn through participation in authentic activities. Both in childhood and in adulthood, then, most learning occurs in naturally-occurring, task-related apprenticeships, in which, with guidance and social and emotional feedback, novices appropriate the values as well as the knowledgeable skills that enable them to persevere and achieve success (Immordino-Yang & Damasio, 2007). So why not also in the classroom? Indeed, in principle, at least, the arguments for adopting an apprenticeship approach to education seem unassailable (Collins, Brown, & Newman, 1989; Resnick, 1987).

There are, however, a number of impediments to organizing formal education along these lines, of which the most serious are the encapsulated nature of school classrooms (Engeström, 1991), the value placed on 'knowledge for show' rather than on 'knowledge for action' (Barnes, 1976), and the ingrained assumption, shared by teachers and students alike, that teachers should know and tell and that students should listen and memorize. Together, these impediments make it difficult to escape the 'transmissionary' tradition. Yet none of them is insurmountable, as an increasing number of reports of

teachers' action research attests (Norman, 1992; Rojas-Drummond & Mercer, 2004; Wells, 2001). In the final section of this chapter, I shall outline one approach that has had some success in a wide range of different school settings. But before doing so, I want to recapitulate the arguments I have put forward in the preceding sections by proposing a number of criteria that I believe the content and manner of learning-and-teaching should meet.

1. The school curriculum should simultaneously equip students with the cultural resources necessary for them to contribute productively to the wellbeing and development of the society of which they are members and also provide opportunities for them to develop their own individual talents and interests.
2. A model of learning through apprenticeship should be established that enables every student to receive the assistance he or she needs to meet the criteria set out above. In keeping with the collaborative nature of most enterprises in the larger society, learning in school should encourage jointly undertaken activities and the provision of opportunities for students to learn with and from each other as well as from their teachers and experts in their respective fields.
3. Recognizing that, in a multicultural society, there is rarely one universally accepted way of thinking about key issues, students should be encouraged critically to question accepted wisdom and to debate alternative perspectives on the issues that make up the taught curriculum.

### **Learning and Teaching through Dialogic Inquiry**

For the last fifteen years, I have had the good fortune to work collaboratively with a group of teachers who have been exploring how to put into practice the principles enunciated in the preceding sections of this chapter. We call ourselves the "Developing Inquiring Communities in Education Project" (DICEP). As captured in this name, our central objectives have been to find ways of making 'inquiry' rather than 'transmission' the basis of our teaching, and to bring together practice as well as theory in our efforts to understand, in action, the ways in which this could be achieved (Wells, 2001). A number

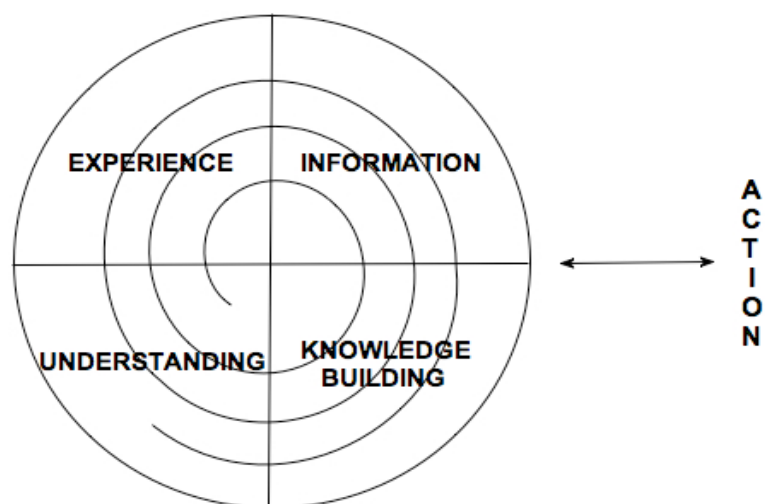
of conceptual tools have proved helpful in our endeavours. The first is that of the "improvable object."

In earlier periods of human history, the impetus for the advancement of understanding was very frequently a problem arising in a practical situation, and the solution took the form of an object that was constructed by the group through their collaborative action and dialogue. This created artifact was both a tool that could be used to solve the problem at issue and also the material embodiment of the group's knowing (Engeström, 1987). In the twenty-first century, by contrast, the object on which a group works together is more likely to be concerned with a semiotic object – for example, a theory of polymer bonding, or a masterplan for a city's transport. But in order to be collaboratively worked on and improved, it must also have a material embodiment, for example on a computer screen or a drawing board, with which participants can engage with their bodily senses; the improved version must also be made 'visible' in their dialogue, whether spoken, written or represented in some other material medium (Cole, 1996; Lektorsky, 1999).

In the classroom, we have found that it is possible to create comparable objects, around which students engage in knowing together in an attempt to improve them. In a grade two class, for example, one such type of object was the elastic-powered vehicles that the children constructed (Galbraith, Van Tassell, & Wells, 1997); in a grade seven class, the object was an explanation of why, at the time of the Black Death, doctors treating people who had caught the plague wore a cloak and mask that made them look like a bird, and why wearing this was effective in protecting them from the disease. In this second case, the object was embodied in a sequence of Post-it notes in which students developed an explanation that was acceptable to all by placing their notes on the 'Knowledge Wall' (Hume, 2001). In both cases, in order to improve the objects on which they were working, the students needed to obtain additional information, to interpret it in the light of their problem, and to act on the objects in appropriate ways.

The second generative metaphor is that of 'the spiral of knowing'. This is, itself, an improvable object – a tool for thinking about the roles that speaking, writing and other modes of meaning making can play in the ways of enacting the curriculum that we wish to promote. In its material representation, it currently takes the form seen in Figure 1.

**Figure 1. The Spiral of Knowing**



[Adapted from Wells 1999, p. 85]

Briefly, the diagram represents a continuing spiral, in which each cycle starts with the *understanding* based on their individual past experiences that participants bring to the present *experience* of the problem situation; to this is added new *information* that is either gained in the form of feedback from their action in the activity in which they are engaged, or is made available by the teacher or other member of the community, or through reference to a relevant text. However, for this new information to lead to further, enhanced understanding, which is the goal of each cycle, it must be individually appropriated and transformed. This, we propose, occurs through *knowledge building* (Scardamalia & Bereiter, 2003), that is to say, through further collaborative action with respect to the object that is the focus of joint activity, both through the dialogue in which participants make sense of and evaluate the new information, relate it to what they currently believe, critically discuss alternative interpretations and implications, and by testing their ideas through some form of further action. In this way, each cycle leads to an increase in both *group and individual understanding*. Finally, what is emphasized by the spiral representation is that learning is rarely instantaneous but rather that it continues over successive cycles, each cycle leading to greater understanding of whatever is the focus of joint attention.

Combining these two tools for thinking – the improvable object and the spiral of knowing – we conceptualize the organization of classroom activities in terms of 'inquiry'. Rather than seeing the teacher's role as that of delivering a preformulated curriculum, designed by 'experts' who are removed from the classroom, and testing to ensure that this content has been acquired, we endeavour to plan overarching themes that, while congruent with the mandated curricular topics, open up possibilities for students to select their own 'objects,' or questions for inquiry and to take responsibility together with the teacher for determining how to proceed. At the same time, individual and group investigations are also designed so that they contribute to the overarching theme.

Central to the success of this approach is the building of a community of inquiry, in which students frequently work together in groups on the same or related investigations, and in which a key activity is whole class meetings for review and reflection on what is planned, in progress, or has been achieved. It is in these meetings, in particular, that the dialogue of knowledge building occurs most deliberately and systematically, as the relationships among the individual or group inquiries are explored in relation to the common theme, alternative suggestions and perspectives are considered and evaluated, and a serious attempt made to ensure that the knowledge building is 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" (Bereiter, 1994). These discussions also provide an occasion for reflecting on the processes in which students are engaging, for describing strategies that seem to be effective, and for recognizing and valuing the diversity of ideas that are contributing to the creation of a common understanding.

What further distinguishes this approach is that, as far as possible, activities are driven by 'real' questions – that is to say, questions that are of significance to those who ask them – to which the attempt to make answers will advance their own and others' understanding. In the process, of course, they also learn new procedures and strategies that are necessary to pursue their inquiries effectively; they also search out additional information from various sources and evaluate its relevance for the 'object' on which they are working. In this way, the 'content' of the curriculum, rather than being an end in itself, is treated as a set of resources that mediate their investigations.

Two further important features of this approach are, first, the built-in expectation that work in progress and the finished product will be presented to the rest of the class and often to a wider audience, both to provide opportunities for feedback and to contribute to the class's collective meaning making with respect to the theme under investigation; and second, that there will be regular occasions to reflect on what has been done and learned and on the processes involved, in a systematic attempt to develop a metacognitive stance to inquiry (Olson & Bruner, 1996). As we have repeatedly found, this attempt to represent one's understanding of the object at issue so that it is clear and convincing for others, and then to respond to their questions, suggestions or objections in a spirit of collaboration as well as competition, is a particularly powerful mode of knowledge building that advances the understanding of both the individual participants and the class as a whole.

Organized in this way, with the students taking considerable responsibility for the actions through which they meet the challenges inherent in their inquiries, the teacher is able to be a 'participant observer', using the opportunity to note how they are proceeding for purposes of assessment (Drummond, 1997; Gipps, 1999) and in order to provide various forms of assistance in the zpd, as and when they are required. One particular form that this can take is what Tharp and Gallimore (1988) call an 'instructional conversation' in which the teacher spends a sustained period of time with a group exploring what the students understand about what they are working on and helping them both to enhance their understanding and to use it in the interest of more effective action, whether this be of a material or a symbolic kind.

In sum, our experience shows that the creation and maintenance of a classroom community of inquiry involves the following teaching practices (Wells, 1999):

- Creating a classroom community that shares a commitment to caring, collaboration, and a dialogic mode of making meaning.
- Organizing the curriculum in terms of broad themes for inquiry that both incorporate the required curriculum content and encourage in students a willingness to wonder, to ask questions, and to collaborate with others in building knowledge, both practical and theoretical, to answer them.

- Negotiating goals that:
  - challenge students to develop their interests and abilities;
  - are sufficiently open-ended to elicit alternative possibilities for consideration;
  - involve the whole person – feelings, interests, personal and cultural values, as well as cognition;
  - provide multiple opportunities to master the culture's tools and technologies through purposeful use;
  - encourage both collaborative group work and individual effort;
  - give equal value to thoughtful processes and excellent products.
- Ensuring that there are occasions for students to:
  - use a variety of modes of representation as tools for achieving joint and individual understanding;
  - present their work to others and receive critical, constructive feedback;
  - reflect on what they have learned, both individually and as a community;
  - receive guidance and assistance, as necessary, in their zones of proximal development.

In order to give a more substantive idea of what this approach looks like in practice, I should like to describe one curricular unit on electricity, as it was enacted in a grades 4 and 5 classroom in a multicultural inner-city school in Toronto. The unit took place about three quarters of the way through the school year and extended over 11 sessions, several of them involving a whole morning.

### **Inquiring about Electricity**

In this study of electricity, there were three major strands. The first focused on the students' questions and wonderings about electricity, its discovery, its properties and uses, and on their attempts to make answers to their questions. This strand provided the starting point for the unit, when the students first wrote what they knew about electricity and what more they would like to know; the questions they generated were displayed on the classroom wall and were frequently returned to and extended in whole class

discussions and in individual students' entries in their science journals.

The second involved the construction by self-selected groups of a variety of working devices and models that utilized some kind of electrical circuit, for example an electromagnetic crane on a model pickup truck, a set of working traffic lights, a walking and 'speaking' robot. These working models, together with displays of the results of their investigations through library-based research into the principles and applications of electricity related to their chosen model, were to form part of the 'electricity fair' to be put on for parents and the rest of the school at the end of the unit. And third, working in groups, the students attempted to solve a sequence of challenging problems involving the construction of circuits of various kinds.

Although separate periods of time were allotted to work on the three strands, they remained closely interwoven, both conceptually and in practice, through the reflective discussions that occurred regularly throughout the unit. In order to give a flavour of this community of inquiry at work, I will focus on the sixth session.

The morning in question began with a review of the entries the students had made in their journals and the teacher reemphasized the way she wanted the journal to be used – not simply as a record of the actions they had performed but also as a reflection on their actions and what they understood as a result. Then, after a few minutes spent considering electricity in the context of energy more generally, and in the collaborative co-construction of a classification of sources of energy and whether they were renewable or not, the teacher returned to questions that students had asked in their journals and focused on one in particular:

There's been a lot of talk among you guys about . electricity in the human body, OK? I'm going to read this part . `Electricity in the Body' (picking up the book and finding the page) I keep searching for it because I know Brian is still not satisfied about it. (She then reads a passage on how electricity in the body can be measured with the use of the electro-cardiogram.)

The discussion that follows leads into a more general consideration of ways in which the answers to their questions that they are constructing together as a class are helping them to understand the principles underlying the various devices and models they

are making.

Then, after fifteen minutes or so, the teacher poses the first challenge for the morning: each group is to make a simple circuit containing one bulb in a bulb-holder and then use it to test various materials that have been provided, such as a cotton reel, a nail, a beer bung, etc. "Will the bulb light up?" Before testing each object, they are to make and explain their predictions. When most groups have finished this task, the teacher calls them all back to the rug. Each group is asked to report its predictions and findings for each of the objects tested and, on this basis, the teacher constructs a table on a flip-chart. Then she asks for a generalization, first considering which materials are poor conductors of electricity and then which are good conductors.

The final part of the lesson – another whole class discussion – was a natural sequel to the practical work the students had done to establish the two classes of materials – conductors and nonconductors, or insulators – and to the extension of this activity through experiments to establish which class water falls into. One group had added salt to the water and another had joined several batteries to increase the voltage. In both cases, the bulb lit up, indicating that water can be a conductor of electricity. The experimenters also noticed that the materials got hot and, in one case, produced what appeared to be smoke. It was very appropriate, therefore, that the teacher went on to point up the value of the knowledge that they had constructed together by reading and discussing extracts from an article about safety in using electricity. The last section was about safety in the garden or yard and the danger of touching high voltage overhead cables. This led Jasmin to ask an interesting question:

I have a question about the wires that are in the yard . um . you said not to touch it with your hands . er - because you'll get shocked . but what happens when- I see sometimes birds on the wires and they don't get shocked?

This is clearly a question that interests several others and there are sounds of agreement. Brian tentatively suggests that it is because the birds are smaller, but this is countered by Nigel, who points out that "because they're smaller the high voltage would be more overpowering". A wit suggests that they wear small rubber shoes, and this joke is much appreciated. The teacher then reminds them of the kind of situation in which a

human being gets a shock, for example when the wire to a kettle becomes frayed through use and somebody inadvertently touches the exposed wire:

Teacher: (acting out the imaginary situation) And you're standing, look, you're touching the part that's frayed - What will happen?

Many Ss: Ouch!/Shock

Teacher: Where will the electricity go? You see the complete circuit . it goes . i into your hand . through your body . down to the ground .. there is a complete circuit .. What will happen?

William: Rest in peace!

[Laughter from many students]

Teacher: Now think about the bird up on the wire, is there a complete circuit there?

Many Ss: No

Teacher: And if the wire is not insulated .

[Several children speak at once, offering answers and agreeing with each other]

Teacher: But the wires ARE insulated .. now if we talk about the wire having a break?

Many Ss: Oh! Oh! (Expressing concern )

Teacher: Now if the bird is sitting on the break of a wire, would the bird survive?

Many Ss: No (in chorus)

Brian: Um . when- . I think I- I think I know why the bird isn't dead . it's because it's not a complete circuit and they're not touching the ground .. and so it just goes up in the air and it can't touch the ground but YOU'RE touching the ground and-

Teacher: Yes . like this (holding up the two wires with crocodile clips that have been used in testing the different materials, demonstrating the gap between the clips) There is no switch but does the bulb light up?

All: No (in chorus)

Teacher: Is the air a good conductor of electricity?

All: No (in chorus - following the argument)

Teacher: There's your answer

## **Conclusion**

In this classroom, as in those of other teachers in the DICEP group, inquiry is not a fixed method of teaching science – or any other subject – but a pervasive stance towards the various topics that make up the curriculum; it can therefore take many different forms. At its heart, however, is a valuing of students' questions and a flexible organization of activity that makes it possible to try to answer those questions through practical work, library-based research and – most important – exploratory talk (Barnes, 1976; Mercer, 2002). Nor does the teacher always assume the role of authoritative knower; instead, alternative perspectives and answers offered by students are considered, and emphasis is placed on providing explanations and justifications in order to arrive at a 'best' solution, with the proviso that, just like material artifacts, knowledge objects can always be improved. But perhaps most important is the emphasis on reflection on the significance of what is learned and on the processes of inquiry and responsible action.

As a result of our work together, we are convinced that there is no universal best way to realize the goals of education, as these were set out above. Since each classroom community is unique in its make-up and its setting, teachers must also be inquirers, as they attempt to find the most effective forms of learning-and-teaching for their own situations. In so doing, they come to understand better the needs of their particular students and how to meet them; at the same time they model for their students the spiral of knowing that leads to understanding and effective and responsible action.

Organizing learning-and-teaching in this way, we believe, we can contribute to the improvement of education and, through our students, to the improvement of the larger society of which we all are members.

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