

Bringing All to the Table: From the Pumping Station to Project-Based Learning

Peter J. Taylor

Science in a Changing World graduate track

University of Massachusetts Boston

“I need the intense preoccupation of a group... inventing new worlds as they learn to know each other’s dreams.”

Vivian Paley (1997, 50), speaking of teaching her kindergarten classes

In 2007, a few years after he completed his *Baroque Cycle*, Neal Stephenson was chosen by history of science graduate students at Harvard to speak in their department’s annual colloquium series. He described some key incidents in writing his fictional account of the late 17th and early 18th centuries in Europe, mentioning, as an aside, consulting with his editor early on when he saw the book could get quite long. (As it turned out, it became three volumes, each more than 900 pages.) The editor reassured him: “This book has pirates, right? It can be as long as you like.”

This pirate criterion got me pondering the relationship of the students to their scholarly topics. They were giving Stephenson, a writer who painted over a broad canvas, rapt attention. Yet, I imagined, their dissertation research must be quite focused, taking particular incidents and texts in the history of science, bringing events and connections to light, and making sense of them in relation to some acceptable interpretation informed by some established theme (such as Shapin’s 1995 account of the shaping of modern science by gentlemen's codes of civility in 17th-century England). But suppose one turned that approach inside out? After all, Newton (to choose an important character in Stephenson’s trilogy) lived in a world where he was concerned not only with calculus, or gravitation, or light, but also with theology, alchemy, the integrity of currency, capital punishment, military and mining technology, the operation of scholarly societies, and more. His was a world of speculation in stocks, household cesspits, the bubonic plague, religion and royal succession, and so on. What then would it mean for engaging with science in its social context if, from the start, all these things were on the table? Not only *things*, but also all the *people* who shaped and were shaped by those things.

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Towards the end of 1970s I found myself dissatisfied with making mud bricks and battling blackberry bushes on a rural commune in Australia—the Black Rose Co-op—as well as with the contract research on rural economic and environmental problems I had been doing to help support the Co-op. Black Rose, formed in 1975 in the anarchist, countercultural spirit of creating organizations that prefigured the society we wanted, had contracted to a small group. The funding and deadlines for the contract research did not allow time to explore social implications that seemed important to me. So I decided to take a break, to travel and spend time learning from scientists whose work on complexity in various life sciences interested me politically as well as intellectually (Taylor, 2005, p.xvi ff). One U.S. biologist I wrote to, Richard Lewontin, encouraged me to apply for graduate studies. I took his advice and in 1980 was accepted to undertake a Ph.D. with him and Richard Levins, a long-time collaborator in science as a political project (Levins and Lewontin 1986).

Between Australia and the U.S.A. I spent some time eking out a living in England where, among other groups and gatherings, I attended the monthly meetings of the Radical Science Journal (RSJ). I especially recall one RSJ meeting in which a working group reported on its inquiries and introspections about why social change was so difficult at a personal level—their domestic and political collectives and open relationships seemed to have generated many failures and "psychopathologies of left-wing groups." While in England I also, as planned, visited with various scientists, some of who had worked in RSJ but then moved away when they felt the RSJ critique of the capitalist social relations and labor process in science left no room for them to be scientists.

On arriving in Boston I persisted in the pattern of joining or forming collectives—challenged, but not daunted, by the specter of pathological left-wing groups and the one-or-the-other experience of ex-RSJ scientists. I got involved in Science for the People biological determinism study group and the New World Agriculture Group, helped form a conscious-raising group for anti-sexist men, a group of graduate students and post-docs examining the social implications of new developments in biology, and more than one discussion group on questions of biological theory. In hindsight, the groups I stuck with longer allowed discussion to move from immediate action to exploration of personal paths and pasts. One participant, for example, had moved from Cambridge UK to Cambridge USA to join a research unit on plant

genetics only when his visa to Mozambique was held up. He had hoped to contribute to revival of agricultural production in that recently decolonized nation. Now in the USA instead, he had to make sense of his supervisor, a young left-wing professor, allowing a multinational pharmaceutical company to fund the research unit in exchange for rights to market what was discovered.

The path that person ended up taking is another story, but in 1982 it was he who introduced me to fellow Cambridge-to-Cambridge migrant, Iain Boal. When I bumped into Iain some months later (after I had spent time back in Australia clarifying my future around the Co-op), our conversation led us, along with visionary architect Brad Bellows, to convene a weekly evening discussion group. The Cambridge catchment area meant that we had guests who combined the ongoing political tradition of the counterculture with varying levels of access to surrounding academic institutions (through, say, a partner, adjunct teaching gigs, or simply the opportunities to attend talks). The people from this critical periphery who became regular participants were looking for more community and connections than could be found in the academic venues where careers and reputations were being wrangled. Pot-luck meals on the refectory table at the home of Iain and his book-conservator wife Gillian, anchored by their vegetarian casseroles, were as important an ingredient as the readings.

The discussions might often, as one new participant expostulated, “pay precious little attention to the text,” but the questions opened up in an evening together usually led to a suggestion about a pertinent follow-up reading. As evident in my crude finding aid for now-discarded photocopies,¹ the group’s inquiries took us from social analysis of art to evolution of mind, from anarchism to Marxism, from the shaping of cities to architectural iconoclasm, from analysis of contemporary culture to the origins of critical theory... At some point the group got a name—the Pumping Station—on letterpress letterhead, and bigger projects were initiated—recording interviews for wider distribution and locating a building for co-housing.² However, after Gillian’s work took her to Berkeley and Iain followed, such plans did not come to fruition—at least not in that place and time. (As described by other contributors, Retort took up in the Bay Area where the Pumping Station left off.)

¹ <http://bit.ly/PSreadings>

² <http://bit.ly/IBonPSletterhead84>

While there were obvious gaps and imbalances of gender, class, ethnicity in these early 1980s dinner discussions, they showed me the value of learning in communities that allow each participant to bring their individual interests into play and explore them in relation to the ideas, questions, contacts, and aspirations of others. Granted, as a young researcher I had to focus in and address the conventions and expectations of my field (ecological theory) in order to finish any project or publication. But, having the Pumping Station as my alter-learning community meant I did not have to move away from my pursuit of science as politics. It seemed that I could contribute to modeling environmental complexity yet pay attention to the alchemy of biotechnology, the speculative machinations of finance capital, the disposal of nuclear wastes, the new epidemic of HIV/AIDs, the rise of the fundamentalist right, the military interventions of the USA and its allies, and so on. Could a researcher discipline such intersecting complexities without suppressing most of what could be brought to the table?

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Fast-forward. I stayed in the USA, finding academic positions that allowed me to teach science-in-society courses and continue research that developed into examining “the complexities of environmental, scientific, and social change together, as part of one project” (Taylor 2005, xvi). The research is another story (told in Taylor 2005), but let me note that this development amounted to a shift of emphasis from product to process: I had begun by seeking a scientific theory of ecological complexity, but I was now exploring ways to stimulate researchers (and students training to become researchers) to self-consciously examine the complexity of their *social situatedness* so as to change the ways they address the complexity of the *situations they study*. This shift meant learning new tools for facilitating group interaction and reflective practice, then sharing the tools by applying them in workshop settings and teaching. On the strength of all this, I moved to a graduate program in critical thinking and reflective practice, which I have led since the late 1990s.³

It turned out that this program had fewer students interested in science than I had expected, but my box of tools and processes was quite adaptable for serving a wider range of mid-career professionals. Yet, I was pleased when, in 2005, I was invited to take over another program’s doctoral course on science and public policy. I set out to bring the readings up to date and, in no time, saw that there were far more topics than could fit in a semester. My response

³ <http://www.cct.umb.edu>

was to give up on full coverage of topics. Instead, I devoted the first three weeks to a project-based learning (PBL) unit (as described in Box 1) hoping that students would connect their particular interests to the scenario (in this case centered on responses to extreme climatic events; Box 2), practice tools for rapid inquiry into issues they exposed, and learn from the diversity of other students' reports. After the PBL unit, students would have a shared experience to refer back to during the discussion of the topics that made up the rest of the course and have gained license to go beyond any assigned readings to connect the topic with their own questions.

Box 1. Elements of Project- or Problem-Based Learning (PBL) (from Taylor 2014)

Scenario (or case) raising problems (or issues) that often are not well defined, which invites the

Students (or participants) who bring their diverse interests, backgrounds, experiences, and capabilities into play as they formulate and pursue

Inquiries, which typically open out wide at first and evolve in unexpected directions, before the student focuses in to generate works in progress (or prototypes) on their way to a coherent

Product (e.g., report) that is shared with other students and perhaps more widely, and from which other students learn. The inquiries are aided by the

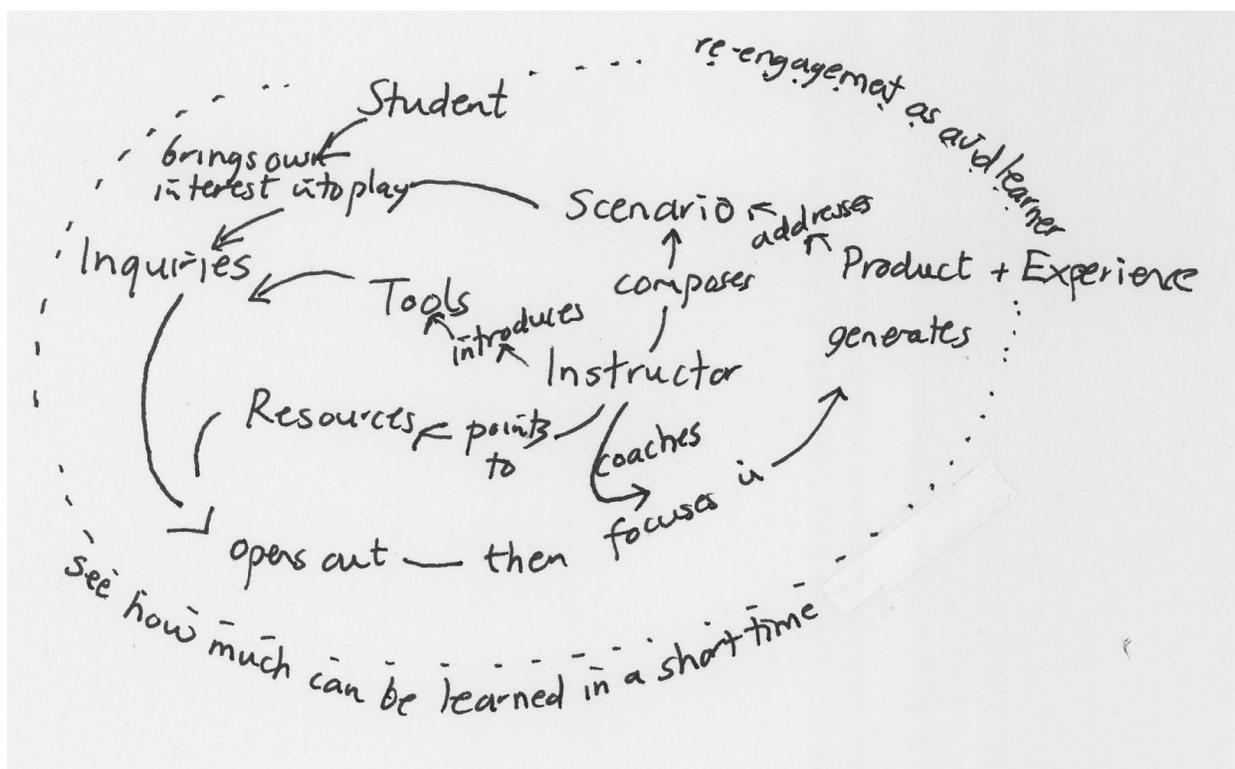
Instructor-coach, who *composes* the scenario, *coaches* the students through the opening-out and focusing-in process, *introduces* Tools, *points* to Resources, *elicits dialogue and reflection* on the Experiences, and *emphasizes* learning interactions over grading.

Tools and processes to help students organize inquiries or to foster support and engagement among the students.

Resources, such as contacts, materials, and reading suggestions drawn from the instructor's own work and life and from previous students' projects. (The internet makes it easier to explore strands of inquiry beyond any well-packaged sequence of canonical readings, to make rapid connections with experts and other informants, and to develop evolving archives of materials and resources that can be built on by future classes and others).

Experiences, it is hoped, include engagement in self-directed inquiry, seeing how much can be learned in a short time using the PBL structure (where learning is not only about the problems raised by the scenario but also about oneself as an inquirer), and moving through initial discomfort to re-engagement with oneself as an avid learner. What makes this re-engagement possible is a combination of:

- the *tools and processes* used for inquiry, dialogue, reflection, and collaboration;
 - the *connections* made among the different participants who bring diverse interests, skills, knowledge, experience, and aspirations to the PBL; and
 - the *contributions* to the topic laid out in the scenario on which the PBL is based.
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Box 2. Excerpts from a PBL scenario in 2005⁴

“Science-policy connections to improve responses to extreme climatic events: Briefings requested—Quickly!”

...The national policy analysis group aims to get political authorities and political groups—from the town level to the international, from the elected to the voluntary—interested in learning about how best to respond to extreme climatic events and pushing for changes in policy, budgets, organization, and so on. It should be possible to engage people who resist the idea of human-induced climate change—after all, whatever its cause, weather like Hurricane Katrina and this year’s record snowfall in Boston area has to be dealt with.

What this group is asking us is that we investigate the *science-policy connections* involved in improving responses to extreme climatic events. They want us to step back from the current disaster and political uproar and look at who—at various levels of political organization and decision making—needs to know what kinds of things that different natural and social sciences have learned or could learn if appropriate short- or long-term research were undertaken—and how that knowledge can be made available to them. The short time we have for the task matches the group’s interest in making an

⁴ <http://www.faculty.umb.edu/pjt/749-05PBL.doc>

informed and informative contribution to public discussion by the end of the month; there is no expectation that we will produce a definitive, everything-wrapped-up report. The group imagines that we can provide “briefings” that provide or point to key resources (e.g., issues, concepts, arguments, evidence, references, websites, summaries of case studies, quotes, images, organizations, people to contact, research already under way, research questions and proposals)—Exactly what might be a resource concerning science for someone involved in policy is up to us to decide, but surely it will vary depending on who the intended audience is for each briefing...

While coaching students during the PBL unit I found it especially rewarding to draw on diverse contacts and readings, including some from the Pumping Station days. Aided by email and the internet, students could be linked to someone who was expert, enthusiastic, and often very helpful regarding some specialized issue (ranging from, in the climate case, maintaining telephone networks when power lines were downed to Cuba’s citizen-based disaster response system. For details of process and products, follow links on the footnoted webpages⁵).

This experience primed me to pick up on Stephenson’s pirate story. Within a few days of his lecture, I had sketched, for a gender studies consortium that was soliciting innovative, interdisciplinary pedagogy, a science-in-society course that used four PBL cases to make up all 14 weeks. The course was approved—provided the title stated that it was an “experiment”—and ran for the first time in 2009. The experiment worked well enough and it has been offered again every other year since. The experience also moved me to revise the science and policy doctoral course into the same format and to initiate PBL-style “collaborative explorations” (CEs) open to a wider public. These meet weekly online for an hour over a month with everyone, including the host, pursuing their own line of inquiry between meetings (Taylor et al. 2014). The sequence of sessions used in the CEs have since been adapted back into some of my graduate program’s online courses in critical and creative thinking.

Each of these educational offerings allows exploration of what it might mean for engaging with science in its social context if, from the start, many and diverse things were on the table. In this regard, student evaluations have been insightful and thought provoking.⁶ One student observed at the end of the first gender consortium PBL-only course that

⁵ <http://ppol749.wikispaces.umb.edu>, <http://grst.wikispaces.umb.edu>

⁶ <http://grst.wikispaces.umb.edu/Evaluations>

... the typical format and rhythm of most graduate learning environments [has to meet these goals:] Knowledge in core disciplines must be gained and “standards” of an academic profession imparted. But where is the joy and love of learning that made us all want to be students for as long as we can be? This class brings the exploration and inquiry back. It feels messy at times and frustrating and stressful, but what gets produced is amazing and deep and diverse and makes you want to know – “What’s next?” Who committed to higher learning wouldn’t want to participate in a course like this?

The positive quality of the learning experience—characterized in Table 1 as “re-engagement with oneself as an avid learner”—emerges, however, only after an initial period of discomfort: “I’m not sure if [the pedagogy] is supposed to feel the way it does... very loose yet strenuous at the same time,” wrote a 2015 student in a mid-semester evaluation. Another mid-semester comment that year asked for the “narrative of the course” to be made clear. This particular student was still discomforted at the end, remarking that “the separate cases were... not threaded together by any overarching theoretical framework or empirical mode of inquiry.” But, contrast his assessment with a 2011 student’s evaluation:

This course is a gift – the chance to be open – open-ended in design, open to process, open to other perspectives, open to changing your ideas, and open to sharing. Of course this means it’s risky too – you won’t always know when you’re coming from or where you are going – you might think you aren’t sufficiently grounded by the course. But you have the freedom to change that – and being on the other side of it now, I see it works out beautifully. The attention to process provides you the tools to grow and by the end you’re riding the wave of your earlier work.

The tension between the discomfort and subsequent appreciation (which is one of several tensions that run through PBL teaching; Taylor 2014) has challenged me to draw students into developing their own narratives about how to learn without a sequence of texts assigned by a teacher to dictate the logic of learning. Seeing, as the 2011 student noted, that the key for open learning is attention to process, nudged me to assemble *Taking Yourself Seriously: Processes of Research and Engagement*, “a field-book of tools and processes to help readers in all fields develop as researchers, writers, and agents of change” (Taylor and Szteiter 2012). Tools

commonly used in my PBL teaching include check-ins⁷, dialogue around written work⁸, dialogue process⁹, guided freewriting¹⁰, plus-delta feedback¹¹, supportive listening¹², think-pair-share¹³, and work-in-progress presentations¹⁴.

However, what most stimulates my thinking these days is a process central to CEs, which were developed after the book's publication. The first session of any CE consists of participants giving 5-minute autobiographical introductions, in which they describe how they came to be someone who would want to explore whatever the topic is for the CE.¹⁵ The stories typically engage everyone's attention; they are rich and varied. An abundance of points of potential interaction emerges, especially when, time permitting, each introduction is followed by "connections and extensions" feedback, that is, short written notes in which each listener identifies one point of intersection with their own interests and one direction they could imagine the speaker's work being extended. In an online CE, participants are not sharing a pot-luck meal around a table, but in a very short time, the autobiographical exposure of points of potential interaction forms a basis for trust and taking risks with people who may have been strangers beforehand. Indeed, I have been struck recently, when introductions were repeated with each new CE over the course of a semester, how the insight and background shared became deeper and more personal every round.

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In my account of Project-Based Learning I have not described the reports produced by the students and other participants—of their very nature these must be diverse. Nor do I show examples of this kind of learning leading to research in which, from the start, many and diverse things are seen as implicated in what gets to be knowledge. Readers may see my emphasis on connections built of autobiographical stories as a continuation of the move I mentioned to exploration of personal paths and pasts in the early 1980s. Yet this is not the personal displacing

⁷ <http://www.faculty.umb.edu/pjt/CheckIn.html>

⁸ <http://www.faculty.umb.edu/pjt/DialogueAroundWrittenWork.html>

⁹ <http://www.faculty.umb.edu/pjt/DialogueProcess.html>

¹⁰ <http://www.faculty.umb.edu/pjt/Freewriting.html>

¹¹ <http://www.faculty.umb.edu/pjt/PlusDelta.html>

¹² <http://www.faculty.umb.edu/pjt/SupportiveListening.html>

¹³ <http://www.faculty.umb.edu/pjt/ThinkPairShare.html>

¹⁴ <http://www.faculty.umb.edu/pjt/WorkInProgressPresentation.html>

¹⁵ <http://wp.me/p1gwfa-F6>

the political—surely, bringing all to the table in making sense of the world requires learning ways to expose and connect diverse aspects of our selves into research and into politics. Indeed, if I had to go, so to speak, *forward to the past*, I would try to bring repeated autobiographical introductions into the dynamics of the Black Rose Co-op or the Pumping Station. I expect that would have strengthened community and connections, addressed some gaps and imbalances, and given more longevity to those countercultural organizations. For now, back in the present, I continue to seek the intense preoccupation of people bringing much to the table to invent new worlds as they learn to know, and to know each other.

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¹⁶ <http://annblum.wordpress.com>