Q 2008 by The International Union of Biochemistry and Molecular Biology

Biochemistry and Molecular Biology Education
Vol. 36, No. 5, pp. 363–364, 2008

Problem-based Learning

Of Tacit Knowledge, Texts and Thing-based Learning (TBL)

Received for publication, April 21, 2008, and in revised form, June 1, 2008

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Practical knowledge has two dimensions- a visible, codified component that resembles the tip of an iceberg. The larger but crucial tacit component which lies submerged consists of values, procedures and tricks of the trade and cannot be easily documented or codified. Undergraduate science students were given an opportunity to explore this component through an inquiry-based course.

''We know more than we can tell,'' noted Polanyi [1] in his book that emphasized the tacit dimensions of knowing. Though tacit knowledge is less visible and more difficult to document than explicit, codified knowledge that can be literally spelt out in words and numbers, it cannot be ignored as many business enterprises have now recognized [2]. Experimental scientists know well that trying to replicate an experiment based entirely on published information is far from easy. Collins [3] describes a particularly interesting case where suspicion morphed into trust when Western scientists saw their Russian counterparts in action. In the mid 80's, scientists at the Moscow State University had set up a research program on low dissipation systems. As part of their studies, they measured quality factors (Q) in sapphire crystals. Because their measurements seemed to indicate that sapphire was an excellent material for use in laser-interferometers, attempts were made to replicate their observations in Western laboratories (the US, Australia and the UK). Inability to match the Russian measurements raised serious doubts about the reliability of those studies. How-ever in the late nineties, Scottish scientists visited the Russian labs and invited their Soviet counter parts to visit theirs. It soon became evident that the Russian sci-entists were skilled workers who did their experiments very carefully so their results were indeed reliable. Stu-dents who move from the standard lab situation to real research suffer the frustrations of that process till they re-alize that usable results require mastery of tacit craft skills [4]. Yet in our class rooms, even in lab courses, we spend very little time in discussing such issues with our students. Even when we start training the students for the ''real'' world of the future, we get them to write mock grants and criticize peer-reviewed publications, again emphasizing our ''text bias'' [5]. Coupled with this inability to recognize and value tacit knowledge is another more subtle problem, the inability of our students and perhaps many of us to have a feel for what Baird calls ''thing-y-ness'' [5] in a fascinating book where he presents his case for what he calls ''thing epistemology.''

For two consecutive years, I have taught an Inquiry course on Teaching and Learning to 3rd year students in an undergraduate Health Sciences Programme. Being well-versed in PBL and active learning, they were quite comfortable in searching the biomedical literature. I wanted them to think more broadly about Teaching and Learning both across disciplines and time periods. To that extent, each student had to complete three tasks. Self selected Groups explored the ideas of eminent edu-cators from a list that included amongst others Dewey, Ibn Sina, Skinner, Montessori, Binet, Freinet, Vygostsky, Freire and Tagore. They framed a conversation amongst three or more of these educators, using as a starting point current educational controversies. They explored the historical antecedents of education and learned that contemporary struggles with process, content and evalu-ation are truly traditional. The second task was to design a course in the arts, social sciences and humanities. Because these were science students, I wanted to pull them out of their comfort zones and get them to think about core issues in education. Their last task was to explore learning in a nonacademic setting, in the world of crafts and skills so they got to realize that learning could occur in many different settings, where tacit know-ing played a significant role. I hoped that their learning how to make things or at least witness things being made would counter deep seated ''text bias.''

Students appreciated these opportunities. They took up their ''thing projects'' as they called them with great gusto. The topics they explored included amongst others, ceramics, glass-blowing, acrylic painting, candle-making, drumming and various types of cuisine. I also took them on visits to a print studio, a potter's home as well as to the McMaster Museum of Art which has an en-

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 DOI 10.1002/bmb.20214

viable collection of German Expressionists as well as some Impressionists.

Each student gave an informal presentation to the class and wrote a reflective piece about their learning process that tried to place their objects in a historical or cultural context. Though I wanted them to really explore ''thinginess,'' I could not escape my own text biases and assessed them on a written document! The students recognized that the craft work was tough, quite unforgiving and that in many ways academic projects were easier. They also recognized the value of traditions and the passing on of skills. Many said they began to look at ordinary objects with different eyes.

At the end of the course, I reminded them that the major objective of this particular component was to provide them an opportunity to recognize that learning can occur in nonacademic situations. I asked them to express the strength of their agreement on a 10 point scale with the following statements: (a) ''The exercise gave me freedom to explore an issue that was of particular interest to me'' and (b) ''I recognize the value of tacit knowledge (i.e. infor-mation that is passed on in a hands-on fashion and not really made explicit or codified)''. The mean score (31 stu-dents from two separate classes) was 9.5 6 1.2 (SD) on the first statement and 9.45 6 1.06 on the second. Clearly, the students appreciated the opportunities given. As one student wrote ''This course was unlike any other that I had taken before, simply because it allowed us to examine such a diverse panorama of topics. Initially everything seemed disconnected from everything else; those class excursions to an art gallery, a print studio, a visit by a pro-fessor who loves the great outdoors. But towards the end, it started tying back to learning and teaching; indeed, it was always about teaching and learning.''

Can one adapt this approach to standard discipline based course so that students recognize the value of tacit knowledge and/or experience material knowledge? Conventional lab courses can be restructured to deal with some of these issues. Students could be given the task of measuring inhibitory constants of a set of inhibi-tors with just the enzyme, a spectrophotometer and no instructions. They would have not only to design the experiment, but learn out how to use the equipment, by reading the instruction or asking someone else. Either way they would recognize their own limitations and the value of tacit knowing. One could even open up the instrument, show them the individual components and get them to detail how the equipment operates to give them the results they need. Baird [5] describes a course on the philosophy of technology that he cotaught with a civil engineer at the University of South Carolina. The stu-dents, mainly nonengineers, built bridges to specified dimensions using simple materials. They relished the ex-perience one confessing that the assignment itself was the sole reason for registering in the course. ''Making'', notes Baird [6], ''is different from saying and made things bear a different kind of knowledge than expressed sen-tences.''

Thus ''thing-based learning ''and tacit knowing can add an extra dimension to a student's learning experience.

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