



## Some Thoughts on the 3Ps Following a Week at Beloit College

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During June 1993 I attended a week-long BioQUEST workshop at Beloit College. It was an exciting time because the library of BioQUEST modules had just been released on CD disk by the University of Maryland. I also remember the week as an extraordinarily stimulating time of discussion and exploration of new teaching methods. And I thought that it was an excellent time to begin rethinking the basic philosophy behind BioQUEST. My own teaching has been strongly influenced by the early writings of John Jungck, Jim Stewart and Nils Peterson on the 3P's (Problem Posing, Problem Solving and Peer Persuasion), but I have become increasingly frustrated by the lack of development of these ideas. What sets BioQUEST apart from other software developers is the commitment to a particular approach to teaching. If the educational philosophy does not evolve along with the software this important characteristic will surely be lost. At the urging of Patti and John I have tried to formulate some of my concerns. My intention is not so much to criticize, but to stimulate discussion. Therefore, I welcome responses from my fellow workshop participants or other readers of this newsletter.

In Bruno Latour's wonderfully provocative book, *Science in Action* (1987), he discusses two faces of science: the "ready made science," taught in classrooms, and the "science in the making," that scientists do as part of their day to day work. Latour neatly captures this composite nature of science in a cartoon of the Roman god Janus who has two faces. The older face looks backward toward the facts already accumulated, while the younger face looks forward to new facts yet to be discovered (or as Latour prefers, "constructed"). Perhaps not surprisingly, Latour's cartoon has been reproduced in the BioQUEST literature, for it nicely reflects the BioQUEST view of teaching. The whole thrust of the 3Ps is the forward looking side of science that has too often been neglected in traditional science classrooms. The BioQUEST literature stresses the differences between the two faces (the point is graphically made by a heavy vertical line bifurcating Janus' head). But now that the BioQUEST Curriculum Consortium has matured, the time for "conscious raising" is over. We are aware of the importance of "science in the making," what we now need is a sophisticated discussion of how Latour's two faces of science can be integrated in science teaching. Metaphorically, we need to remove the dividing line separating the faces in Latour's cartoon. After all, the two faces are connected to the same head (and I suppose they share a common brain). We need to go beyond dichotomizing content and process in teaching, and show in a convincing way, how they are unified. The 3Ps has yet to accomplish this.

A major concern that I have is that rather than providing a conceptual foundation for building teaching modules, the 3Ps is becoming an (expendable?) appendage of computer simulation. The assumption seems to be that the 3Ps are built into the use of computer simulations — but, as we all know, even BioQUEST exercises can be used in ways incompatible with problem posing and problem solving. In practice, the 3Ps often seem to be "computer driven." Too often discussions of the BioQUEST modules seem to be almost completely focused upon the generation of numerical data and on a rather narrow subset of analytical skills. Analysis and quantification are important, but surely there is more to science than these characteristics. For example, how are new problems generated? How does the scientist choose among competing solutions to unsolved problems? How do biases and assumptions influence the choice of methods and the interpretation of data? What are the intellectual and social consequences of these choices? To what extent does the successful "persuasion of peers" depend upon a shared commitment to a common world-view? These are questions that go to the heart of the 3Ps philosophy. Previous



discussions of these questions in the BioQUEST literature have been highly suggestive, but the issues are so important that they deserve a more formal and extended treatment.

As an educator I am committed to using the 3Ps in all of my courses — including lecture hall courses for non-majors. I am, however, uncomfortable with what I perceive to be a lack of critical attention to the problems of applying the philosophy in very different types of classroom environments. It is not enough to repeat the claim that this approach works with non-majors, middle school students, etc. Of course it can be made to work, but is it really better than other educational models? And even if it is the best model, should it always be employed in the way that Peterson and Jungck discussed in their early Academic Computing article? For example, the insistence that students must always pose their own problems strikes me as misguided. Problem posing and problem solving in science is always constrained by social factors. Sometimes problems are posed to scientists by their peers or mentors. If this is true for science, why not for science teaching? I certainly agree that students ought to have many opportunities to pose and solve their own problems, but I don't believe that this should always be the case. This is an issue about which different educators may disagree while still maintaining a shared commitment to basic principles. But let's acknowledge the differences and discuss them seriously.

On a related note, we also ought to acknowledge that the 3Ps is a model for scientific producers rather than consumers. The values and norms of basic science are those which inform the entire approach. This is not necessarily a bad thing. Non-majors as well as biology majors need to understand how scientists do their work. It seems to me, however, that most of the discussions at the BioQUEST workshop that I attended turned on the question of how we can best train future scientists. Let's get the issue of training majors and non-majors out in the open and discuss it critically. Are the needs, interests, and goals of majors and non-majors really the same? Is the same educational model really appropriate for both groups? Do we simply offer "watered down" majors courses to non-majors, or should different (but equally challenging) approaches be used for the different groups? And, more to the point, should BioQUEST modules be used in the same way for both types of students? I admit that I don't have answers to these questions, but I call for a spirited discussion of them. A mature 3Ps philosophy ought to provide a platform for fruitful examination of these important educational issues.

There is an old adage that criticism is the sincerest form of flattery. I hope that these thoughts are taken with this in mind. I wish to thank the BioQUEST staff for an exciting week in Beloit. I am grateful for the opportunity to think about science education and discuss it with such a lively group of committed teachers. I look forward to future discussions with other BioQUEST users.