CONCEPTUALIZING A "HALL OF MIRRORS" IN A SCIENCE-TEACHING PRACTICUM

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In recent years, we have witnessed a resurgence of ideas about "experiential learning" in the professions. Teacher educators have joined the movement, turning their attention toward the notion that we learn to teach in the context of action. Similarly, the task of providing models of practice in schools of education has taken on a new life. Some of us put less credence in the attempt to reduce teaching to its "technical components," and we have moved away from the idea that beginning teachers can construct their practice from propositional knowledge such as the "principles of effective teaching." We are more concerned with how people see practice in its whole character, what they attend to in actual situations, and how their repertoire of concepts for making sense of these situations is enriched.

This article presents a conceptualization of a science-teaching practicum and explores its use in pointing out features of supervision dialogue between a student teacher of grade 9 science and his supervising teacher. Of particular interest is one aspect of what Schön has called "a reflective practicum," a ball of mirrors model of supervision (Schön uses the term coaching). In this article, the model focuses on "parallelisms" that are created at times between the practice of supervision and that of science teaching, although a similar case could certainly be made in the context of other subject areas. The argument is threefold. (1) that a model is made meaningful through demonstration and description, (2) that it is understood through imitation and construction in the student teacher’s performances, and (3) that the model is more powerful when the practice of supervision mirrors the practice of teaching.

This work is part of a larger project, "An Analysis of a Constructivist Approach in a Teacher-Education Context," which has identified and documented a series of teaching strategies and materials based on a cognitive perspective known as constructivism. Briefly, this perspective holds that

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1The research is taking place at the University of British Columbia under the leadership of Gaalen L. Erickson, department of mathematics and science education. The University of British
learners continually construct the meaning of new information and events as a result of the interaction of their prior knowledge and experiences with their current observations. A second premise holds that learners are "purposive" beings. Thus, a constructivist account of learning is concerned with the "intents, beliefs, and emotions of individuals, as well as their conceptualizations, and recognizes the influence that prior experience has on the way phenomena are perceived and interpreted." The project's general concern is to assess the viability of a constructivist research program in the context of teacher education. The specific concern of the work focusing on the practicum is to explore the character of what Schön called a "reflective practicum," in which student teachers are systematically inducted into an "appreciative system," in this case, constructivism.

CONCEPTUALIZING SCIENCE TEACHING

Traditionally, the teacher's role is to impart knowledge to students. In science teaching, where the subject matter consists of ways of representing and explaining natural phenomena, a long-standing ritual engaging students in the laboratory remains—a custom that endeavors to provide first-hand experience with these phenomena. Thus, students gain access to something on which they are to hang that domain of our intellectual heritage, science. In turn, teachers use the laboratory to provide scientific experience, which they can use to impart scientific knowledge to students (see Figure 1).

Although this simplified model of teaching may sometimes exist in the ways we talk about science education, at least from a curricular point of view, it cannot exist in practice for several reasons. The first set of reasons has to do with what constitutes a scientific experience and the role of a specialized language in mediating the experience.

Science, like other disciplines, has well-defined ways of ordering perceptions of natural phenomena. For a long time now, philosophers have argued


that phenomena do not speak for themselves, information about the world is not simply handed to the knower. Rather, phenomena are apprehended, or taken from the world:

Perception is not a matter of simply seeing what is out there much as a camera loaded with sensitive film will take a picture of anything in its field of focus. For the most part it is a matter of being directed to take notice of certain things and not others.  

Thus, we have the notion that perception itself is "theory-laden." To make a scientific perception, or to have a scientific experience, we depend on public formulae that tell us two things: what to look for and what significance to attach to it. These public formulae consist of the concepts, principles, models, purposes, and criteria for judging claims—all are inherent in scientific languages and theories.

The role of scientific languages and theories in ordering experience can be represented by a two-way arrow between the teacher and the domain of natural phenomena, as depicted in Figure 2. We can say similar things about the role of language in ordering students' perception and experience. Although we make provisions for students to gain access to the realm of natural phenomena under consideration in science, they, by definition, are not equipped to perceive these phenomena in a manner consistent with the scientific community. Rather, students have acquired a much more extensive realm of experience with the natural world through the use of ordinary language.

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7N. R. Hanson, Patterns of Discovery (Cambridge, England: Cambridge University Press, 1958).
Like scientific language, ordinary language consists of concepts and rules that function as public formulae for focusing attention on a limited number of characteristics of the entity under consideration. Depending on the nature of those characteristics, "the concept puts the thing under consideration into a number of categories that limit what can be reasonably attributed to that entity." Because the student of science is a learner of a specialized language, the primary mode of perception and experience, at least initially, is that of ordinary language. Thus, the student's main access to the realm of natural phenomena in the science class is that of ordinary experience as represented in Figure 2 by the two-way arrow between the student and the domain of natural phenomena.

What becomes problematic for students and teachers alike is that ordinary perception and experience differ from scientific perception and experience, even though both languages often use the same words. In ordinary language, for example, it is quite appropriate to say, "I can feel the cold entering the kitchen from the refrigerator." Or, to use one of Brauner's favorite examples, "I see the sun going down over the horizon." It is a very different accomplishment to "perceive" heat energy being moved about the room by the refrigerator, or the earth rotating backwards on its axis, thus hiding the sun from view, as a scientist would perceive these phenomena.

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By attending to the different ways of experiencing natural phenomena that derive from these different language communities, we have some elucidation of the sorts of problems facing science educators, as documented, for example, in an extensive literature pertaining to "children's science" or to "critical barriers" to science learning. As Osborne and Wittrock argue:

Considerable emphasis in research, curriculum design, and teaching at all levels needs to be placed on the nature and detail of children's views of the world and meanings for words used in science. Teaching needs to take more fully into account pupil perceptions and viewpoints and, where appropriate, to attempt to modify and build on, but certainly not ignore, children's ideas.

At least two pedagogical principles follow from this perspective on science teaching. If we subscribe to the notion that experience is mediated by language and, further, that learning to see phenomena as a scientist does entails learning the specialized language of science, then we should be concerned with the concepts used in that language and, particularly, the ideas that students have about these concepts. Thus, teachers must first develop strategies that will permit them to become aware of their students' intuitive, or commonsense ideas, because these ideas are derived through the use of ordinary language and are manifest in how students perceive and interpret phenomena. Second, we must take these intuitive ideas into account in the instructional program to provide a foundation for constructing new concepts and the meanings derived from them. As teachers, then, we would listen closely to what our students have to say about phenomena under consideration in our science courses. We would strive to understand what our students understand—to see phenomena as they do. The matter of teaching, if we take this perspective seriously, appears much more in the form of bidirectional communication, as depicted in Figure 3 by the two-way arrow between teacher and student. The term children's science refers to the knowledge and ways of dealing with experience that students bring to the classroom.

The constructivist model of science teaching, represented in Figure 3, is not unlike the trialogue style of teaching, proposed by Roberts and Silva in response to the inquiry-teaching movement of the 1960s (the language used here is somewhat different, influenced by a Wittgensteinian tradition of phi-

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Similarly, the triangular arrangement of the model is in accordance with what Hawkins wrote about in his essay, "I, Thou, and It." These ideas about science teaching are not necessarily new, although there is a danger in equating them with "discovery learning" as it was usually practiced and reported in the '60s and '70s. The danger of revitalizing a term like *discovery learning* is that it seems to imply a view of knowledge that is clearly untenable. Information about the world is not simply handed to the knower, it is not waiting there in the world to be discovered.

What we do have in the science-education community of the 1980s is an extensive empirical literature documenting how children typically conceive of a range of natural phenomena. An increasing theoretical literature also pertains to constructivism, in which there is some convergence of ideas, together with many promising avenues for further exploration and analysis.

**CONCEPTUALIZING THE PRACTICUM**

The dynamics of the practicum can be represented in a similar, though not identical, fashion to the model of science teaching. To begin, a similar

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triangular arrangement among the supervising teacher, the student teacher, and in this case, the realm of practicum phenomena under consideration exists (see Figure 4).

The domain of practicum phenomena consists of classroom teaching—both of the supervisor and the student teacher—and, to a lesser extent, the general interactions among the student teacher, school staff members, and students outside of the classroom context. These phenomena are subject to the supervisor's and the student teacher's examination and serve as the focus of their discussions. Further, the supervisor and the student teacher experience these phenomena differently, at least initially, because the student teacher is in the position of learning the practice of the supervisor—learning to perceive teaching events as the supervisor perceives them.

The supervising teacher has an extensive repertoire of ways to apprehend and represent the phenomena under consideration. To use Schon's language, this repertoire consists of various "frames" and "appreciative systems" that allow the supervisor to attend to certain features of practice situations and not others. Some of these frames, at least those the supervisor can articulate, come from pedagogical discourse and give rise to "thematic experience," which, like scientific experience, consists of specialized ways of perceiving events.

Because of the student teacher's position, he does not initially have command over the supervisor's ways of representing the phenomena under consideration, these things must be learned. In the beginning stages of the practicum, therefore, and perhaps throughout the practicum in some cases, the student teacher experiences the phenomena under consideration in an ordinary manner, relying on ordinary perception, derived through his use of ordinary language. As the practicum proceeds, he gradually learns to "see" teaching as the supervisor does, thus becoming more familiar with the frames and appreciative systems the supervisor uses to represent and interpret practicum phenomena.

The lower half of the model represented in Figure 4 depicts the different ways the supervising teacher and the student teacher experience the domain of practicum phenomena to which they both have access. The upper half of the model, depicted by the two-way arrow between the supervising teacher and the student teacher, represents their communication about the events they have experienced. Schon's work further conceptualizes this special communication.

For Schon, much of the matter of learning a profession has to do with learning the competence of framing problems of practice. The role of a frame

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in setting a practical problem is much like that of a concept in directing perception. It tells us what to look for and what significance to ascribe to it. Further, Schön suggests that competence in framing problems is the sort of thing one either gets as a whole or not at all. The early stages of a practicum are bound to be mysterious for students, he says, since this competence cannot be communicated in a form that they would at that point understand. In the context of architectural education, where the focus is on learning to design, Schön describes the failure of effective communication between student and studio master:

In the early phases of architectural education, many students who have taken the plunge begin to try to design even though they do not yet know what designing means and cannot recognize it when they see it. At first, their coaches cannot make things easier for them. They cannot tell them what designing is, because they have a limited ability to say what they know, because some essential features of design escape clearly statable rules, and because much of what they can say is graspable by a student only as he begins to design. Even if coaches produce good, clear, and compelling descriptions of designing, students, with their very different systems of understanding, would be likely to find them confusing and mysterious.
At this stage, communication between student and coach seems very nearly impossible.16

Schön has derived from his analysis of a practicum in the design studio three models of coaching that he claims might move beyond the bind of communication failure in the early stages of practicum: follow me, joint experimentation, and ball of mirrors. Each model represents a possibility for conceptualizing a so-called reflective practicum, one in which a student learns how to see practice situations as a competent practitioner does. Of interest here are the follow-me and hall-of-mirrors models—follow me, because it addresses the general character of communication between supervisor and student, hall of mirrors, because it shows how in some professions, the character of supervision itself mirrors the practice that the student is attempting to acquire.

The follow-me model focuses on the component processes of telling and listening and demonstrating and imitating. The supervisor must at first try to discern what the student understands, what she already knows how to do, and where the difficulties are. These things must be discovered in the student’s initial performances. In response, the supervisor can show or tell, or demonstrate, a particular technique that he thinks the student needs to learn, or, with questions, advice, criticism, and instructions, describe a feature of designing. The supervisor models actions to be imitated and experiments with communication, testing with each intervention both the diagnosis of the student’s understandings and problems and the effectiveness of his own strategies of communication. The student tries to make sense of the supervisor’s demonstrations and descriptions, testing the meanings that have been constructed by applying them to further attempts to display skillful practice. In this way, the student reveals the sense that she has made of the model.

Returning to the conceptualization of the practicum represented in Figure 4, the two-way arrow between supervising teacher and student teacher is conceived in terms of the follow me model. The supervisor’s communication to the student teacher consists of demonstrating and describing teaching, both of which constitute modeling pedagogical knowledge. Since the student is learning about teaching in the context of doing, his communication to the supervisor is mainly conceived in terms of imitation, though not excluding the student teacher’s discourse about teaching.

On this point a couple of qualifications need to be made. First, the word imitation refers here to a highly creative and constructive process, not blind mimicry. None of us is apt to condone the sort of mindless regurgitation of performance that the shallow sense of imitation would suggest. Second, we should be well aware of the possibility that the follow-me model could be taken in the sense of “my way or the highway” or “follow me in bad practice.”

16Ibid., p. 100.
If we take Schön’s analysis of practicum seriously, we can see the logic of the follow-me model; however, we can also see the necessity for joint experimentation, in which the student teacher takes on more autonomy, or for the hall of mirrors.

The hall-of-mirrors model points to how the supervisor’s practice in handling the student teacher exemplifies the practice that the student teacher is attempting to acquire:

In the hall of mirrors, student and coach continually shift perspective. They see their interaction at one moment as a reenactment of some aspect of the student’s practice; at another as a dialogue about it, and at still another, as a modeling of its redesign. In this process, they must continually take a two-tiered view of their interaction, seeing it in its own terms and as a possible mirror of the interaction the student has brought to the practicum for study. In this process, there is a premium on the coach’s ability to surface his own confusions. To the extent that he can do so authentically, he models for his student a new way of seeing error and “failure” as opportunities for learning.

But a hall of mirrors can be created only on the basis of parallelisms between practice and practicum—when coaching resembles the interpersonal practice to be learned, when students re-create in interaction with coach or peers the patterns of their practice world, or when … the kind of inquiry established in the practicum resembles the inquiry that students seek to exemplify in their practice.17

When a hall of mirrors is created in student teaching, a consistency about the supervisor’s model makes it all the more powerful. First, whether he is aware of it or not, the student teacher can experience the supervisor’s model in action, now at another level of teaching. The student teacher may consider what it is like to be the recipient of the model, that is, he may think about the effect of the supervisor’s teaching approaches from the perspective of a student. If student teachers experience the effect of the model in this manner, they may be in a better position to reflect on children’s learning of science. Here I am thinking about a “capacity,” or “disposition,” that might be nurtured in a practicum for student teachers to attempt to see the world from their students’ points of view.18 Further, I am thinking about how a student teacher may contemplate the nature of teaching by reflecting on his own learning in the practicum. Both ideas rely on the underlying notion that modeling may serve an important role in educating prospective teachers. Numerous other possibilities bear investigating in the idea of a hall of mirrors.

A diagrammatic representation of the hall-of-mirrors model as it might be created in a science-teaching practicum is shown in Figure 5. To better display the mirror effect of the practicum on the practice of science teaching, the upper part of the diagram—the conceptualization of practicum—is inverted.

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17Ibid., p. 297.
Figure 5. The Hall of Mirrors

- Practicum Phenomena
  - Thematic Experience
  - Pedagogical Discourse
  - Ordinary Experience

- Scientific Language
  - Scientific Experience

- Scientific Knowledge
  - "Children's Science"

- Ordinary Language
  - Ordinary Experience

- Imitation and Construction of Pedagogical Knowledge
- Demonstration and Description of Pedagogical Knowledge

- Teacher
- Student

- Supervising Teacher
- Student Teacher

- Practicum
- Practice
The two parts of the diagram are conceived to enable their superimposition in Figure 5.

Like all conceptualizations, especially those that attempt to characterize a large, complex set of phenomena, the necessary but dangerous tendency is to oversimplify things. The hall-of-mirrors model is no exception. For example, each of the six sets of two-way arrows depicted in Figure 5 has occupied all sorts of scholars for many years, yet this conceptualization cannot answer all the questions we can ask about science teaching or science-teaching practicums. Rather, we should regard it as a means of raising questions for further study and investigation.

Beyond the danger of oversimplification, there are things that this conceptualization does not do. For example, it tells us little, if anything, about the actual process of teaching, either in the science classroom or the practicum setting. It does explore the various ways that different individuals might experience the same phenomena and the role that languages play in their experiences. Certainly, there is more to experiencing than any investigation of language can uncover. The whole field of phenomenology, for example, has to do with the notion of "lived experience," which language can never capture in its entirety.

The one strength of this conceptualization has to do with a premise lying at its heart. Words alone cannot characterize and communicate all of teaching. Following the writings of philosophers like Ryle and Polanyi and theoreticians like Schön, I believe that professional knowledge resides in our actions, that practitioners know some things tacitly, and that the meaning of certain features of practice is learned largely through imitation, in the context of the student's own practice. Therefore, we must carefully investigate the notion of modeling in teacher education.

AN ILLUSTRATIVE ANALYSIS

A preliminary analysis of a supervision dialogue that occurred between a student teacher, Kevin, and his supervising teacher, Gary (both names are pseudonyms) follows. The analysis focuses on their dialogue about a videotape of a lesson that Gary taught during the previous year. (The videotape was made for the purposes of pre- and inservice teacher education, part of this research project's activities.) The class is a grade 9 group of 26 students studying a unit on heat and temperature, this lesson covers thermal expansion of solids.

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Below are excerpts of part of the lesson dealing with “the ball and ring” demonstration, interspersed with excerpts of Gary and Kevin’s discussion as they viewed the videotape. At the time of their discussion, Kevin is in his 8th week of a 13-week practicum, and he has just finished teaching the same unit on heat and temperature.

The first excerpt of the lesson orients the reader to the ball-and-ring demonstration. G identifies Gary as the speaker. Students (who don’t actually appear until the second excerpt of the lesson) are identified by number, according to the order of speaking—S1, S2, and so on—and their identity is consistent throughout the transcripts. Immediately before the ball-and-ring demonstration, students observed the lengthening of a piece of nichrome wire as it was heated by an electric current, and they spent some time explaining the phenomenon. Then, Gary introduced the ball-and-ring demonstration:

G. I’m going to try something a little bit different here. Some of you probably have seen this before. . . . I’d be surprised if you hadn’t. [Holds up the ball and ring] I have two objects that are made of brass. One is a ring, . . . and this is a little sphere. Now, they’re machined in such a way, or constructed in such a way, that the inside diameter of the ring is exactly the same as the outside diameter of the ball. So as I put the two of them together, they just barely fit. There’s no room in there to rattle around at all. It just is a perfect fit. Okay? Now I’m going to ask you in a moment to sketch this . . . and to make some observations as I heat one or the other of them up. I want you, as you’re drawing this, again, to make some predictions. Think about some possible tests that we could do with these two objects . . . and think of some predictions . . . some things that you think might happen. [Students work in their notebooks while Gary draws a diagram of the ball and ring on the board.]

As the next excerpt of supervision dialogue illustrates, Kevin is familiar with Gary’s general orientation to science teaching at this point. (Kevin is cueing Gary to make certain points for the intended videotape viewer, which, in its final version, will include Kevin and Gary’s dialogue.) The discussion focuses on a technique for eliciting students’ ideas about heat and thermal expansion of solids by having them predict what will happen when the various tests are performed on the ball and ring. After they have given their predictions, and Gary has conducted the tests they suggest, students will be invited to explain the results. The technique illustrated thus uses prediction, observation, and explanation (POE) for exploring students’ ideas. (K identifies Kevin’s utterances in the excerpts.)

K. So you’ve just done what you said you were going to do. You’ve explained what you’re going to do, and they’re going to make some predictions. Now my question here is why is that a vital part to your lesson, for them to make predictions?

G. From the point of view of getting them involved, but also to pull on their own notions of how the world works. To use their own theories, their little mini-theories, their preconceptions of what they bring into a science course with them.

K: Uhm hmm.

G. And through these kinds of investigations, if they can come face to face with what they believe to begin with . . .
K: Uhmm hmm.

G. And then if we can give them some experiences with their own guidance, and lots of involvement, as you mentioned earlier . . .

K: Right.

G. . . . as being an important characteristic, then their knowledge can become personalized. Sometimes, if they're faced with discrepant events that don't always match what they came in believing, and if they have some kind of crisis, then they are forced to rethink; they are forced to come to a new explanation. They are forced to come up with a new theory or hypothesis.

K. Right. And you provide them with that. And if they weigh the evidence, they'll feel that this new explanation better explains the phenomenon.

G: Yeah.

K. Yeah. I was just going to ask a question, but I guess we could continue viewing. . . . Are they going to have some sort of room to debate among themselves their various predictions and . . .

G: [Nods] Let's look for that.

K: Okay [turns on video again].

So far, we see nothing out of the ordinary in the way of supervision conduct, although the supervisor and student teacher analyzing the supervisor's practice is somewhat unusual. The dialogue so far portrays a typical description of an approach to teaching. Gary and Kevin's discourse is straightforward so far. Let us return to the lesson:

G: Okay, what kind of tests can you think of that we might have? [S1]?

S1. You could heat them up, and then the ball will expand because of the heat, and then you won't be able to pull it out.

G: Okay, and so you're saying you'll heat them both up?

S1: Yeah, one inside the other. Put the ball inside it . . .

G: Yes [puts the ball inside the ring]. Like that?

S1: . . . and then heat it up.

G: Yeah.

S1: And then you won't be able to pull the ball out.

G: I see . . . okay. Why do you think that might be?

S1: I think that the metal inside the ball is going to expand.

G: Okay, good.

S1: [Softly] . . . and so will the metal in the ring.

G: Okay . . . [S2], what would you test?

S2. But that wouldn't work because if you did that, then the ring would expand too, and they probably both would expand at the same rate, so then you'd still be able to move it.

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G. I see, okay. So you suggest the same test, but you predict a different result.

S2: Yeah.

G: Interesting. Okay. [S3]?

S3: Uhm . . . [inaudible] . . .

G: Sorry . . . a nice, loud voice so that everyone can hear you.

S3. If you heat up the ring, then the ring will expand, and then you put the ball inside the ring, there'll be much more room?

G. Okay, so you're suggesting a second test where I heat up the ring, but not the ball?

S3: Yeah.

G. You think, then, that it'll fit much better [puts the ball through the ring]?

S3: Yeah.

G: Okay. [S4]?

S4. I think if you heated up the ball, if you put the ring inside, or around the ball, then heat it up, you wouldn't be able to get it off. Or, either way.

G: Okay. [S5]?

S5. Uh, to the thing that [S1] said, with the ball inside the ring, well, I think that would work because the ball has more or less mass than the ring has. So I think it would heat up differently because one has more mass than the other . . . [inaudible].

G. Okay, do I hear you saying, then, that the rate at which they expand or contract depends on how much of the stuff there is?

S5: Yeah.

G: Okay. [S6]?

S6. I just think you should heat up the ball and then see if it'll fit through the ring or not . . .

G. Okay. What do you think would happen, [S6], if I heated up the ball without the ring?

S6: Well, the ball would expand, and then it wouldn't fit through.

G: Okay. Can anybody think of any other tests? Yeah?

S7: I think both [S2] and [S3] are wrong . . . even though . . .

[Students all laugh.]

S7. If you put the ball inside the ring, they both expand. But the ring doesn't just expand out, it also expands inward.

G: Yeah?

S7: So it would be tight, you wouldn't be able to get it out.

G. Okay, let's try all of these things. Let's try all of these things. I'll just heat the ball up first, but we'll try each one of them [begins beating the ball]. What I hear a couple of you saying is that the ball will no longer fit. Any other variations on that? Do I hear a no?

S8: Sure . . . no.

G: [S8], what do you think [continues to beat the ball]?

S8. Well, I think that if you heat up either, both of them will expand anyways.

S9. The ball's not in [the flame].
So if you heat up the ring, the ball won't fit through. If you heat up the ball, it won't fit through. And if you heat up both, it won't fit through either.

Okay, so whatever I do, I can never get it through there. All right. Yes?

Well, if you just heat up the ring, the ring will expand. It'll also expand inward and outward.

I'm keeping this one [the ring] cold.

Oh.

I'm just heating up the ball now. Yeah?

I was just stretching.

All right. Well, let's try it then. Okay? Watch carefully.

Besides the POE technique for eliciting students' ideas about heat, the videotape of this lesson illustrates a discussion style that Gary calls "interpretive." Like the POE, the interpretive discussion is designed to elicit students' ideas about the subject matter of the lesson, its main aim is to encourage the negotiation of ideas among students.

In this excerpt, the students are clearly listening closely to one another as they collaborate (even argue at times) in making their predictions. At least four patterns in Gary's teaching may contribute to the negotiation of meaning evident among the students. First, by suspending his own judgment of their predictions, Gary gives students the responsibility for assessing the reasonableness of each other's ideas. The pattern of accepting a student's suggestion with a neutral "Okay," or "I see" contributes to this effect. Second, Gary often invites students to elaborate on something that was said, encouraging them to explore their reasoning further. Third, he often moderates the discussion by comparing one student's idea with another student's, encouraging them to compare and contrast their contributions to the discussion. A fourth pattern is Gary's tendency to check his own understanding of students' ideas by paraphrasing what they have said.

In the next excerpt of supervision dialogue, we see Gary and Kevin exploring some elements of the interpretive-discussion style. The character of this dialogue differs markedly from the earlier one. Here, we can see a hall of mirrors created between Gary's style of supervision and the practice under discussion, we can see the same patterns in Gary's supervision that are being pointed out in his teaching:

Over the last few minutes of this lesson, you can see that we're in a discussion mode here. And I'm just curious to know if you have any observations of the kind of strategies that I'm using in the discussion.

Well, I've noticed a number of things. First of all, the students are making a number of predictions, and there seems to be no lack of involvement. Or, you don't seem to really be prying predictions out of these kids. There's a fair amount of openness that you've developed in the classroom.

That they'll respond . . .

Yeah.
G: ... and volunteer without being ... 
K. That's very impressive. I mean, the kids are ready and willing to give some predictions. And that takes a certain amount of risk.
G: That's right.
K. Because they could be way off base with some of these predictions.
G. Actually, that's really important. Can you think of any ways that you could develop that sense of trust?
K. Well, for one, with their predictions, all of your answers are very neutral. You don't in any way give any teacher signs as to they're on the right track; you seem to accept them all with the same "I see." And, perhaps, ask for further clarification or just elaboration. And as a student, I would find that very easy to respond to ... maybe wanting a bit more out of you, but you don't seem to be giving it to them right yet.
G: Okay.
K. And I noticed as well when you were responding to one of the students, you related it back to another student's remarks. Therefore, the first student feels that his remark had some value. And the second student, you link up her idea, even though she was actually contradicting the initial prediction, there was a link made, so they felt that both of them had weight. And they would be able to wait and see which one was right.
G: Okay, good. All right. So a sense of trust ... 
K: Definitely, yeah.
G: And ... 
K: And that trust allows them to take risks.
G. Okay, all right. And what I'm asking these kids to do is really to lay their souls bare in the sense of what do they really believe to be true.
K: Exactly.
G: Not being tested by any observations at this point.
K: Evaluation.
G: They're just saying what they think would happen.
K: Exactly.
G. And yeah, there's a lot of risk in that. And it does take a while. Is there anything else that you notice in the discussion?
K. Well, in their predictions. One student would make a prediction, and I notice you would either paraphrase or ask for clarification. And I guess there's a number of reasons for that?
G: Can you think of any?
K. Certainly the clarification is for you to be able to relate to the student if you're not exactly sure what he's saying ... 
G: Okay.
K. Also, it allows him to really redefine what he's saying, he can work it through in his mind as he speaks it out, and that's probably a very important part. In terms of paraphrasing, that allows the whole class to become part of that answer, because oftentimes, kids throughout the class don't necessarily hear a response.
G. Actually I did quite a bit in this particular segment, probably more than I would ordinarily do in a classroom situation, just for the benefit of the microphones that were in the classroom to pick it up.

K. Right.

G. And some students have very soft voices, just to ensure that it was actually picked up. But, you're right. And you've picked up a couple of things. One is to check the meaning of the student, to make sure that what I understand him or her to mean is in fact what they intended to say.

K. Yeah.

G. It sometimes gets confused when they are using their own language and they're not using scientific language. And they will often use words, as we learned today, beat and temperature, kind of interchangeably.

K. Exactly.

G. And they will say beat when they mean temperature. And unless you kind of check for clarification as to what they really did mean, we can sometimes be misled.

K. And so paraphrasing would help you do that.

G. And paraphrasing would help that. A useful exercise, too, sometimes—I think I might have done it here once or twice—is to get other students to paraphrase what one student has said.

K. Right. That not only says, "Hey, you'd better be awake and listening," but it says, "Do you understand what they were saying, can you derive some sort of meaning of your own?"

The parallelisms created between practice and practicum run throughout this interchange. Gary opens up the dialogue about the discussion in the lesson by inviting Kevin to make some observations. Thus, he elicits Kevin's ideas about a technique designed to elicit students' ideas. One of the things that Kevin comments about is the open atmosphere that pervades the classroom ("a sense of trust," says Gary); Gary encourages this idea and further requests that Kevin explore the possible reasons for it. Kevin goes on to talk about how students are encouraged to give their ideas because they know their teacher won't judge them unfairly—their ideas "have weight." Gary paraphrases Kevin's ideas about paraphrasing students' ideas. Also, Gary takes the opportunity to do some teaching: after Kevin has had his say about paraphrasing, Gary adds an important aspect about its use in checking the meaning of the words that students use to communicate ideas. The dialogue is intriguing. What is even more striking is that Gary was totally unaware at the time of the hall of mirrors he created.

CONCLUDING COMMENTS

In this article, I have conceptualized and illustrated a hall of mirrors between practicum and practice in a constructivist science-teaching context. When created, it leads to a powerful model of teaching—it can lead to consistency in the practice supervisors demonstrate for student teachers, and it may communicate some aspects of teaching that defy description.
An important matter that I have touched on only briefly here is how the supervisor's model may be understood, in part, through imitation by the student teacher. In the case of Kevin's practicum, Gary's model was understood in a variety of ways. At times, for example, various features of the model were apparent in Kevin's teaching, but only some of them were articulated in his conferences with Gary. This may be an important area for further investigation and analysis, but it must remain the topic for another paper. The hall of mirrors presented here and illustrated in a science-teaching practicum may lead to a promising way of conceptualizing practicum, as well as the notion of modeling in an experiential teacher education.

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