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**One class, many worlds**

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**Abstract**

Through interactions with their social and physical worlds, humans learn to see others, themselves, and their physical surroundings in new ways. When interactions do not occur, learning is inhibited. Such a view of learning was used as a lens to look at a physics class, 24 students and their experienced teacher, in an Australian suburban high school. Our observations and interviews with teacher and students provided evidence that participants experienced themselves in different lifeworlds: not only did they describe the social world in different ways but also the physical world. Furthermore, we observed that participants interacted little, which prevented them from recognizing that they experienced different lifeworlds. All participants appeared to treat the physics course as an obligatory passage point and colluded to produce learning at a low cognitive level.

> Men don’t know each other because they don’t communicate with each other.
> Martin Luther King

After having been contacted by one of us, Mr. Sparks had invited us for a 6-week period to observe teaching and learning in his Year 12 physics course at Woody Park High School and agreed to meet with us regularly to talk about the events in his classroom. Today, he has joined us in the school’s conference room watching a videotape of one of the physics lessons. In the 7-minute clip we just finished viewing, Mr. Sparks had used a demonstration “to attract [students’] interest in the completely unforeseen series of events in these demonstrations.” We present him with the results of our posttest and interviews which showed that 21 of the 24 students in his physics class could not describe and explain the demonstration we have just reviewed and that, during a repeated

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1 We use pseudonyms through this article to preserve the identity of participants and community.
demonstration as part of our posttest, 18 students had not perceived the aspect of motion necessary to understand Mr. Sparks’ theory talk.²

Mr. Sparks explains, “Well, I think it’s my human nature that whenever I do a demonstration, the direction I’m taking is in my mind. It’s only when sometime down the track I get a wrong answer in a test or I get a wrong comment somewhere that I realize that what was clear to me, wasn’t clear to them. This always keeps happening, because my mind is going ahead of theirs. I’m working from a platform at this level [hand waves above head], whereas this is their first exposure to it and I see what I’m expecting to see and they’re not seeing what they’re expecting to see, or they don’t see what I think is evident. Part of the reason to me, personally, is the excitement of just going on to the next little demonstration, and the next one and the next one. Before you realize it, you’ve covered quite a wealth of material. The alternative is: You do a short demonstration and you stop and you wring all the information out of it. You can do that by question and answer and discussion. But this breaks up the continuity of the series of ideas. Maybe I do not like to keep breaking it up. To keep going is probably what motivates me.”

Here, Mr. Sparks provides a number of explanations for the discrepancies between intended and observed learning outcomes. He talks about having goals in mind but testing students’ understanding only “sometime down the track”; having his mind go ahead of the students’; working on a different platform; and about being excited and maintaining a continuity of ideas. He explicitly addresses a gap between his and students’ ways of perceiving demonstrations.

We invited students to this setting and used video to stimulate the conversations. Students provided descriptions that differed from those provided by their teacher. More so, their descriptions of classroom events and environment also showed great variation within their peer group. In the end, students did not understand the key ideas that Mr. Sparks thought to have taught; students also did not experience a continuity of ideas that would have helped them to understand. Among ourselves during the debriefing session, we asked, “Why did Mr. Sparks and his students not communicate with each other to know each other?”

Mr. Sparks’ talk is not atypical for teachers. Discourse approaches assume that what researchers get to hear from participants are not so much individually characteristic “beliefs” or “knowledge,” but ways of talking about the world and ways of constituting what counts as belief (cf. Lynch & Bogen, 1996). Thus, others in the school like Mr. Neale, an administrator at Woody Park, explained the lack of understanding we observed by describing students as pragmatic collectors of diplomas and marks, with little interest in the school subjects themselves. He suggested that “Students tend to want to be given what they’ve got to do so they can do it, and get on to the next one so that they can keep achieving. They want to achieve well because they are going to go on to great things and build bridges and whatever. They often don’t want to be led through the process of

² We provided elsewhere a detailed analysis of the demonstrations and answers to the question, “Why do students fail to learn from demonstrations?” (Roth, McRobbie, Lucas, & Boutonné, 1997b). Similar problems were shown to exist in a study of physics lectures for preservice elementary teachers (Roth & Tobin, 1996; Roth, Tobin, & Shaw, in press).
learning. I think that students might not want to sit there and think about things and examine things. They just want the answers, let’s get this done, let’s get on.”

We had observed the lessons with Mr. Sparks and his 24 students for a period of 6 weeks and conducted 5 or more interviews with each of 10 students and Mr. Sparks himself. In the course of our study, it became evident that the students in this class were little engaged in what happened in the class, and that they were understanding very little. Mr. Neale offered his own explanation why there might be worlds of difference between Mr. Sparks and his students. He also talked about a gap, a gap in part brought about by a teacher failing to provide students with rationales. He suggested that “if we could close that gap between teaching and learning, by knowing just what turns things on, what makes them spin around; that would be a major breakthrough in making meaning.” These gaps, the distances between the lifeworlds of our participants, are the focus of the present study. Our study should not be read as an indictment Mr. Sparks or his students; rather, it should be read as one description of a situation that needs remediation.

**Theoretical Framework**

Learning can be viewed as the process of becoming part of a discourse community (Traweek, 1988). Through interactions with others (newcomers and old-timers) in a community, members learn to see each others’ lifeworlds in new ways. When participation and interaction do not occur, learning is inhibited (Lave & Wenger, 1991). Classrooms can be viewed as such communities which develop discourses not only for talking about subject matter but also for talking about other aspects of the setting. Classrooms are therefore learning environments that are not simply constituted by content matter, students’ abilities, and teaching strategies, but are ecologies that involve social and cultural forces. The development of these ecologies is not entirely predictable (Lederman, 1992). These ecologies are seen by participants as their school- or subject-related lifeworlds. With the new discourses that students and teachers appropriate as they interact with each other and the teacher, new lifeworlds are opened to them and therefore new learning experiences (Roth & Alexander, 1997).

Anthropologists and sociologists recognize that to understand the lifeworld of people who belong to another culture, or a particular group within the same culture, people from different groups have to participate in each others’ lifeworlds. That is, to understand for example a workplace, researchers and workers have to learn to talk about the same objects and events in the same way; they have to participate in each other’s practices (Jordan, 1992). Through interacting with each other, researchers learn to see the world through the eyes of the workers and workers learn to see the world as do researchers. Such interactions are essential if, for example, new computer-based workplaces are to be understood not only by the designers, but also by the future users (Ehn, 1992). Designers and future users learn together and from each other through participating in common activities and developing a common discourse. In the same way, learning in schools and universities necessitates the participation of teachers and students in collective activities through which common discourses are established (Bourdieu, 1997; Bourdieu & Wacquant, 1992).
RESEARCH DESIGN

Ethnographic Background

This study was conducted at Woody Park High, a large (1,400 students) suburban school in an Australian metropolis. Our study focused on the events in one physics classroom over a six-week period—with follow-up interviews being conducted up to two months later. There were 24 students in the physics course (17 male, 7 female); another section of the course was held concurrently by another teacher. Most activities, demonstrations, and examinations were coordinated between the two classrooms. Conversations with teachers, students, and administrators revealed that in this school, physics is held in high regard. The local culture projects an image of physics as the most difficult school subject, one that achievers have to take. For example, Mr. Neale suggested that “It’s better to do poorly at Physics than to do well at multi-strand science,” a perception shared with many of the academically-oriented students even those who experienced difficulties in the subject. In addition, some universities require or highly recommend physics for all those students who plan to enter science, engineering or technical courses of studies.

Our conversations with the teachers and administrators in the school showed that Mr. Sparks is a well-regarded teacher who knows physics well. He holds a graduate degree, presents at teacher conferences, and spends considerable time developing teacher demonstrations and laboratory equipment. His fellow science teachers frequently seek advice from him for demonstrations or ask him directly if they could use what he had developed. There are also suggestions that he is held in high regard by some students and parents for his willingness to answer students’ questions on the phone from home.

Research Context

We had contacted Mr. Sparks about conducting a study on physics learning because one of us was familiar with him and with Woody Park High School. As a team, we were interested to find out about several dimensions of learning in a physics classroom known for its large number of demonstrations and computer-related activities: course grades, conceptual understanding, epistemology, views of the nature of science, views of the classroom learning environment, and learning through laboratory activities. Our research team brought together different subject matter expertise—from newcomer to many years of teaching physics or training of physics teachers—and different epistemological and ontological commitments. This led to interesting discussions of various ways of experiencing, describing and explaining the lessons in which we participated. For example, through the eyes of the physics newcomer in our team, one of us recognized in students’ talk her own experience during the lectures. This was an important aspect of our work,

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3 We reported on other aspects of this classroom elsewhere: participants’ views of science (Lucas, McRobbie, & Roth, 1996); views of the learning (McRobbie, Roth, & Lucas, 1997); learning from laboratory experiences (Roth, McRobbie, Lucas, & Boutonné, 1997a); learning from demonstrations (Roth, McRobbie, Lucas, & Boutonné, 1997b); conceptual understanding (Roth, McRobbie, & Lucas, 1996); social construction of discourse about the nature of science (Roth, McRobbie, & Lucas, in press); and social construction of physics grades, gender, and career paths (Roth & McGinn, 1998).
because those of us who had worked as physicist, physics teacher, or physics teacher educator shared with Mr. Sparks much tacit knowledge, a mundane sense for how the world should look from a physicist’s perspective, which did not necessarily coincide with students’ perspectives.

Whereas we had some clear research goals, the topic of the present study emerged as we became increasingly familiar with the participants. During our interviews and observations, it was evident that different individuals experienced and described different physical events and social relations. More crucially, individuals in this class frequently were not aware of other persons’ lifeworlds. There were discontinuities between the different ways participants used to describe events in this classroom. These discontinuities were so pronounced that it makes sense to speak of different worlds experienced by our participants.

### Research Ethics

We conducted the study with the presupposition that “there is no exit from the moral order” (Jayyusi, 1991, p. 246). Accordingly, the ‘moral’ is a pervasive and constitutive feature of social order. Throughout the study, we had a commitment to an ethic of caring (Brickhouse, 1992; Tobin, 1992). During our initial negotiations with Mr. Sparks, we described the extent of our data collection we wished to establish (see below) while causing as few disruptions as possible to the normal course of classroom activities. He invited us without hesitation and cordially welcomed us throughout the duration of the study. We renegotiated consent with Mr. Sparks and each individual student throughout the study. We discussed with Mr. Sparks what appeared to be problematic issues, such as the apparent lack of interactions among students and between students and teacher, and talked about possible alternative teaching strategies. Although we expressed to him that we were concerned about the amount of time he spent with us in discussions, he always encouraged us to discuss more with him. He always indicated that he was not concerned about the length of time in discussions, was eager to continue talking, and wanted to participate and learn from the project.

We also invited him to participate in the authoring of research articles, but he declined citing lack of time because of commitments to family, church, private business, and other activities. We provided Mr. Sparks with copies of our draft manuscript to read. In most general terms, he was in agreement that there were problems in students’ understanding and a lack of interactions, but he suggested that providing for more interactions within the student body and between students and himself was not his strength. He felt that his ample demonstrations by and large made up for this lack of interactions. We did not try to impose our view on Mr. Sparks, nor did (or could) we expect that he (or his students) could change during the relatively short period of our stay (cf. Louden & Wallace, 1994). Furthermore, the study was conducted during the last quarter of the school year, so that change in this classroom was not really an option.

### Data Collection

To understand these worlds, we draw on a large database established during an entire curricular topic and the preceding and following weeks. As it happened, the unit was
“dynamics of rotational motion” and lasted for four weeks. During these four weeks, we recorded each lesson with three video cameras that followed three student groups of four students each; these groups also worked together on laboratory activities. Mr. Sparks was continuously audiotaped using a remote microphone. Transcripts were prepared of all tapes within days of the recording. Before and after the unit, we spent additional lessons observing what happened in the classroom, but did not use the cameras or cassette tapes. Our observational fieldnotes from these periods also entered the data base.

We conducted interviews with the students and the teacher throughout the study. Ten students—representative along the lines of gender, achievement and understanding, views on epistemology and nature of science, and experienced classroom environment—were interviewed at least five times. We used written instruments and a knowledge pretest, described in the following paragraphs, to assist in the selection of the students—computer-based clustering and scaling techniques of quantitative data—as well as our observations prior to the commencement of the unit. In the selection, we were especially interested in identifying (and receiving agreement to participate from) students who were able and willing to articulate their experience and understanding. The instruments also constituted the starting points for our interviews, which were nevertheless open-ended. Each interviewer stayed, with few exceptions, with the same students for the duration of the study which allowed us to establish rapport and gain the confidence of individual students.

We formally interviewed Mr. Sparks six times, often taking the same instruments used with students as starting point and then connecting the conversation to relevant aspects of particular lessons observed. During the interviews with students and teacher, we also replayed videos of lesson segments for stimulated recall, including segments from lectures, demonstrations, and student experiments. These interviews normally lasted about one lesson (70 minutes) but, in the case of the teacher, often extended to 2 hours. In addition, we debriefed Mr. Sparks after each lesson and often in the context of the teaching materials used. These debriefings lasted between 10 and 30 minutes and were recorded on videotape. All interviews and debriefings were transcribed within days of their recording.

We used a variety of instruments including a constructivist learning environment scale (CLES [Taylor, Dawson, & Fraser, 1995]), a nature of science survey (selected items from VOSS [Aikenhead, Ryan, & Fleming, 1989]), a science laboratory environment inventory (SLEI [Fraser, Giddings, & McRobbie, 1995]), an instrument assessing students’ pre-unit understanding based on items used in previous research (Gunstone, 1984) and an instrument assessing students’ post-unit understandings. We further included the teacher’s own tests in our data base. Mr. Sparks completed the same inventories, but was also asked to predict students’ answers.

**Data Analysis**

Here we adopted an approach to discourse according to which language does not express or represent aspects of reality, but produces them, including “beliefs,” “desires,” “attitudes,” “Self,” “reality,” and “world” (Edwards & Potter, 1992; Lynch & Bogen, 1996). “Beliefs,” “desires,” “attitudes,” “Self,” “reality” and “world” are constituted,
maintained, and reconstituted through language in public discourse. In this study, we therefore heeded the ethnmethodological advice to “analytically examine the ways that conduct, belief, and judgment are organised, produced and made intelligible in members’ own accounts and descriptions, and how these are embedded in various other practices” (Jayyusi, 1991, p. 234). We therefore understood our participants’ talk as ways of constituting their lifeworlds, the worlds they experienced. Here, “world” is not only meant in a physical way, but also includes social and psychological aspects of our participants’ experience. Worldmaking always happens in a current conversational context and in a way taken as legitimate for the purposes at hand. Therefore, when our participants made seemingly contradictory statements, we did not take this as evidence to construct them as irrational or as having split personalities; we took this as evidence for their attempts to construct coherently intelligible and plausible accounts of some phenomenon.

In daily meetings, we tried to make sense of teaching and learning in the classroom, and how students and teacher understood themselves in this context. The research team debriefed after each site visit; we also met daily to talk about the data, directions for subsequent data collection, and to prepare initial analyses. We frequently drew on videotapes and transcriptions of interviews and lessons to support or discard our initial assertions and working hypotheses. Our ongoing personal fieldnotes sensitized us to what later became an important result of our study, namely that students and teacher looked at the world in general and the events in the classroom more specifically in different, often incompatible ways. Our fieldnotes also directed our data collection, in that we decided to use specific video clips with our participants to find out more about their assessment of what was happening in the classroom. Furthermore, we glossed Mr. Sparks’ descriptions of some events and asked students for their own descriptions; in turn, we asked Mr. Sparks to react to our glosses of student statements. In this way, we not only obtained participants’ independent description of their lifeworld in physics class but also their reactions to the descriptions of others.

Positioning

Writing this article about a situation in which there seemed no way out has been a difficult experience, for what we want to tell could easily be construed as an indictment of the participants. Because any insider’s perspective could be construed as a power move (Haraway, 1995), we present our perspective of the events and what participants told us and attempt not to be partial to either teacher or students, high achievers or low achievers, women or men, etcetera. In this, we attempt to live up to a commitment of “mobile positioning and passionate detachment” (p. 183) in the conduct of our research rather than to attain an Archimedean position that would lead us to eccentricity and alienation (Tijmes, 1995). We lay no claim to having constructed the ultimate account and write this article from an empathetic but non-partial position and without any relativizing irony.

WORLDS OF DIFFERENCE

Mr. Sparks and his students experienced quite different worlds. These differences existed not only in the social world, where different views are more apparent (a reason why some have less esteem for social sciences than for natural sciences where scientists
agree to a much larger degree on common theoretical perspectives), but also in the physical world.

**Seeing Different Physical Worlds**

In this class, Mr. Sparks and his students looked at events together; yet they saw very different things without becoming aware of it. When Mr. Sparks asked students to conduct various investigations, students frequently saw phenomena that differed from those that he expected them to see. In one of these investigations, he had prepared steel balls, hollow and solid cylinders from various materials, and little carts that could be used to simulate sliding motion of the other objects. Students rolled and slid the objects down an inclined plane (their slanted desks) and look for differences. Whereas students came to see a number of regularities, these were not the expected ones. Of six groups, one arrived independently at a result consistent with canonical physics; another group arrived there with Mr. Spark’s help. The other four groups had seen phenomena which were inconsistent with canonical physics. As Mr. Sparks continued to lecture, it was left to students to re-interpret their prior actions and observations and to construe one of them as artefact. At one point during the subsequent whole-class debriefing, Christina insisted on having data that “disproved” the teacher’s theory. He told her that she was wrong. The other students did not talk about the phenomena they had seen and several of them later indicated that Christina’s insistence disturbed and even angered Mr. Sparks. Because he frequently reacted as he did with Christina, students inferred that they simply did not know and that they had not done what they were supposed to do.

During the posttest, we tested what students observed in one particular demonstration: students were divided in their observation of the event (Roth, McRobbie, Lucas, & Boutonné, 1997b). Five students, all high or very high achieving, agreed with Mr. Sparks and did not observe movement. Eighteen students stated that they had seen movement—eight of them adding that the movement was little or slight. Karen’s uncertainty whether what she observed was to be interpreted as motion or stationary state becomes apparent from her account of the situation, “He was fairly much stationary but he moved slightly and I wasn’t quite sure what the actual movement was.”

It is generally accepted that there can be no theory-free observation. That students, who are yet to learn scientific theories, will see the world differently from canonical physics is therefore no surprise. However, although Mr. Sparks suggested in his conversation with our research team in the introductory vignette that he might see different things than his students, there was no evidence that he considered this situation in planning for his teaching. That is, Mr. Sparks conducted his presentations and lectures as if students had seen events in his way and took this as a foundation for the subsequent theory lesson(s) building on these events. At the end of the unit, only a minority of students (e.g., 3 or 4 in the class) understood what the demonstration—crucial to understanding the conservation of angular momentum—had been about.
Of Students and Pupils

There were differences not only between what students and teacher described, but also between the descriptions by the same individual provided in different contexts. For example, in Mr. Sparks’ world there existed different kinds of learners; one could also say, he cast his worlds with different human actors. Asked about why students did not bring examples from their own experience, Mr. Sparks constituted them as pupils. To pupils, he taught, for they are not aware of relevant events or not mature enough to pursue learning as a student would.

[Mr. Sparks:] They’re still children you know. In many countries they wouldn’t be going to university next year, but twelve months even later. They’re very, very young. They should do an extra year before university.

At other moments, he constituted them as students. He suggested that he encouraged students to “inquire and not take things at face value,” “be critical of what they’re being taught, but in a worthwhile way,” “start thinking, questioning and looking,” and “keep up with reading science journals in the library, and start educating themselves in these lines.”

Depending on the context and often within a matter of minutes, Mr. Sparks described the same individuals as both too young to understand how culture and society interacted with the construction of scientific knowledge and as old enough to understand the politics of science. In one world, he dealt with responsible students, taking charge of their learning, who needed little supervision and feedback for constructing understanding. In the other world, he had to do everything because he dealt with pupils, too young to know and take responsibility. With pupils, Mr. Sparks lectured. The fundamental problem with pupils was that they had rather pragmatic interests, for “to them the bottom line is solving the problems and getting them correct in an exam.” But while Mr. Sparks made his students responsible for their own learning (e.g., homework), they described his intentions in a different way: “He just says do the homework but doesn’t care if you do it or not, basically.”

Student Worlds

While talking to students, we realized that they too constituted and experienced different lifeworlds. Some students appropriated the teacher’s discourse and with it, submitted to all the constraints, needs, power, etc. of the teacher’s interests. Thus, the “constraints of time,” “being rushed,” “having to cover material,” or “external (Board of Senior Secondary School Studies) guidelines” impinge on classroom events and determine what happens in the classroom. Jon suggested,

[Jon:] Sometimes we find we’re getting pretty rushed at times, just racing through the theory and all that. I mean it can be demanding but I suppose, I mean we have to get through it in order to pass the course and all that. I mean we’ve got to; they’ve obviously got their guidelines as teachers as to which areas they’ve got to teach.

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4 Similar observations were made among scientists and engineers who, within minutes, described their work in diametrically opposite ways (e.g., Gilbert & Mulkay, 1984; Latour, 1992).
Here, as in Mr. Sparks’ descriptions, factors external to the classroom determined the events inside. The actors inside have little or no influence on the general flow of the events. The world was constrained but all right and some students appeared to confirm Mr. Spark’s views. Not all students agreed with these descriptions. For example, some students suggested that Mr. Sparks spent time on activities that were tangents and often so difficult that they did not help students understand.

Among students, there were frequently worlds of difference when they talked about the “same” situation. For example, Brenda, Jon, Rhonda, and Sean worked together on laboratory activities throughout the unit we observed. According to their information, they had done the same on infrequent occasions at other times. Because they sat side by side in the back row, the four had other opportunities for interacting with each other over aspects of the course. However, the assessments of their collective work were quite different. Sean described Rhonda and Brenda as less motivated, less interested, and less goal directed than he saw Jon and himself:

[Sean:] I mean they get involved and all but I don’t think they really decide to, like get down and do hard work and all that. I think they both got sound achievements or something. Jon and I just automatically go ahead and do it. Whether they want to get involved or not is up to them I suppose. It would be interesting to just let them go ahead and do it and let us just sit by and watch. I don’t think we’d be able to do it, we’d want to have some sort of impact.

Their “sound achievement” contrasts with his own “very high achievement” and Jon’s “high achievement” (on a scale from very high, high, sound, low, to very low achievement). Talk of his own activity contrasted talk of the girls’ inactivity and reluctance to become involved. Brenda and Rhonda, however, described a different laboratory world. They claimed that they were interested but that they were constantly squeezed out of any activity by Sean. Although Rhonda frequently provided good suggestions, she felt put down by Sean who, in her description, plays on his high marks and does not want to have them tainted by poor performance from working with her and Brenda.

[Rhonda:] We’ll sit there, because we nearly always sit with Jon and Sean, and we’ll put something together wrong or something or have a wire in the right spot and we will say we don’t understand this can you explain again. Sean’ll say, “Oh you should have been listening” and start to complain, “Oh you’re going to blow up the equipment.” And he starts to complain, so we sort of don’t want to say anything. But then you don’t get experiments done, because you’re sort of sitting back and waiting for [Sean] to check the equipment before you touch anything.

LACKING INTERACTIONS

Monitoring Students’ Understanding

In their descriptions of the physics classroom, Mr. Sparks and the physics students at Woody Park constituted different lifeworlds. These lifeworlds had little in common. Listening to different individuals, one could think that they attended different
classes. Our observations suggest that, because there were few interactions between participants regarding the content, there did not exist opportunities to learn about the worlds experienced by others. Consequently, neither students nor Mr. Sparks noticed that (a) what students saw (e.g., in demonstration) was not what Mr. Sparks had wanted to show them and (b) students’ and Mr. Sparks’ descriptions and explanations of phenomena were incompatible. For example, during a demonstration designed to teach students the conservation of angular momentum, Andy had important questions and objections. Mr. Sparks, sitting on a revolving stool, had set in motion a bicycle wheel and then turned it in different directions. When he held the wheel so that it was spinning in certain directions, the revolving stool on which Mr. Sparks sat simultaneously turned in the opposite direction. Andy invoked forces to explain the demonstration. But Mr. Sparks responded that he was not speaking of forces and continued to talk about other things. Mr. Sparks wanted Andy to think about the demonstration and its implications in his own time and simply said, “I’m not even mentioning forces.” Andy acquiesced so that neither he nor Mr. Sparks came to understand the problem at hand: students did not understand why “forces” are inappropriate to describe and explain the demonstration, Mr. Sparks did not understand that and why many students inappropriately described the forces using a force notion. Mr. Sparks clarified his reasons for moving on:

[Mr. Sparks:] I can’t find out individually from everyone [that they understand], simply because of lack of time. I simply don’t have the time to get to them and there’ll be—I’m just aware that there are some [students], no matter how much detail you go into, no matter how much time you spend, [who] never get the point... So I have to reconcile myself to that, as hard as that is.

As for his part, Mr. Sparks left little possibility for a greater degree of interaction with students, “that’s about as far as you can go.” He was satisfied to “find out whether they were following just by reading their faces” and he checked “if the class looked content with what he had done” and whether “there are a sufficient number who will interject and say, can you go over something.” Because few students interjected, he had reasons to proceed with his lecture or demonstration. We asked Mr. Sparks about increasing his interactions with students but he repeatedly referred to “lack of time” and “not so bright students” and thereby constituted a world in which interacting with students was next to impossible. He also suggested that interactions were not his forte but that some of his colleagues were providing students with more opportunities. In his view, he made up for the lack of interactions by showing more and more varied demonstrations and thereby keeping interest high. (In all the interviews we conducted, there was no indication that any students studied physics because of an epistemic interest.)

**Worlds Apart**

Students and teacher constructed different worlds as to the possibility of interacting with each other; but even among students, there were different worlds of interactions. Mr. Sparks described himself as an open and approachable teacher. He could not conceive that students thought he was belittling them or just shouting them down, or having some other unpleasant reaction. But he also said that there were students who never approached him.
Among the students, we found a substantial number who described Mr. Sparks in rather different terms. Rhonda constituted him as a teacher who, while not likely to shout her down, would react very negatively (“Occasionally he gets a bit uptight about it,” “He would get annoyed”); Brenda suggested that Mr. Sparks had chosen her as a target for his jokes, belittled her, and therefore she did not “feel comfortable at all” asking any questions:

[Brenda:] Mr. Sparks will joke around with me, you know he’ll tape my shoes together or something like that, and everyone will laugh at me and that you know gets frustrating.

[Rhonda:] He sort of tends to be you know, “You’re the little people and I’m really good and I am teaching you so you just have to sit there and listen when I want you to.” He doesn’t sort of let us get the chance to speak up or anything like that.

Norm voiced similar concerns. He talked about the stresses of participating in a class where students’ contributions were simply stamped right or wrong, often without explanations. Norm felt he had to keep his ideas to himself so as not to be embarrassed in front of others. He was especially confused about seemingly contradictory messages in the class. How could Mr. Sparks claim that there is no right or wrong in physics but label his (Norm’s) views as wrong? Norm’s greatest concern was that he (as a considerable number of his peers) was not able to communicate with Mr. Sparks about his problems.

[Norm:] I try to talk to him, it might just be my communication but I think he doesn’t really answer the question that I am after. I think that he is rejecting what I am trying to ask.

Brenda provided an explanation for the lack of communication:

[Brenda:] I think most people are scared of him, cause most people get really scared of their teachers’ reactions if you question anything about the teachers themselves. And I think, I don’t know, but Mr. Sparks really seems to be like that. He seems to intimidate people.

Both students’ explanations draw on power as an explanatory resource to account for the lack of interactions. In Norm’s case, the teacher (as the more powerful) can reject students’ questions; in Brenda’s case, the teacher can react in such a way that one has to be scared. On the other hand, most students knew, and had done so, that they could call Mr. Sparks even at home when they had questions about their assignments or about the content while preparing for an exam. We asked students specifically about speaking out and about asserting their own rights. Some students suggested that Mr. Sparks only considered his own rights and that he disregarded theirs. Some students suggested that asserting one’s rights in this physics class would lead to problems. Trouble in one class could even lead to trouble at the school level.

[Brett:] I suppose it is the old thing that you have come to accept over the years, they-know-best kind of thing. At this point, I have no rights. I suppose I could go out and make trouble for myself. But that is probably about it. I would probably just get noticed by the office, nothing else. They would keep an eye on you so if
you did something wrong they would pull you up for it and you know maybe kicked you out of the school.

From Mr. Sparks’ view, it was nearly impossible that there could be timidity, feelings of inferiority and hesitancy. Many students, on the other hand, described lifeworlds in which they were belittled and feared repercussions; lifeworlds that were clearly distinguished by power differences. Their only way to cope in this world was through submission and keeping quiet about their needs. In the experiential worlds of the students there was just no climate for individuals who had problems of understanding to open up and ask questions; there was no need in some cases because students already did well. From the students’ perspective, Mr. Sparks frequently signaled that their questions were not desired; that he had not enough time to complete the curriculum—though he had time for demonstrations that were so sophisticated that very few students could understand and many others, as they told in the interviews, simply turned off and forgot about them within a couple of weeks. That students did not follow in these cases could also be inferred from their passive participation—they simply sat there and did not ask questions, although they did not understand what Mr. Sparks was “demonstrating.” The few negotiations between students and teacher resulted in unsatisfactory changes. Mr. Sparks said that he accommodated students. Students described the situation differently, suggesting that Mr. Sparks did not really seem to listen so that nothing changed. Some students suggested that Mr. Sparks got frustrated when a student (there were very few of these) insisted.

There was a diversity of lifeworlds. However, this diversity was not made explicit. There existed few opportunities for establishing a discourse for learning and interpenetration of the different lifeworlds that existed. The problem we want to raise is not that people, students and teachers have different views, use different discourses, and belong to different communities within and outside of schools, or have different goals and purposes for being in the school. Rather, problems arise when people who have to work together, as students and teachers in schools, do not engage each other in dialogues that could make each other aware of and bridge the gap between their worlds. There were few exchanges and both students and teacher appeared to collude in leaving the things as they were. They failed to create a situation comparable to an interpenetration of cultures, of lifeworlds, so that students and their teacher could develop common understandings on the basis of some shared experience. In these exchanges, one or the other opted out from maintaining a conversation that could have brought out the different descriptions and explanations. The important point here is that teacher and students did not communicate. Communication could have made the differences explicit and provided opportunities for negotiating some of these differences.

COLLUSION

In this class, there was little communication between Mr. Sparks and his students. From our (the visitors’) perspective, there appeared to exist a silent agreement to settle for the lowest common denominator. Mr. Sparks asked for minimal comprehension and gave predictable tests which asked for plugging numbers into formulas. Students prepared for these tests but did not engage with physics as a way of knowing and making sense of
the material world. Our interviews and observations revealed that they paid little attention in class and did not attempt to construct conceptual understandings of physics. Students and teacher appeared to collude in keeping mutual engagement low (“Obviously we want to pass the course so we’re pretty much going to do anything he wants us to do”). Everyone knew that tests would predominantly consist of word problems and a few definitions. Some students explicitly talked about the low cognitive demands of the tests:

[Jon:] I’d say that the majority of the problems we do are basically formulae. We’d have a couple of questions like this where you need to know the theory, but on the whole the majority of problems we do are basically just using formulae, so long as you know just what the values were, how to manipulate formulae and stuff like that I don’t think you’d have any problems in that part of the test.

Sean suggested that all you needed to do well in this kind of environment was to listen in class and then to “cram” at home when it came to the examination, because this was the only way to deal with “all of this information.” Most often, students did not do the homework assigned by Mr. Sparks who, in turn, did not check whether students actually did what he asked them to. This frequently led students to have what might be called a false sense of security about their understanding. Mr. Sparks’ great experience in performing high school physics demonstrations allowed him to present the subject in such a way that it was plausible. So when asked, students said they “understood.” When we probed their understanding about the same events and with the same practical examples used by Mr. Sparks on our posttest, students did not understand at all (e.g., Roth, McRobbie, Lucas, & Boutonné, 1997b; Roth, McRobbie, & Lucas, 1996). Some claimed that they had not yet learned what we asked them.

Christina and Karen described the great difference between Mr. Sparks’ tests and our posttest for understanding that took them step by step through a problem:

[Christina:] It is because you are not just rattling off facts that you have learnt, its like you have to understand why its happening, you already know that it does happen but when you have to explain it and show arrows. It really tests your understanding, not your content or your formula, not how you can sub in values to a formula [but] your understanding of what’s going on.

Brenda suggested that while doing problems, understanding is “Not necessary but you have got the formula, but I would really like to know why you had that formula.” And Rhonda described how one could be rather successful (in terms of the grades) without understanding physics, “you need to talk about just anything.” When she did not know what was asked, she wrote about some aspects and provided a description because she could get a few marks for having an idea. Even for numerical problems, Rhonda had strategies for getting marks without understanding much at all: “I just rewrite the question in numbers, just say the velocity is this, and you just write V equals, so just do that and you might get one or two marks.”

Mr. Sparks thought it impossible to think that students might have anything that they were unhappy about, or that they might want to complain about. Some of the students and particularly those who did well under the present system certainly concurred with Mr. Sparks. Sean, for example, suggested that “Most of us are pretty much willing to learn, we don’t stuff around like other classes and I think we just want to get through the
course and that.” There were also students who did not complain specifically because they feared the reaction of their peers, such as Sean, who would put them down. There were students who felt more strongly than others that their peers participated in this collusion. When asked why they did not question the teacher as often as they preferred about the choice of topics and approaches to teaching, some of the quieter students provided answers such as, “They’d probably all sit there and go, ‘Yeah you chose physics so of course you have to learn it’,” “There are a few people that would stick their noses up at you,” “For starters, just that other people in the class will laugh at you,” and “They think they’re really good because they get really good marks and stuff like that.” We found considerable unhappiness among students, who coped or marginally coped with their different lifeworlds in this class.

OBLIGATORY PASSAGE POINT

From our (the visitors’) perspective, the physics class we observed appeared to be an obligatory passage point for all participants. Mr. Sparks and his students constituted themselves and each other as individuals who had to come through this obligatory passage point as part of their respective lifeworlds. It was this passage point in which their respective lifeworlds intersected. Mr. Sparks ranked the priority of teaching after his family, church, and several other interests. For the students, this class was but one of the hurdles they had to pass on their way to university and to their later profession. Thus, students suggested that “In high school, you’ve just got to get through the work” or that they were “Looking at a high grade and looking at getting into university.” From the students’ perspective, Mr. Sparks was the one who set the height of these hurdles; he had the gatekeeper function which goes with obligatory passage points. But this was not true for all students, for some had already decided not to count physics among the five subjects they entered for their entrance requirements. The hurdles were too high, they were less motivated to understand or to get a high grade. They suggested to us that they were just going through the motions.

School science has been viewed as a rite of passage (Brookhart Costa, 1993). However, the notion of rite of passage puts too much emphasis on the dynamic aspects of an activity, that is, on socialization. For rites of passage to take place, people have to engage with each other in activity. In this class, however, teacher and students interacted little. We did ascertain that many of the things the teacher talked about and presented in terms of physical events had little effect on the students. Thus, this class did not constitute the setting in which the students were passing from their everyday lifeworlds to a more scientific one; rather, the goal of students and the teacher appeared to be getting through the test at the end of the course.

Engagement with students during the lessons also would have allowed Mr. Sparks to learn that students constructed different worlds, populated with different events and theories from the same experiments that Mr. Sparks used in class to reconstruct the canonical scientific world. Not engaging students relieved Mr. Sparks from having to worry about such different visions of his practices and the products emerging from them. Students, too, did not want to change the learning environment as it was. Some were successful and had no reason to request changes; others were not successful and wanted
change, but feared negative opinions on the part of their more successful peers and Mr. Sparks. The few attempts to bring about a dialogue—by students such as Christina or Andy—were insufficient change the lifeworlds of those present.

CONCLUSION

In this article, we showed how students and their teacher experienced one physics class as different worlds. In this classroom, most individuals were therefore figuratively “worlds apart.” In such situations, learning is difficult if not impossible. In our opening quote, Martin Luther King appears to suggest that we do not know of each other because we do not communicate. It is not uncommon for different people to describe their common worlds in different terms, populating them with different objects and events (e.g., in a courtroom, different witnesses and attorneys construct different worlds). However, there is evidence that to understand and learn from each other, people have to engage each other through discourse about things they can take as common (e.g., some object). Through the interactions, they learn to understand if not see, the lifeworlds of others; and, as phenomenologists emphasize, in learning about others people come to better understand themselves (Bourdieu, 1997; Ricœur, 1990). In this physics classroom, teacher and students did not engage each other, nor did they strive to do so except on rare occasions. We made sense of this class as an obligatory passage point for the participants. To make this experience least painful, participants colluded to keep the cognitive demands on the lowest possible level. What is sad in this situation is that the participants, the teacher and many students had talked about the necessity of interactions to bring about learning and understanding of physics. Many worlds will therefore continue to exist without the possibility of bridging the gaps described by Mr. Neale in the opening vignette.

If one tried to understand all the descriptions we received as descriptions of one and the same world, it would be a world full of discrepancies, contradictions and irrationality. To get to know each other’s worlds, students and teacher would have to begin to interact with each other; they would have to enter each other’s lifeworlds by participating in a common discourse. Our observations in this and other physics classrooms around the world suggest that interacting with others, discussing experimental results, explaining each other’s ideas and constructing phenomena in small-group and whole-class sessions are listed by students as their greatest need. This need was not met in this class. Students themselves feel that they need more sense-making conversations among each other and with the teacher. The question then is, to what degree students and their teachers are ready to change and reconstruct the learning environment? From our perspective, this means that both parties need to construct opportunities for engaging each other in sense-making conversations about physics, teaching and learning, and the learning environment. We may expect change once we enact Martin Luther King’s statement (which we opened this article) in school situations: if students and teachers communicate with each other, they are likely to create opportunities for knowing each other.
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