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Bridging the Gap Between Science and Science Education

My Vexation

There seems to exist at universities a mutual lack of respect between many science and science education faculty members (hereafter referred to as scientists and science educators). As a neuroscientist who became concerned about the state of science education in our K-20 system and shifted focus to dedicate my professional life to science education over 10 years ago, I believe my perspective is grounded in both worlds. Namely, I feel that there are a number of root causes for the disconnect between many scientists and science educators. (It is important for me to emphasize my use of the term "many" as I know that there are others, from both groups, who have very successfully bridged the gap between these worlds.)

For the most part, science educators do not value the science teaching of scientists—and with good reason. Undergraduate instruction consists mainly of direct teaching (lecture) and laboratory activities whose outcomes are known at their outset as they are designed to confirm what students were taught in lecture. Thus, science educators are anxious to reform undergraduate instruction—and rightfully so. Our K-16 science instruction is neither maintaining the pipeline of students interested in pursuing careers in science, nor achieving the level of science literacy necessary to address many current and rising global societal issues. As a community science educators need to acknowledge that scientists were *never* trained to teach; rather they are pursuing their passion—research—and teaching for many scientists is just one more thing they have to do in their jobs that takes time away from this passion. Most know little, if anything, about current reform in science instruction.

Many scientists, on the other hand, hold science education research in very low regard. This disregard arises from the perception of the scientific community that there is a lack of rigor in published science education studies. Too often I hear the comment among scientists that "there probably is good educational research out there—you just have to wade through too much poor research to find it." Every science graduate student who has attended a national or international science education meeting with me has expressed amazement at the lack of rigor in much of the research that is presented there, stating that, "this would never be acceptable at a meeting in [my discipline]." I also have seen post-secondary administrators with science backgrounds refuse to invest resources in educational programs until the research presented as the justification for these proposed programs achieves a level of rigor and validation that would justify allocation of resources. This dichotomy between science research and science education research is more than just the difference found between any two groups with different research methodologies. For example, research in the natural sciences and research in psychology employ many different methodologies and the differences between these disciplines are not unlike the differences between science and science education. Nevertheless, most scientists do not hold psychology research with as little regard. I believe that one main reason for this is that Psychology, as a discipline, has made a conscious effort to require a high level of rigor for their published research.

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My Venture

How can this gap be bridged? Each group needs to examine the "mote in their own eye" as well as learn more about the scholarship of the other. First, scientists need to learn more about the value of qualitative research and the checks and balances that *should* be used to achieve high quality, reliable science-education research data using these methodologies. On the other hand, science educators, if they have not done so, need to spend time totally immersed in the world of science research. Participating in science research and experiencing the level of research rigor demanded by the scientific community for publishable research will enable them to better understand the scientist perspective and the world of the scientist. Furthermore, this deeper understanding of science can only positively influence science education in many other ways. I feel that this experience will result in a community of science educators that is more critical of their own research and a "raising of the bar" on what is acceptable for publication and what should be considered as exploratory or pilot research. High quality research—both that which is currently available and which would arise from an increased emphasis on rigor—coupled with better understanding of what constitutes rigorous *qualitative* research, will result in scientists who are more easily convinced of the value of reform-based instruction and the need to employ it.

Projects such as the GK-12 program of the NSF are attempting to provide this instruction to scientists-in-training—and we are engaged in one of these programs at my institution. In addition to educating graduate students from science disciplines, GK-12 seeks to educate the graduate advisors (scientists) of these students. We are also beginning to invite scientists to join workshop sessions held for inservice teachers that are designed to educate about reform-based teaching methodologies. Standing with a foot in both worlds, it seems to me that if the science education community is really serious about bridging the gap, they must be the ones to take the next step. A dialog about the research rigor issue needs to be initiated among the science education community (and/or expanded where it has already been initiated). The reality is that until science educators deal with the root cause(s) of the low regard that many scientists have for science education, reform will be slow—if it is achieved at all. The end result would be science educators whose scholarship is more readily accepted by the natural science community *and* scientists who are more willing to learn about and employ reform-based science teaching methodologies that are underpinned by rigorous research studies—a win/win situation.