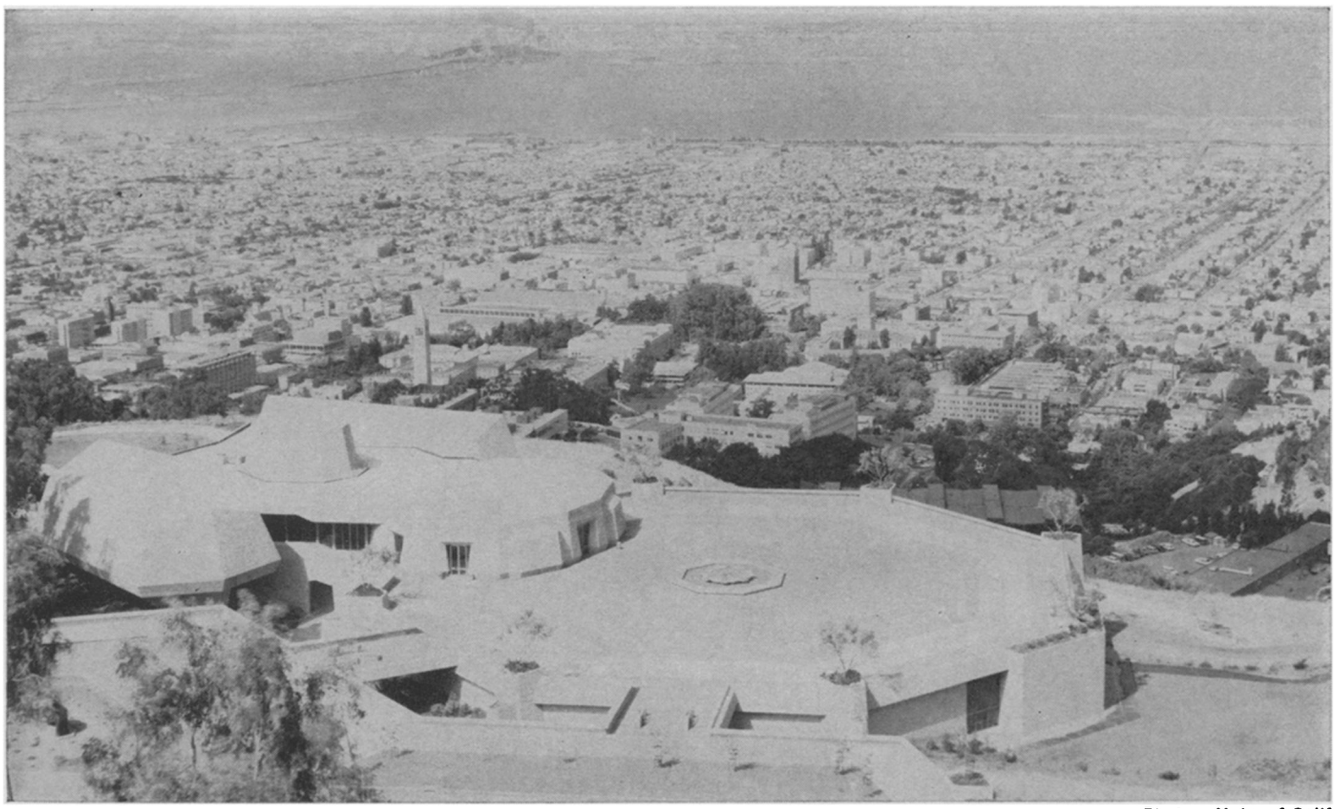
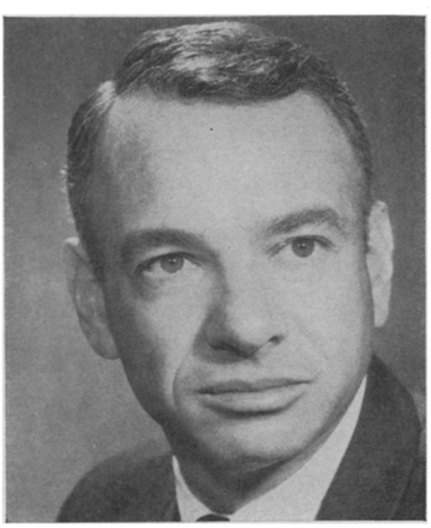


Photos: Univ. of Calif.

The Lawrence Hall of Science, overlooking San Francisco Bay, is a landmark in the new frontier of science teaching.



Portis: A way to meet new challenges.

EDUCATION

Research Olympus for science teaching

The Lawrence Hall of Science is leading the way in developing new methods for science and mathematics education

by Charles Weiss

In the fall of 1957 an aroused American public looked up at Sputnik and realized what specialists had known for years: Science education in American schools was sadly deficient. In too many high schools across the country students were deflected from science by outdated textbooks, untrained teachers and uninspired teaching methods. Science in junior high and elementary schools, when it existed at all, was in still worse shape.

After years of neglect, science teaching was suddenly in the limelight. Committees of the nation's top scientists, armed with large foundation grants, readily devised modern science curriculum and proved in model classrooms that elementary and junior high school students could learn much more than they had been given credit for. Thirty-year-old textbooks and hoary demonstrations were replaced by space-age curriculums and a newly rediscovered principle: The best way to teach science is to turn the student loose in a laboratory and let him find things out for himself. Eager graduates of new elite courses in high school biology, chemistry and physics forced colleges to revise their musty introductory courses or lose their students to other fields.

Yet in most schools across the country the promised revolution in science teaching is still hanging fire. The new curriculums have required too radical a change in teaching methods and too sophisticated a technical understanding for most of today's science teachers. Even the schools of education are frequently not convinced of the need for new approaches to the training of science teachers.

One of a unique pair of institutions that heads the effort to reformulate the

new frontier in science teaching is the Lawrence Hall of Science of the University of California at Berkeley. (The other is the Education Development Center, a nonprofiit organization in Newton, Mass., with strong links to the Massachusetts Institute of Technology Education Research Center.) In both places early crash efforts have been consolidated into a continuing program of curriculum development, teacher training, graduate research in science education and public relations.

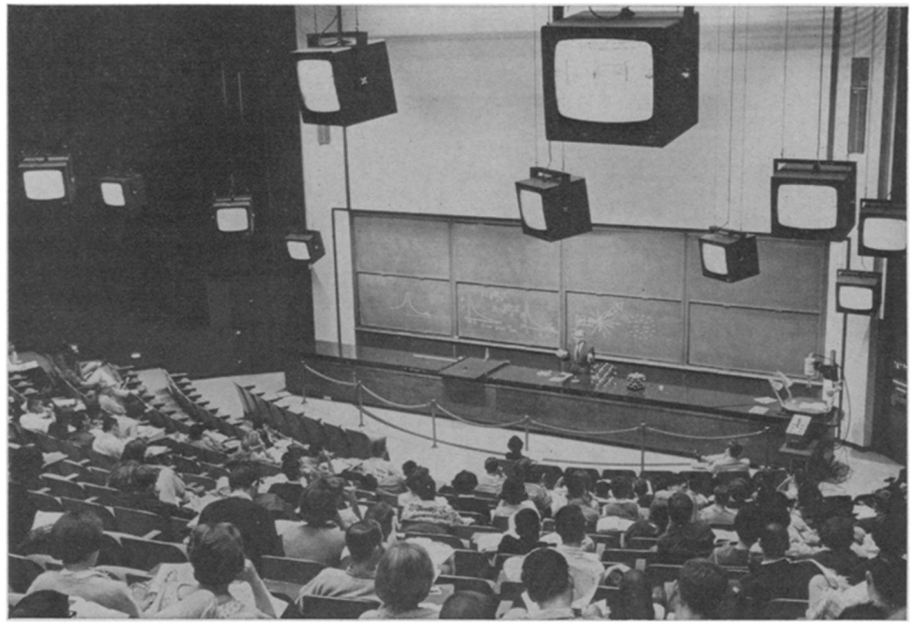
Housed in an impressive new building high in the Berkeley hills with a spectacular view of San Francisco Bay, the Lawrence Hall of Science combines many missions under one roof. In the words of its new director, Dr. Alan Portis, a Berkeley physics professor, "The Hall of Science exists to make it possible for University of California professors to do research in science and mathematics teaching." The Hall takes an active part in the University's Ph.D. program in science and mathematics education. It also offers a resource center where a teacher can come for a year to work on his own special project: a new unit, a film, a text, a piece of classroom apparatus. Teachers from anywhere are eligible; all they need is someone to pay their salaries.

The Hall also houses several continuing national curriculum development programs, including the Science Curriculum Improvement Study for elementary schools, the Chem Study program for high school chemistry and the new Chem Tec program for college students.

The LHS has deliberately set out to change the teaching habits of junior high school science teachers in the San Francisco Area (and eventually across the nation) with a series of summer and school-year institutes based on what is called the discovery method. Junior highs were selected because they were most in need of attention, says Mauri Gould of the LHS staff. Teachers come to these sessions expecting to hear a series of lectures on new or advanced technical topics. Instead, they sit down at a lab bench and discover scientific principles by themselves, using simple equipment they can later build in project shops across from the classroom.

While the regular teachers are at the Hall, specially trained substitutes go to their schools, take over their classes and try out some of LHS's new teaching units. (The salary of the substitute is the major expense to the school.) So successful are they proving to be that one of the Hall's major personnel problems is to keep its substitute teachers from being hired away.

Yet the substitutes themselves may originally have come to LHS with no experience or training in science teaching, as awed by technology as any housewife. In their first classes, these substitutes may figure out for themselves how to wire simple circuits, then go on to learn Ohm's Law as a series of experimental problems rather than as a formula in a book. The response is enthusiastic. As one junior high school teacher put it, "You know, I never really understood the difference between AC and DC before."



Innovations in classroom design contribute to the flexibility of the Hall.

After LHS institutes, teachers who had never before used their laboratories have returned on their own time to make classroom materials in the Hall project shop. Teachers who never had thought to ask their administrators for equipment money have fought for and received discretionary budgets—which they now, for the first time, know how to use effectively.

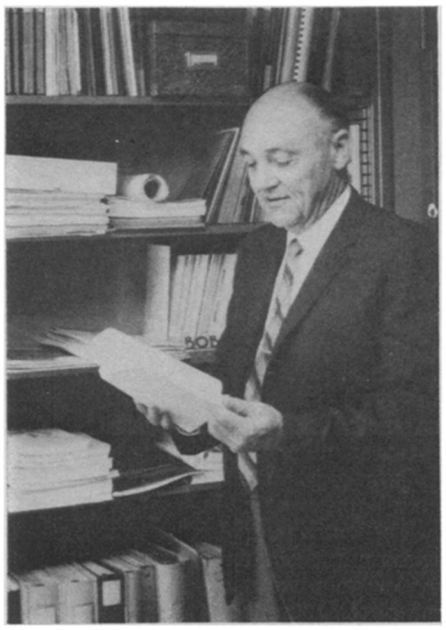
Such teachers have become innovators on their own, and no longer need depend on the experts. This creates an enthusiasm that is transmitted to the students. "When the kids start asking questions, you know they've got the message," says Gould. "Their curiosity is aroused. They are alert to their environment. They look at nature a different way."

One limit to the impact of LHS ideas on surrounding school districts has been the severe financial crisis now gripping California schools. Still, Gould says, "The school boards know that something is wrong; they are pleased with our approach and they have been willing to buy the things needed to put our ideas into practice."

Grant money has been an essential item since LHS opened for business in 1968, and the Hall is suffering from budget cuts along with the rest of the scientific community. The LHS financial predicament is the more piquant because national attention has shifted from the period of post-Sputnik preoccupation with science during which the Hall was originally conceived. With the educational problems of California's black and Mexican minorities now crying for public attention, the strictly scientific focus and Olympian image of the huge edifice on the hill no doubt hurts in the competition for the newly constrained educational budget.

Dr. Portis has met these new challenges with efforts toward a more direct contribution to community problems. Students from minority areas are being brought up to the Hall from San Francisco and Oakland for special classes, although only a small number can be transported more than once.

In any case, Dr. Portis insists that the Hall can contribute most to community problems by using the university's resources and the Hall's relaxed atmosphere to carry out original projects of future national import. As an example he cites the new national curriculum project for chemical technicians, sponsored by the American Chemical Society; a junior college project to introduce computing into the physics curriculum, and teacher-training and curriculum development programs that affect inner-city and suburb alike. Gould cites graduates of LHS teacher-training institutes who were able to achieve new rapport with minority science classes simply by putting away the textbooks and giving them something to do. "The discovery method is independent of reading ability," he



Rice: Bridging the resource gap.

emphasizes. "It gets the kids off the failure path."

Many innovations at LHS are in classroom design. The biology classroom is a remarkably flexible educational tool, yet costs little more to build than a standard classroom. Its movable lab benches have already become a standard item in educational equipment catalogues. The chemistry lab replaced the traditional permanent fume hood, which takes up valuable space, with a removable fume hood that can be stored when not in use. The movable lab benches have quick-disconnect fittings for easy rearrangement of utility connections. A 300-seat auditorium comes complete with closed-circuit television, a revolving stage and an elaborate preparation room. A new television studio has just been completed.

School politics in California is no tamer than elsewhere, and many obstacles lie between an idea at Berkeley and a new school building in southern Alameda County. No school has the resources to copy LHS ideas intact, says Robert A. Rice, a former president of the National Science Teachers Association. But educators are enthusiastic when they see how innovations can be adapted to local needs and budgets.

Despite its preliminary successes, the Lawrence Hall of Science still has much to do. "Twelve years after Sputnik," says Jack Campbell, LHS operations manager, "there are still high schools using science texts that are 20 and 30 years old. Here we are in business for only two years and we are already giving courses up to the limits of our capacity. There is so much to be done that nearly everything we try is a success." □