

“WAIT! DON'T TELL ME!”

THE ANATOMY AND POLITICS OF INQUIRY

Mark St. John

THE 1998 CATHERINE MOLONY MEMORIAL LECTURE

The City College Workshop Center

CATHERINE MOLONY (1920 - 1977) was a beloved member of the City College Advisory Service to Open Corridors, a workshop leader at the Workshop Center, and an educator whose ideas and research on reading influenced teachers. The Catherine Molony Memorial Lecture is an annual event at City College in her honor.

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Director: Hubert Dyasi

Founder: Lillian Weber (d. 1994)

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IN ONE OF MY FIRST JOBS, fresh out of graduate school at Berkeley, I was evaluating a teacher program at the Exploratorium, in San Francisco, when Frank Oppenheimer, its director, called me in to ask how exactly I was going to do it? I huffed up my chest and said, I am going to do in-depth ethnographic interviews. He looked at me and he said, "Good lord, don't do that."

I was sort of shocked and said, "Why not?"

He said, "Just go talk with the teachers," advice that has proved very sound over the years.

And when Hubert Dyasi invited me to give a formal lecture at this annual tribute to Catherine Malony, I said I'm not going to do that: I'm not a lecturer. In fact, the other night when I was having dinner with my brother, who is an investment banker, and told him about this invitation, he started laughing. He said, "Look, I may be just a banker, but even I know it's ridiculous to lecture people about inquiry."

So instead of presenting something I've thought through and written down, I'm just going to talk and think out loud with you, and not only share with you some of my experiences and some of the lessons I have learned, but also how I think about things. And I'd like you to come along with me and think with me. I think actually that this kind of exploring—kind of thinking out loud—is the most legitimate point of entry into a discussion about inquiry.

Let me say a little bit about the work I do and about who I am. We have a small research group in Inverness, California, where my colleagues and I study investments in education.

Government agencies like the Department of Education and the National Science Foundation (NSF), the Ford Foundation, the Pew Charitable Trust, etc.-all invest in ways to make education better and we come into it through the door of evaluation, which can mean a lot of things.

Sometimes it means just documentation of what happens-documentation or portrayal.

Sometimes it means being a critical friend, giving people feedback. Sometimes it means being summative, helping to make a case to a funder, which shows that you have been accountable, or

at least responsible, for the work you are doing. Sometimes it means research--pulling out the more general lessons learned from this one instance. We do all of those things in varying degrees, depending on the context of the project, the mandate, and so forth. But the common element in all of it is that we spend a lot of time in schools, often in workshops, studying the reality of what is happening as people try to improve teaching and learning in the schools.

K-12 system in this country is a massive system, like a huge river, like the Mississippi or something; a huge system and a massive enterprise: \$340 billion a year, 2.5-million teachers, 60 million students. And alongside of that enterprise, there is what might be called an improvement industry, or improvement infrastructure, which is also massive: curriculum developers, assessment people, workshop people, plus a whole group of funders: Eisenhower monies, NSF monies, etc.

There are also all of these theories about how to improve teaching. Some people say, "We will restructure schools." Other folks say, "We will develop standards and assessments." Still others say, "We will do a statewide systemic initiative."

There are lots of different arguments being made here and our position, in a way, is watching this process unfold. Money comes to the improvement folks, they go out and work in the schools, and we study this whole process for the lessons that are to be learned from this enterprise. Are we, in fact, making our schools better places with our investments?

The Nature Of Inquiry

I want to start by thinking out loud about the nature of inquiry. And I want to bring you along with me as we think about this because I am quite convinced that unless we are quite clear and articulate, and grounded in our understanding of inquiry, we won't get very far. In this first part of my talk, I am going to try to share with you a kind of re-creation of what inquiry is.

Then, in part two, I would like to talk to you about teachers and the issues that come up for them when they try to create inquiry learning experiences for children in classrooms. I'm going to point out some things that perhaps you teachers who are here all know. Finally, in part

three, which takes us out to the level of the systemic, I'm going to ask to what extent and in what ways is the culture of the system supporting these classrooms as they try to create inquiry.

Just to get our brains going, let me put you to work doing some problem solving. You might solve the problem I am about to give you with a partner. It's just an exercise to have you begin to think about things: it's a math problem. You have a five-gallon jug and a three-gallon jug. You go down to the lake and, like all problems, there is an arbitrary thing you have to do. You have to come back with exactly four gallons in the five-gallon jug. How would you do that? Stop for a moment, dig in, and think about how you would do that. You can talk with a partner.

[A brief pause in the presentation.]

Because time is limited, I am going to give you the answer. The answer is this...

[Shows the jug. Then, the audience, in unison. . .]

"Wait, Wait! Don't tell me!

The experience you just had, the experience of Wait, Wait! Don't tell me, is, I think, a very important one. You were beginning to get excited by the challenge of solving a problem. You wanted to get on with it. You were talking with a friend about it, and you were interrupted in that process. I am going to argue that there is a very primitive desire in people to grapple with that intellectual challenge and to solve it for themselves, and that when that is interrupted, it is very frustrating and dis-empowering. So the first thing I want to say about inquiry might be summed up with the statement, Wait, wait, don't tell me; I want to find out for myself. It's a primitive human experience that runs through all cultures. A child with its parents says, "don't tell me; don't tell me. I want to figure it out for myself." And some of you may have had another experience, which is summed up by the expression, 'I'm not even going to try! You have learned that it is not smart to invest yourself and authentically take on the challenge. You will wait because you know someone will come up with the answer.

I would argue that in all too much of our schooling, we're doing exactly what I did to you. In schooling, we say in effect, 'Look, I don't really care whether you figure out the problem, but

you need to know the answer. You need to know the answer for the test. The answer goes like this: here is how you do this kind of problem. We have to cover this, and we have to move on.’ And, of course, if I tell you the answer, it short circuits some very important processes-it kills the urge to figure it out for yourself.

The word inquiry comes from the Latin words, *in* and *quirer*. *In* means inward, and *quirer* is to question. Thus inquiry is not just asking questions – questioning about or questioning of – but it carries this perception of depth, which is questioning into something. After an accident or crime, for example, it is customary for the police to conduct an inquiry. Something about your state of knowledge is not satisfactory: I want to know more and I need to investigate it for myself.

With inquiry, two things sort of happen simultaneously. One is that we gather factual evidence. The other is that we listen to stories that explain or give meaning to that evidence. An inquiry, in some sense, is about the reality and description of things. It is our probing into that which is there because we know our understanding is incomplete. We say to ourselves: ‘We need to know more. I want to go down in; I want to find out for myself. I want to solve the problem because I am not satisfied with my current state of knowledge.’

Let me describe an experience I had about a year ago in order to keep illuminating this notion of inquiry. Hubert [Dyasi] and I were in a workshop together at the Exploratorium, a rare occasion, and we were asked to partner up and begin to do an inquiry in a domain that we had studied a lot. We had once spent a whole week at the Exploratorium studying candles, and here we were again, with light and candles, just messing about. The first thing, of course, is that we lit a candle: we started out with the candle as our phenomenon, and we put the phenomenon on the table. We are phenomenon-centric and our basic operating principle is to start with a thing and not an idea. just as an historian starts with archival material and a mathematician starts with numbers or patterns, the scientist starts with real stuff. Then as we happened to have other things around, one of which was a flashlight, we picked up the flashlight and thought, ‘This is interesting. We have a flashlight that projects light,’ and when you project light you can make a shadow. You can make a shadow on a board, like I’m doing with my hand. Why does the shadow appear? It’s just common sense. The light can’t pass

through because my hand is blocking it. So a shadow is where the light is being blocked. What question might I then ask?

If I shine the light on the flame, will it make a shadow?

That was the question Hubert and I asked: If I shine this flashlight on the candle, will the flame block the light? And as Hubert and I began to discuss this, we realized we had ourselves a very good question. And to be a very good question for Hubert and I, at that point, it had to meet several criteria. One is, very simply, that we didn't know the answer. A second is that the question is not complex or abstract. I am not asking about the chemical makeup of the flame, or the atomic structure of the gases in the flame. It is a very ordinary question in that it is right in front of us. It's also I think the kind of question that we sort of commonly think we should know the answer to: *Why don't we know the answer to that? Why didn't we know whether or not a flame makes a shadow?* It is also what I would call a generative question in that, as you begin to think about it, we see that we could argue it a couple of different ways. Hubert argued one way and I argued another way. In a way, in fact, we were theory-making, but checking our theory as we went along. We were checking our thinking by expressing it, without shame, out loud. I said to Hubert, "That flame is nothing but light, and I am sure that light passes right through light. Therefore the flashlight should shine right through the flame and not make a shadow: it is simply more light adding to the light that already is there." Hubert said, "No, I can't see through that flame. The flame must be blocking the light on the other side. There must be a shadow."

Before long, we had a raging debate going. Two scientific theorists having it out because of a contradiction in our theories. Can anyone guess what is going to happen? How many think you'll have a shadow if I shine the flashlight on the flame?

[Half the room raises their hands.]

How many think I won't?

[The other half raises their hands.]

So even here, we are kind of torn.

And we want to find out. There is an energy in this; there is an authentic energy. We are not reading about this in the textbook; we are going to find out for ourselves. As Hubert would say, “We are going to have a direct conversation with the phenomenon-not with someone who wrote a book about it.” This is the beginning of inquiry. This is first-hand learning. There is a wonderful question and it turns out that the answer is neither yes or no.

[Mark shines a flashlight on the candle flame.]

There isn't much of a shadow, but actually there is something there. We get a larger flashlight and create other flames. We play with it. We get deeper and deeper into this thing. We begin to discover.

In another inquiry, we were working with bubbles and foam, which we had played with for years, and I noticed a tiny bit of foam on the black piece of paper that we used to cover the worktable. Someone said, “That's not a bubble, it's a 'speck' of a bubble.” I said, “How do you know?” They said, “Look carefully.” And sure enough, when we looked, it was a little dry piece of silicon. I said, “How did you know that wasn't a bubble?” So we began to think about that, and then the question came up: How small could a bubble be? Could the bubble be smaller? If its walls have to be a certain thickness, at some point it must get to where there is no room left inside for air. So how small could a bubble be? A wonderful question.

Then there is what you might call a technological inquiry. Two teachers we were working with at the Exploratorium started with a standard experiment, which is to take black ink, put it on a piece of paper, add water, and let it run. In the process, you are meant to discover that the black ink is made up of many different colors. Once they had done this, they said, “Can we put the colors back together again to make black?” which is a difficult thing to do. In fact, they got brown, but they couldn't get black. They spent two weeks trying to figure it out. In the process, they discovered for themselves the entire set of rules of color mixing.

Thus inquiry is often in the form of setting the challenge for yourself: Can I do x, y, or z? Can I find the smallest bubble? Can I make black out of many different colors? Sometimes you do it by setting a challenge for yourself that is quite simple: can I construct this, can I design that? You create a generative task that is going to literally shed out all kinds of knowledge about the

world. I think people in technology know this. A lot of findings come by trying to make, or do, or build, or create something. You discover all of the stuff that falls out of that challenge.

All of these things come about by having, in whatever ways, a phenomenon on the table, like the candle. Then there arises a kind of question, or challenge, which makes you put your thinking also out on the table. Thus, side by side, you have the phenomenon, and your current thinking about the phenomenon. Inquiry is really the process of comparing those two – the phenomenon and your understanding of it. Thus when you begin an inquiry, you are deliberately setting out to search for what you *don't know*. Inquiry requires that you know that you don't know something that you feel you should know. And, in that process, you get this engagement, this excitement, and energy, just as we did here.

But you have to become very good at knowing that you don't know something. You have to become interested in your non-knowledge. You have to become fascinated with your particular ignorance in a particular place. And I would argue that is exactly the opposite of what happens in schools, where you focus on what you do know, or are supposed to know, and where you are absolutely terrified of what you don't know. Where, in fact, you want to run from what you don't know. But inquiry isn't just a matter of acknowledging that all forms of ignorance are equally good. You have to become a connoisseur of your ignorance. You have to find just the right point of ignorance.

It would not have been a good thing to say, "I don't know the chemical makeup of that flame." That is certainly something that I didn't know, but if you think of living in the bubble of the known, that particular non-knowledge wasn't right in front of us. It is a much better thing to say, "I don't know if that is going to make a shadow or not." That question is one step out from what we do know. Hubert and I described that as our 'proximal zone of ignorance!

In the bubble of the known, you are surrounded by a model of the world that explains things to you, and fits with what you know, like the chair in which you are sitting. In that sphere, it all makes sense. Then-and here is what you have to get good at-you discover the limitations and contradictions of your model: the boundary beyond which your theories fail to explain the world. And for a child, you are always looking for that door from the known to the unknown,

where you can press forth and push, and in a sense expand the bubble of the known. But it has to be proximal. If it is too far away, it is not useful.

In a recent experiment, psychologists tried to determine who the risk-takers would be in a group of youths. The youths were given a chance to win some money by tossing a ball through a hoop. For the risk of \$1, they could either try the nearest hoop, which returned \$1.20, a second hoop a bit further out, which returned \$2, or a third hoop some 20 feet way, which returned \$10. It turned out that the real risk-takers, the people who are serious about taking risks, went for the hoop in the middle distance. The first group is taking what you call a sinecure, a given. At that range, you might miss occasionally, but it is almost assured that you will make the shot. And the far hoop is sort of a fantasy, like the lottery; it isn't serious risk-taking. You expect to lose your dollar and you are doing it because it is fun. The real risk of failure comes mostly in the middle ground, and I would argue that that is very true in life. The real risk is in taking a finite step large enough so that there is a real probability of failure and yet also there is a real probability of success. Real inquiry involves risk-taking, and it also involves taking an incremental step.

Inquiry is about finding that piece of ignorance that allows you to take that step, being able to discern where that piece of step is, knowing when it is a critical step to take and even the size of the step. No one teaches us that. How do you become an expander of your own knowledge? How do you get good at that? How do you notice where your knowledge breaks down, and where you can expand it? How do you find those critical questions?

Let me stress another thing that is needed in doing inquiry: the word that describes it is proprioception. *Proprio* is Latin for self; *inception* means a 'capturing in understanding or awareness' of self. For example, normally I have proprioception of my hand. If I close my eyes and wiggle my fingers, I know what they are doing; I can feel it. But when I fall asleep on it, it becomes numb, and I lose proprioception. Proprioception is self-awareness. In order to do inquiry, one needs self-awareness, not of one's hand, but of one's thinking: What is the state of my thinking? How does my thinking work? What is the model in my mind? If I can't get perception of that, I can't put it on the table next to the candle. This is one reason, in fact, that we do inquiry as a social, or public event. By listening to Hubert, I become aware of my own

thinking, and vice versa. I know how I am thinking, how Hubert is thinking, and, more generally, what kind of thinking there is around here.

And again I would say that there is very little attention given in schools to this question of what you are thinking: Can you tell me what you were thinking? Can you be articulate about your thinking? Can you be interested in your thinking? In fact, I would argue that a more important part of that exercise is for children to learn to examine and be aware of their actual thought processes in a dispassionate way. Usually you are identified with your thinking. Consequently you are terrified of exposing it, because “I am my thinking.” In truth, you aren’t your thinking, but that attachment of you and your thinking is a very, very strong barrier to being able to help children become aware of their thinking and being able to operate on it, to deal with it, to study it, to inquire into it. And that is crucial for doing this kind of learning.

Another issue in this discussion of inquiry is the question of authenticity. The question we came up with about the shadow of the candle’s flame wasn’t on a worksheet. It was a question that emerged as we started to play with the thing. It emerged out of our conversation with the materials. It was an authentic question. The word authentic comes from the word author, which means that we authored the question and the investigation; we were the writers, we were the creators. It wasn’t somebody else’s question, it wasn’t what somebody else noticed. And it wasn’t just that we made up a question. It was a good question because it reflected our boundary of knowing and not-knowing. For someone else, the boundary might be much further out; or it might be much closer. The point is simply that the question you ask has got to be personal. Inquiry is personal experience, not “research/” which is the collective inquiry of the field. Research advances the state of the canonical knowledge in society, pushing the collective knowledge forward. The kind of inquiry that we’re talking about here for children, in schools, is personal. It has to do with my knowledge and my pushing it forward, and only I, in a way, can know this.

Some schools use something called the KWL chart in doing what they call inquiry. It is a device or tool for asking children what they know about something, what they want to know about something, and then later what they learned about it. I suppose that’s a step in the right direction. You say, ‘What do you know about whales?’ and you make up a bunch of stuff to put in a child’s head about whales. That’s okay; we’ll get a little bit of thinking on the table from

that. But what are we missing? We are missing the whale! We're missing the candle! We're missing the phenomenon! On the other hand, if there was a whale to look at and I said to you, "Let's look carefully at this whale," you would say, "What are those things on its side? Why does its breath smell like that?" You would notice things about the whale. It would be more like having a direct conversation with the phenomenon. Sometimes museums ask us to do front-end evaluation: to find out what people want to know from a particular exhibition, and we have to tell them that that's not the right approach in the circumstances. The right approach is to let the visitors interact with the phenomenon, and see what the questions are that arise. Questions of inquiry have to be grounded in the phenomenon. They have to be located on the border of the known and the not known, and that is a personal thing. And one needs a proprioceptive ability to notice all of this, and to find the right door into the unknown.

The thing we are talking about is also not fantastical. Sometimes you think about this kind of fantasy-making of children, and such fantasy has no place here. It is fine to do fantasy, but the thing that we are doing here is very much grounded in reality. Neither is it just a matter of thinking up a question; that's not what we're talking about here. That's fine to do also, but the thing I'm talking about is actually very disciplined, very rigorous. It is the discipline of carrying on a conversation with something that is real, rather than with, say a movie or television screen. You always have to keep coming back to the reality. With the candle Hubert and I were observing, there either was or wasn't a shadow there! And for children, making this distinction is a demanding task. Not to be too heavy here, but I do want to disabuse us of the notion that inquiry is somehow just a matter of making stuff up.

Last spring, we interviewed some children in a high school English class, where inquiry was used to elicit their writing, and clearly the approach had made an impact on the children. It showed up when they talked about their writing. They were very, very aware of what they did, of what they thought, of what they didn't think, of what they knew, and of what they wanted to work on. They had proprioception about their writing to a degree that was extraordinary. They were very articulate and very honest about their own work. Clearly something had happened in that classroom to make them learners of their own writing. They were students of themselves vis-a-vis writing. They were students of their knowledge, of their skills. And that's

the kind of outcome we are talking about when we talk about this kind of education, this kind of process.

More than becoming interested in your own knowledge, in your own thinking, you have to have a relationship with it, and one that is quite honest and fearless about where that knowledge and thinking begins and ends. For example, when we were with the staff at the Exploratorium, we studied an exhibit there that was absolutely inexplicable to us. The exhibit signs offered textbook explanations, which we all cited as we were discussing things, but we are all quite quick to get to the point of saying, "I don't think I know whether to believe this. Someone might know these things, but I don't. It doesn't make sense to me, so let's push farther and see if we can figure this out for ourselves."

You have to own up to your own self, if to no one else, fearlessly and candidly, when you don't know. And you have to be very excited about 'finding out' when you don't know. Scientists do this all the time. Konrad Lorenz, who studied animals, writes in his book, *The Year of the Graylag Goose*:

Whenever I sit for a couple of hours on the gravel bank of the river Om with my flock of geese, or in front of my capacious aquarium with tropical fish at home in Altenberg, the time rarely goes by without my observing something unexpected. I never have an explanation at hand for these novel observations. Rather they lead me onto new questions which require further observations, and very frequently also experimental investigation. If zoologists like me conduct fewer experiments than do the adherents of other schools of behavior research, the difference is that we investigate only questions that arise from actual observation of animals, if possible in their natural environment. Pure and simple, observation provides the basis for all of the research we do...

Lorenz is looking for that moment of incongruity, that moment when observations stop matching up expectations.

Jane Goodall, another scientist who studied animals with great care, said almost the same thing would happen every time she went into the field to study chimpanzees. She'd watch the same family of chimpanzees for days, and for days she would see nothing. And by nothing she

means, "I see only what I understand, and only what I understand is what I see. They are doing things that make complete sense to me."

Which terrifies her, she says, because she is not there to see what she knows, she is there to see what she doesn't know. And by the end of the second day, she is completely terrified because all she is seeing are things she can explain.

But finally, after watching and watching, something emerges, like the candle; a question comes to her. She says to herself, " Why are they doing this? This is new to me! I see a pattern I don't understand! " She's searching out that place where she isn't knowing: the proximal zone of ignorance, where your knowledge breaks down, or it is contradictory, or unknown. This is a proposition about learning that we value neither for teachers, classrooms, or children-that what you don't know is important-and that it is important to teach children to become real connoisseurs of what they don't understand!

Let me add one more thought, which has to do with the concept of explanation. I find it interesting that the Exploratorium employs high school students on the floor to 'explain' its exhibits. In arranging for that, Frank Oppenheimer understood something fundamental about explanation. If you said to high school students, "I'd like you to come into a museum and study museum exhibits for six weeks this summer," I don't think you'd get a lot of takers. On the other hand, if you say, "You're going to wear an orange coat, turn the exhibits on and off, and explain the exhibits to people," it becomes a very exciting task in a very public arena.

And in having to explain these things, as any teacher knows, you learn. It makes you put your thinking out on the table; it makes you confront how you are actually understanding the thing you are describing. And in the process your thinking becomes transparent. You begin to question how satisfactory this thinking is. You begin to make comparisons. You become dissatisfied with your explanations. Explanation, in a sense, is a public disclosure of the status of one's knowledge. Doing inquiry and making explanations are almost two sides of the same coin: you need both of them.

I'm reminded here of how the philosopher J. Krishnamurti, at his first meeting as head of the Theosophical Society in 1929, which some 20,000 members attended in Holland, moved to disband the society, saying simply that "truth is a pathless land." And by that, he meant you

have got to ask questions and find out for yourself whatever it is you are looking to understand. You have to go through first-hand learning. You've got to be the author of your own knowledge. Therefore, he said, "our society is not needed here."

About that last inference, I am not so sure. But I love the expression, "Truth is a pathless land."

Classrooms in schools

If you think about the problem of understanding a phenomenon, there is no better case in point than the phenomenon of elementary science education. When I ask people at NSF, or anyone else of my acquaintance, to describe the current status of elementary science teaching in the US, nobody can do it. And there is no system in place to make knowing possible. If I ask whether elementary science is taught or not, or about how many hours a week it is taught, or whether it is taught hands-on, or whether they are doing inquiry, lots of opinions are ventured, but nobody knows. We have all seen a little bit, but there is no systematic understanding of this landscape. We all have beliefs and mythologies about it, but basically we reformers are all trying to change a landscape that nobody has ever really mapped.

In California, a tremendous debate rages about whole language and phonics. The claims are made that test scores are down because of whole language. I ask: 'Exactly how much whole language is there in the classrooms? What is the actual teaching practice of teachers? Is it whole language, is it some kind of integrated mix, or is it still phonics; what is the actual practice?' Dead silence. No one has a clue about how language is taught in California's classrooms.

My guess is that it is some hybrid mixture. And I doubt that whole language practices have wrecked our scores. But it doesn't matter. The point is we have not studied the phenomenon; we have not looked at the candle. We have a lot of beliefs about the candle, we want to change it, but nobody has seen it up close.

An interesting counter example to the above is the Third International Math and Science Study (TIMSS) 1994-95, which has tremendous power because someone went out and studied 100 German classrooms, 100 US classrooms, and 50 Japanese classrooms in detail, including video-taping them in the process. They said, 'Here is the phenomenon, let's look at it.' To me, it is an

extraordinary work because, if nothing else, it is the first time I've seen it done. Meanwhile we are all trying to change a landscape that nobody has ever really studied carefully.

Having said all of that, here is my take on what you would see if you went around the US observing classrooms in regard to science teaching. I would posit there are three levels of practice, as seen through an inquiry lens. On the first level, which includes 80 percent of the classrooms, they are teaching science a couple of times a week perhaps, or once a week when there is no social studies or assembly. And that science is heavily overlapped with literacy: students are reading about science, and writing about it.

Teachers in this first level rely on a kind of personal repertoire of science-like activities. They have things they teach in science, whether it is planting a seed, or getting leaves from the backyard and drawing them. Often it is just a kind of idiosyncratic personal repertoire of 'things we teach'-things that are experiential, like field trips, etc. and often attached to a kind of hopefulness that someone else in later years will teach the children "proper" science. There is recognition of doing science, sort of, but in the abstract. You wouldn't call these inquiry-based, or even science-rich classrooms.

On level two, there is a set of classrooms where there has been a systematic attempt to integrate elementary science kits into the curriculum, and in those places I think you see a little bit more. You might see that a district-wide science program exists. But the teachers who are doing the kits focus on the procedural. That is, they say, 'Let's do the kits,' and they walk through it. It is kit-based "discovery learning" without a lot of inquiry.

Kits are seen as a tool for learning the concept, one of the many ways to learn it, and the concept is what we're trying to get across, but if you relate back to our earlier conversation of pressing from the known into the unknown, the valuing of what you don't know and the raising of authentic first-hand questions-these things are not much present. On level two, we are just trying to break out of a more didactic mode of schooling; we are taking a first step.

Finally, at a third level, and this might be just a few percent of American elementary classrooms, there are teachers who, I would say, for one reason or another, and I suppose it is either through experiences like being at this workshop, or just because of who they are-who are committed fundamentally to a process of having children learn how to learn, of having them

become firsthand learners. They often are excited about science because it is a very rich area in which to pursue their commitments, or their personal agenda in regard to having children ask their own questions. They are usually very strong teachers to begin with, teachers of substantial experience, and they see science as the arena in which they can fulfill their professional selves. And even they struggle to orchestrate prolonged, well-designed inquiry experiences for children. I see their situation as akin to teaching people how to fly-fish, if I may use that analogy. We have gotten some of the teachers excited about putting on the hip waders and the vest, putting the pole together, getting the line out, tying the fly on, walking through the woods to the creek, and even learning how to cast. They are very excited because they are no longer simply reading about fly-fishing; they're outside in the stream, going through the motions of casting. They've learned how to cast the fly out. And when the fly is finally floating down the stream, and just where there is a trout that is ready to take the fly – you've picked just the right one, you have the right leader, and you are waiting – but instead, suddenly, the fly is whipped away-because the next cast has to happen! "What about the trout?" we shout. "The trout," says the teacher, "what trout? I thought what we were doing was about casting, walking, equipment!"

Teachers do all this stuff with the kits-and we watch this happening time and again in the classrooms we visit – you put these kits out, you have the children engaged with them, you are waiting for exactly that moment when the child seizes on the bait, you get there – the child, like the trout, is suddenly lured by a real question, he is on the boundary of the known and unknown, there is something exciting happening there for him, making him wonder, 'Why is there a shadow?' and at that point, we whip the fly away because we have to go on to the next thing.

Just as the point of fly-fishing is to get to the moment where this fly comes down and the trout takes it, the point of all of this mental preparation-setting up the kit, putting out all of this stuff-is to bring the child to a point where he could ask his or her own question. And since he is going to bring his prepared thinking right up to the boundary of this thing before you take the fly away, it's not only a matter of missed opportunities, but of killing the budding curiosity.

Of course, part of this "dumbness" is self-serving. The teacher also realizes that if the trout takes the fly, it is going to be messy. Pulling the fish in is going to take time, there's going to be a

struggle, it's going to get goo on the fly; it's a lot easier to pick up the fly and go home. What if I have 30 lines out and 30 trout, all struggling with their own flies?

And in a way, the teacher's inclination, which most of the time is to keep the casting going, is understandable. But from the position of observer, or evaluator, you can't help but be frustrated seeing the fly-caster miss strike after strike. It is the thing we see in classrooms that is most frustrating. We have taken some steps in this country to get hands-on going, to get activity going. In some places, we have created this wonderful, teachable moment, with children getting excited, all ready to go. Only the whole thing falls flat when the fly is suddenly whipped away.

Added to this frustration, is another very strong reality in the classrooms right now, which is what I call the Great Tension, or the Great Schizophrenia, which is best summed up by the besieged figure of the American School Principal, whose indecisiveness with respect to policy matters resembles less a creator of social values in the community where he works than a rat caught in a maze. We do a fair amount of work in a large western school district, which is the eighth largest school district in the US and the fastest growing. Jeremy, who is actually an old friend, is principal of the school where we work. Jeremy used to be a teacher on special assignment, who was giving elementary science workshops on inquiry, and who then was appointed to be a principal. One day, Jeremy came to me with an anguished look on his face.

"The teachers are threatening to go out on strike," he said. "Two weeks ago, I went to them after a district meeting, announced that 'We are an underachieving school, these kids can't do anything,' and gave them the whole spiel about having to get our math and science scores up. 'Forget the rest of what we're doing and really focus on raising the test scores,' I said, 'because that is what can do the most for the district.' The next week, I came back from another workshop meeting on inquiry science, and announced, 'Forget all that test stuff from last week, just focus on helping the kids do firsthand learning, assess for long-term goals, etc.' "And now the teachers say, 'Jeremy, you are schizophrenic.'"

He said to me: "I think they are right: I am absolutely schizophrenic."

Our system is schizophrenic and I think all of you here recognize it. On the one hand, the system's rhetoric promotes these higher-order goals-first-hand learning, and helping children to

figure things out about the world by themselves; and on the other hand, it goes on obsessively about the proven mastery of very basic skills. That clash of direction is very, very tough for teachers to deal with. And yet it is fundamental to the culture they work in. There are a lot of theories about this phenomenon, but I would argue that right now it is unresolved for many teachers, and left for them to resolve by themselves.

Given these dilemmas, and these various levels of inquiry realization, let me tell you a little bit about what I think it is going to take to create a good classroom. Maybe the way to get into this is to liken the situation to Abraham Maslow's hierarchy. At the bottom of this hierarchy is what I would call an 'at-risk' classroom, which we see a lot of. Like youth at risk, a classroom at risk doesn't have any options. Maybe at best you have one way of proceeding, and if that fails, you are not going to make it.

A good example of a classroom that would be at-risk is one where I would be put in charge of teaching second grade music. Why? I don't know anything about music. Also, I don't know anything about second graders, and I don't know anything about second grader's knowledge of music. I don't know anything about a curriculum for music. That classroom would be very much at-risk! And, in that situation, I would want textbooks, with problems at the back, that would show me exactly where I was at. Or I would want a kit; I would want something that was well designed to help me out.

At the polar opposite of the classroom at risk is the 'rich' classroom, or a robust classroom, where there is a teacher who really understands and knows and loves the discipline. If you put me in charge of teaching science rather than second-grade music, I could do that. I love science, I love the inquiry part of it, I like the topics, I read about it; in some ways, it is a friend of mine. I also know how children know science, and I have a wide repertoire of ways in which to get the children to meet science.

In that rich classroom, what are the key elements? One key element is curriculum. Curriculum and materials, and a shared set of expectations around how they are going to be used. Having scattered materials is not enough. You need good elementary science curriculum, like Insights, or even like FOSS, that are well structured, and you need to ask teachers to begin to teach it as designed. This may seem to run against the grain of doing inquiry, but bear with me. As the

second-grade music teacher, I would want a good music kit to get myself started. A good curriculum is educative: if I do it the way it is designed, it is going to teach me something, the children are going to succeed, and their success is going to lead me farther on. It is a good starting point and it is do-able on a large-scale.

Good curriculum also has a high ceiling, or an open ceiling, so I can take off with it. It doesn't require that I trade off my expertise for the structure I need. In fact, the more my expertise as a teacher develops, the less structure I need in the curriculum, and vice versa. The critical factor is maintaining some constant sum of curricular structure plus professional expertise. And again, I am talking about these issues of curriculum in light of the need to create large-scale dissemination of inquiry science in the schools.

A second key element, or building block, is a teacher's knowledge, and capacity and propensity to teach certain ways and certain things. At the Exploratorium, Frank Oppenheimer kept saying of school reformers: "They are asking teachers to share something they don't have." We have all been in so many math classrooms where the teachers say, "We all hate factoring, but we have to do it." That's hardly the stuff that makes for motivation. Teaching is the sharing of something you love, and when you don't love the thing, it is hard to share it well with your students.

Few teachers have had the opportunity for this deep sense of first-hand inquiry experience. But if you have that kind of experience yourself, then you are in a position of being able to replicate for a class of children, not the activity you do, not the materials, not what you learn, but the learning experience itself. Not the same kind of writing you did at The Writing Project, but the same kind of excitement generated there, the same kind of engagement, the same kind of extension of self that comes from the work.

Here is what one person at the ASTC professional development Institute said about her experience:

"I think the thing that moved me the most was the actual inquiry experience of the Institute, working on it together with others, seeing what other participants worked out for themselves in working together, the genuine excitement that came out of being able to

play with materials, seeing a particular series of questions develop, one out of the other, over a period of time, and realizing how valuable they were... "

A really strong inquiry experience is transformative. In undergoing that transformation, you begin to see the world differently, your psyche shifts.

A third key element that teachers need is an understanding of the content; the knowledge of the discipline. We used to hope that a good elementary teacher could say to her students, "I don't know, you don't know; let's figure it out together.' I don't think that's quite legitimate or fair. If I'm to guide people through a landscape, I need to walk through that landscape myself-to know what ridges and valleys and canyons there are. I need to know some of the particulars. I need to have gone there myself and learned it. I don't have to know everything, but I can't guide people through a music landscape without knowing something about music. How I learn that content is an open question, but it is naive to say I can teach music simply by knowing how to do inquiry. I need to explore myself. I need to know how to guide. I need to know something about the landscape.

But that's asking a lot. I don't know if an elementary school teacher can be a good guide through nine, or ten, or twelve different landscapes. I would almost argue that in elementary school your knowledge of science needs to be greater than at the high school level because to make it simpler, you need to know it better; you need a deeper and more fundamental understanding of science. On this issue, in elementary school, we may have actually run up against an unanswerable question. Maybe it's enough that a teacher be a good guide in history or science, or for language arts. For me, the need for content knowledge at the elementary level remains a real dilemma.

The National Standards And Beyond

Most recently, in the movement towards standards-based reform, there has been a lot of effort expended on trying to create an educational culture that encompasses both an inquiry approach and a mastery of basics. In the Sixties and Seventies, the school reform effort was curriculum-driven. The saying was, 'Let's run summer institutes, and the curriculum plus the institutes will create reform!' But the new system failed to materialize. They were wonderful curriculum and

wonderful summer institutes, but something more systemic needed to be done. What has emerged in the last couple of decades is, in some ways, a more sophisticated theory of change.

Standards-based reform says: "We will create sets of standards where there is consensus-public consensus, educator consensus, scientist consensus-and those standards will lay out a vision of what children should know and be able to do. That vision will be kind of the North Star by which we will navigate. Everything will aim toward that North Star. We will create tests and assessments that will tell us whether we are making progress toward achieving those things. And we will create an accountability system that will have rewards and punishments."

We had it all lined up to make it happen. At least theoretically we did. The theory is quite good at describing how a major system should function. That is, it is very good at describing the fact that things are systemic; that policy matters, curriculum matters, professional development matters, assessment matters, public opinion matters. It is less good at being prescriptive. That is, it doesn't tell you how to get there. It is a bit like saying parents matter in education. That is true; where there is good education, parents are often involved and supportive. But saying that doesn't tell you necessarily how to get them there.

We have done a lot of studies in standards-based reform efforts. We have done one for the National Academy of Sciences and we are doing one for the Pew Charitable Trusts, and I would like to share with you my candid assessment of where, in that whole movement, we are. First of all, there are now national standards in science and math. The national standards are pretty good if you are looking at them with an inquiry lens. They say things like:

- School science should reflect intellectual and cultural conditions that characterize the practice of contemporary science.
- To develop a rich knowledge of science in the natural world, students must become familiar with modes of scientific inquiry, rules of evidence, ways of formulating questions, ways of proposing explanations.
- Learning science is something that scientists do, not something that is done to them. In learning science, you describe objects and events, you ask questions, you construct explanations, you test these explanations.

- Good instruction enables children to acquire clear and stable mathematical concepts by constructing meanings in the context of physical situations and allows mathematical extractions to emerge from empirical evidence.
- Young children and active individuals construct, modify, and integrate ideas by interacting with the physical world, materials and other children.

This is all the stuff that we have been talking about. In terms of promoting inquiry the standards, as documents, are quite strong and visionary. So what has happened as these policy arrangements have begun to play out?

One thing we discovered in the course of our study for the National Academy is that educational policymaking is increasingly focused on political goals and strongly shaped by local political forces. Standards seem to be the answer to two types of questions: the answer to the education question, which is, "What should children know and be able to do, and what should I teach," and unfortunately the answer to the question that the politicians and policy-makers are asking, which is, "What can I do to appease the current dissatisfaction with education?" Everybody likes standards because they are seen to be an answer to that problem.

"We will install standards and assessments, and tough accountability," the policy-makers say, "then we will look like we are doing something, and it is an absolutely on the cheap; a practically free solution." Obviously, when policy makers say standards, they mean something other than the inquiry described in the national standards.

There is also increasing complexity and ambiguity about the locus of control. Those working at the federal level have control over funding and policy. The States, as I'm sure those of you who work in New York know, have tremendous control over assessments, curriculum and funding. Districts in New York City have tremendous control over testing, professional development, and school policy. With site-based management in effect, schools are increasingly extending their control over things. And, of course, the teacher can always close the door to her room.

So you have five levels of governance deciding on things, none of which has the majority of votes. It is like a parliament with five parties, none of which has control. And there is this

constant, often contradictory, and tough policy-making that goes on at each level. But now it seems everybody, at all five levels, loves standards, and as a result we have lots of them.

In science alone, we have the national standards, the standards of the AAAS funds, the standards of NSTA doing Pathways, the New York State MST standards, the scope and sequence standards of the school districts, the standards of the individual schools, and grade level standards. In an interview, a teacher told me she has collected standards in science that sit 14 inches thick on her desk. What could she do with those, she wanted to know?

So standards are set up as a first step to reform. They say, "Let us go and write 'a vision' of exactly where we want to go," which is, in many ways, the exact opposite of looking at the candle. Looking at the candle is to look at the phenomenon of where we actually are in the teaching of science and how we might take a step forward; an incremental step forward. But no, we are always focused somehow on the horizon-on the way things should be.

The national standards have tended to generate a tremendous number of reforms. The reforms keep coming faster and faster, and the tendency for teachers is to hunker down and let them go by; 'reform overload' is a huge barrier in this business.

People also give short shrift to the national standards for what they see as reasons of survival. They say, "I don't care about your national standards, I only care about the state test; the test is where the rubber hits the road! You can say anything you want about your vision of education, but the test is high stakes; that's the standard! " It's a *de facto* standard. And tests unfortunately for legal reasons, for economic reasons, for technical reasons-tend to degenerate back to pretty ordinary instruments of assessment. So we keep falling back, further and further, from inquiry.

Ironically you can have a district-level policy and a district-level test which for all practical purposes serve as barriers to teachers having any access to the national standards. In Wyoming, where there are no state or district standards, most teachers have direct access to the NCTM standards. In New York, I would guess that the large majority of teachers pay little attention to national standards because they focus entirely on their district's scope and sequence. They entrust their districts to incorporate the broader visions at the national level, but to a large extent, looking at the situation through the lens of inquiry, it doesn't happen.

Where to go from here? If one cares about the kinds of experiences we have been considering here, what can we do? The first thing I think we need to do is to hold accountability accountable. Accountability has a free rein now and it is driving the system in unintended ways, like when you build a dam and the consequences downstream are tremendous and unforeseen. Just when you install a testing system, and think you are going to test for accountability, you create tremendous unforeseen implications for the system, which we ought to be more careful about. Holding a school accountable, saying the science is bad, because their children score low on the science test is like saying that a psychiatrist isn't a good psychiatrist because his patients are crazy. Let's look at what the school contributes in this area, let's be careful about these things, let's do them scientifically.

Accountability as practiced currently is a political act, not a scientific act. As a scientist and evaluator, I get fairly outraged by this. I need to remember that accountability, as currently practiced, is about solving political problems, not educational ones. Still I'm hoping that we can have complementary accountability processes that go beyond simplistic measurement of outcomes and instead that focus on quality.

The School Quality Review was a wonderful process for looking at the inner workings of schools. It's now been eliminated in New York and other places, but it is imperative for us to have other ways of looking at teaching and learning as it is happening, and registering the degree to which children are having high-quality learning experiences, not just registering the outcomes.

We need to help teachers in particular, but also ourselves in general, to create a vision of education that is not dichotomous. We talk about inquiry over here, and basics over there. I am convinced that those ways of organizing educational experience belong together. My analogy is with sports again.

By scrimmaging, playing every day and picking up the basic skills in the context of the game, you could learn to play soccer. That would be equivalent to doing a science investigation, learning the science concepts and skills along the way. At the same time, you could also do drill, practicing dribbling the ball, passing the ball, heading the ball, etc., acquiring the basic skills that would help you in your game. A good soccer team does both, plays games and drills,

and does them in a way that they reinforce each other. Schooling is too much just about doing the drill and never playing the game, and that is not much fun.

I had a friend who took golf lessons. For three days, he practiced on the tee, hitting ball after ball; but he had no concept of the game. Finally he said what he was doing wasn't much fun and gave it up; he saw no point to it. I think we do that with children a lot. We give them arithmetic practice and then more arithmetic practice, without giving them an understanding the nature of the game. I think we need a non-dichotomous vision. I think the dichotomy into inquiry on the one hand and basic skills on the other has really hurt us all.

In California, it has been very destructive to those who are interested in constructivism and inquiry because they made an enemy of the more conservative public and lost the battle. The math community in California, for example, has not understood, or is unwilling to listen to, the concerns of parents who say, "I want my child to be able to double a recipe, " or "I want my child to be able to add." It is a mistake not to listen hard to the concerns of parents. Those are legitimate concerns and we need to be able to address and answer them. At the same time, we also need to make a case for the kinds of inquiry learning experiences we have been talking about here today

Finally, we need places like the Workshop Center to keep reminding us all of the importance of coming back to this personal experience in inquiry and of approaching the world from that stance, from a stance of "I don't know, but I can find out," from the stance of "Let's push the limits of our knowledge, but keep checking our thinking against the phenomenon." Defending that perspective in the world of the sound bite, the quick conclusion, and the oversimplification, where as someone once said, "for every complex problem, there is a simple and wrong solution," you sometimes almost feel like you are a monk in the Dark Ages.

But that is the journey we have taken here, from the small classroom configuration to the large system, and then back again to the small. I hope all of us are paying attention to our own thinking, and that we are, in fact, carrying out an inquiry as we continue to engage in all of this work.

Discussion

I can identify completely with what you said about the schizophrenia of education, and being told to do one thing, knowing you are supposed to be doing another. I'm a graduate student here and, after nine years of teaching, I must say that I see myself as a poor teacher. I am not doing inquiry, and I don't know what I am doing. I feel like I'm in a whirlwind.

M. St. J: It's as if you are in a boat that has cross-seas running high-one sea from the southeast and one from the southwest. What you're feeling are the cross-currents and you don't know which way to steer. The pressure of the political process is a big part of it, as I alluded to earlier-politicians needing to address the public concerns of education and needing to do it in a way that doesn't cost money. Therefore they find ways to look as if-and this may be an unfair assessment-they are doing something, when in fact very little that's constructive is being achieved.... The only thing they can do, they conclude, is put tests in place, and try to 'test-in' excellence, which I don't think you can do. They are acts of frustration on their part, I think, but the consequences are that the messages you get as a teacher are really contradictory.

As a teacher, you wear a hat that commits you to wanting to do the best for your children. You also wear a hat as a member of this school, a member of this district, a member of this union, getting very different messages depending on the hat you have on at any one moment. The state says this, the principal says that, the union says this....

My only suggestion is that you take responsibility for resolving the confusion back on yourself and say, I have to work this out, the classroom is my house, it is my place. I have to figure out where I can do both: I would be dumb to ignore the fact that the district and the political pressures exist. I also don't want to ignore the fact that I have these other goals for my children. I have to try to work it out in a way that is as integrated as it can be.

It may help you to know that you're not in a nourishing and coherent system; you're in a contradictory and conflicted system, and that's the source of your craziness. If you think it is you, not the system, then it's very confusing. But if you know that it's the system, then I think it opens a space for some kind of whole action from yourself. I have met individual teachers who sort of say about their situations, "Okay, I understand the system is there and wants such and

such. I understand this and I want that, and so I'm going to negotiate that for myself. I am going to find a way to do this..."

In order for a school child to get beyond right-answerism and take risks, a sense of trust has to exist.

How, within the existing system, do we enable trusting environments to flourish?

M. St. J: One of the ways to do it is to create in your own classroom or school what we call a 'third space,' where you begin to create a different value system. Then the risk-taking associated with asking perceptive questions can be seen to be a good thing. In such a space, it isn't so risky anymore to ask perceptive questions. Risk-taking is when you are going against the values and norms. In that situation, asking perceptive questions isn't risk-taking, it's suicide. But if you create a third space, with an alternative set of rewards and incentives, where you are marching to a slightly different drummer than the other guy, and where you tell your children what gets rewarded in this classroom are perceptive, authentic questions, then you get perceptive, authentic questions.

I was in a classroom in Massachusetts, where the principal had brought me in and said, "These kids have been studying potatoes and they know a lot about it. Ask them any question you want." So I said, "What have you learned about potatoes?" They showed me the 'eye' of the potato, they showed me this; they showed me that. I said, "What questions do you have about potatoes? You studied potatoes and you don't seem to have any new, good questions."

One child raised his hand and said, "Actually, I do, but I was afraid to ask." He said: "How come when I eat the eye, it doesn't grow inside my stomach?" That was a good, authentic question. And with that, the other children started to come forward with their real questions. That changed the environment.

Another time, doing an evaluation in a primary school in Rochester, NY. I was introduced to a group of four third-graders. It was the ideal science class. I sat them down and said, "Let me give you a hypothetical situation and you tell me what happens. Let's say, at the back of the room, there is a table with a dead bird and a microscope on it, and another table with a bunch of books about birds, and the teacher says, *It is time for science. Go to the back of the room and do science.* What would you do?" One third-grader said, "I would go to the table with the bird." I said, "How come? Do you have a worksheet?" They all said, "No, no. In science, there are no

worksheets. You make up the worksheet." I said, "What do you mean? He said, "Look, it is sort of like art. You start with the stuff"-in this case, with the bird.

"What do you do with the bird?"

"You look at it."

"Then what happens?"

"Well, if you look at it closely enough, and think about it, you get questions."

"You get questions?"

"Yes, you notice something that you want to find out about."

"Well then what do you do?" "You try to find it out."

Another child said, "You go use the books. Not first, but you use the books and you read about it."

Another child said, "Yes, that is a good thing to do, but there is a difference between the bird and the books." "And what is that?" I said.

"The books might lie to you, but the bird never lies."

Setting up the thing, having a say in what's important to you in your classroom, is basic, and that takes an act of courage. But there is no need to draw a false dichotomy between knowing the name of a bird and knowing a good question to ask about the bird. Doing inquiry doesn't exclude knowing things. It is not against knowing the right answer. It is about discovering and looking for and becoming interested in the boundary between the known and the unknown.

Hubert Dyasi: I'm reminded of a previous Malony Lecture by Philip Morrison. Professor Morrison said: "Say you are in Africa, and you belong to this clan of fishermen who navigate by the stars. You are out at sea in these little dugouts, or slightly better boats, and the wind starts picking up. And then it starts raining, water cascading down all over the place. What do you do, you still have to steer that boat in the right direction? Do you think you have time to go to

your bed and get a map to see which star you should be looking at? In fact, the moment you take out the map, water splashes all over it, and makes it unreadable. That's when you ought to know which star is which. That's the role of memorization."

Do you see a distinction between inquiry and problem solving?

M. St. J: I see problem solving as a subset, or an aspect of inquiry: how do I do this, how do I do that? In inquiry, you're pushing to forward your own knowledge. The problem-solving can sometimes be somebody else's problem, and in doing somebody else's problem it might well allow you to push your own knowledge-if it is a well-designed, thoughtful problem about where you're at. But if it is too hard, or too easy for the child, it is no good.

Would you comment on the assessment of inquiry? I teach a course in inquiry and we do a lot of things. At the end of an inquiry experience, I might ask a student to do an oral report, so people who are articulate do well at that. A written report, people who write well do well at that. People who draw well can do a nice visual. But what I'm not picking up is something like hypothesizing. In the course of inquiry, children are hypothesizing all over the place and I think I'm missing that. How do you assess whether the inquiry experience is good, bad, or indifferent? Is there a model?

M. St. J: So much is implicit in the audience for whom the assessment is intended. The closest thing I know to a model for assessing how authentic an inquiry is, how rich it is, how multi-step it is, etc., is careful observation and listening along the way. If it is a good experience, you see these kinds of peaks and valleys of the inquiry, of the struggle, of the excitement. just being a connoisseur of what that experience is like and watching it carefully and listening for it, and having people talk about it, doing whatever you can to open that box, is helpful. If someone is really stuck and doesn't get out of it, that's a problem. Or if they come to the answer too easily, without the struggle, without thinking it through: if they re not putting their thinking on the table, if they are not making that visible, if they are not looking at the phenomenon carefully, that's a problem. I don't like entrusting assessment to a formal mechanism.

Working with teachers over a period of time, my colleagues and I discovered that one of the things about Inquiry in classrooms that helped teachers a lot was the idea that inquiry didn't require you to set aside a big chunk of time as a lesson, but was an ongoing experience, like having flashlights and candles in the

back of the room for children to explore with when they got fidgety. Your presence there, witnessing and valuing when a question arises, is enough to allow the thing to be ongoing and slowly become richer.

M. St. J: I think there is deep confusion about inquiry as an event, or as distinct activity, or a distinct pedagogy, versus a classroom that has a culture of inquiry, that's always open to questioning, and to valuing of the question asked, to valuing of the known/not known dimension of learning. If you think of inquiry only as this kind of big, long whatever, it is more problematic and harder to create.

I can walk into a classroom and in 10 minutes tell what that classroom is like: open to questioning or closed; it's like tasting a wine. All you need is one taste, you don't need to drink the whole bottle. When you taste a classroom, you have a sense of the culture there: what the sources of knowledge are, who has the authority, what is the game being played, and what's the point of the game? A cultural issue is different than a pedagogical issue. It goes beyond technique.

Look, for example, at the notion of wait-time, which Mary Budd Rowe's research described. If you go into a classroom, and see the teacher waiting after she asks a question, because everybody is thinking, you say to yourself as a researcher that that classroom is very thoughtful. The waiting in itself does nothing, but it is a manifestation of a real event: people are thinking. In fact, it is only waiting because you have a solid expectation that people think. But as a simple and mechanical technique-waiting a certain amount of time after each question-almost completely misses the point. It may be a technique, but it is not a culture.

Under the new standards will I be helped to learn how to ask open-ended questions and to teach children how to think?

M. St. J: I will give you an answer, but it's not the right answer. What you want to learn about-how to assess children, how to ask good open-ended questions, how to help children think-is the life-long mission of a good educator; it is not something you learn in a course. It's like becoming an artist. Asking that question is like an artist asking, "How do I paint in a way that captures people's imagination?" That is the central core of the educator's mission.

But it is very good that you are asking that question as opposed to saying, "How am I going to get my students' test scores up?"

Hubert Dyasi: In a video I was reviewing, students were studying nutrition. They were carrying out food tests for sugar and protein, among other things, and among them was this young girl who was very intent. When the class teacher came around and asked her to explain what they were doing, the girl said, "There is something about this that puzzles me." "Oh, what is it?" "When we tested milk for sugar, it was positive." "What is puzzling to you about that?" "Doesn't milk come from cows?" "Yes, of course. You know that!" "But cows eat grass; they never eat sugar. So how come the test shows that there is sugar in the milk?" Right there was a magnificent moment for going into inquiry, into nutrition, and away from a set-piece. Something must have happened somewhere for that sugar to be in the milk without someone adding it. The matter needed exploration. If the teacher failed to deal with that moment, she would lose a golden opportunity for advancing students' knowledge through inquiry.

M. St. J: She would have whipped the fly away at the wrong moment.

[end of lecture/discussion]