

**Dr. Lawrence Woolf (Larry.Woolf@gat.com) testimony to the California Curriculum Development and Supplemental Materials Commission on 1/16/04 in Sacramento CA**

**Version Presented**

I am a PhD physicist at General Atomics in San Diego. I've been involved in many K-12 education activities for over 10 years.

The current draft of the Criteria requires that the science standards be taught using materials with "hands-on activities composing no more than 20-25 percent of science instructional time."

This 25% limitation is at odds with curricula and programs advocated by the National Science Education Standards, the American Association for the Advancement of Science, the American Association of Physics Teachers, the American Physical Society, the American Chemical Society, the National Association of Biology Teachers, the National Science Foundation, and the National Science Teachers Association. These organizations represent hundreds of thousands of scientists and science educators. None of these organizations have proposed or supported the limitation of hands-on activities as proposed by the draft Criteria.

It is also at odds with the vision of Glenn Seaborg, the father of the California Science Standards and former chairman of the Lawrence Hall of Science, who stated, "Lawrence Hall of Science programs have been able to successfully convey the essential elements of the "guided discovery" approach to science and mathematics education and to spell out how that approach can be practically presented, by both veteran and less experienced teachers, to the enormous benefit of all concerned. Learning by doing—activities in which students explore and experiment, as the teacher facilitates with open-ended questions to encourage independent and critical thinking—this effective educational philosophy and practice is the "hallmark" of the Lawrence Hall of Science. This too has its democratic reverberation, for without direct citizen and community "hands-on, minds-on" participation, there cannot be responsive and effective democracy."  
<<http://isswprod.lbl.gov/Seaborg/LHS25th.htm>>

Who is in favor of the 20-25% limitation? The handful of writers of this Criteria and the relevant section of the Framework. This handful of people must have strong evidence that hands-on programs in excess of 25% are detrimental to science learning. But do they? Where is their evidence?

As far as I know, it is non-existent. It is contrary to the views of thousands of scientists and science educators. It is also contrary to over 30 years of education research. This research has shown that interactive engagement of K-16 students in heads-on and hands-on activities produces much more conceptual understanding and problem solving ability than is achieved in traditional lectures. This limitation is therefore unscientific.

The Criteria also require:

"Each hands-on activity must include suggestions for how to adapt the activity to direct instruction methods of teaching."

Since lab work is hands-on, this edict indicates that labs must all be written so that they can be done by lecture – which seems absurd.

In industry, we utilize logic and the best available materials and ideas. These Criteria are illogical and prevent California's students from using the best science education materials. I find this action unconscionable.

As a scientist, I would be happy to provide data to back up all of my statements. I challenge the science subcommittee to do the same.