

## Science Teachers Speak Out: Laboratory Science National Science Teachers Association Issue Brief

On Monday, March 5, 2007 the National Science Teachers Association (NSTA) asked science educators and science supervisors via email to describe the problems with the lab experience in their school. Within a few hours NSTA received over 250 responses, many of which are listed below.

The question asked follows: *NSTA's position statement (<http://www.nsta.org/position>) asserts that lab science should play an integral role in science instruction. Yet the current quality of lab experiences is very poor for many students. High school labs in many districts are constricted by lack of funds for needed equipment and materials, and/or are hampered by poor or unsafe conditions. Many teachers are simply not qualified to lead lab investigations. **What are the problems with the lab experience in your school?***

- In my urban, inner city school, I teach a lab science in an old business room. There are no tables, benches, water or gas service, sinks, fire extinguisher, eye wash stations, fire blankets, or other equipment. In addition, while there is a high rate of attrition towards the end of the year, each September starts with 50 students in each class.
- I have no specific, safe area in which to conduct labs. My yearly budget is the same as it was 12 years ago. I must purchase all my own equipment and supplies. I have no safety equipment other than a portable eyewash station and a fire extinguisher. My district claims labs are "extracurricular" and not mandated by my subject. My kids are used to labs using kitchenware or materials purchased at Wal-Mart. They have no idea how to use scientific equipment or even what it looks like due to a lack of funding.
- I have been teaching high school biology for ten years. I have old microscopes that I could swap for coke bottles and not notice a difference. However, the greatest problem I see is my lack of skill in the area of lab investigations. I agree that this is the best source of learning that my kids can get, I just simply do not have the skill to design these labs. IF the NSTA wants to make a change in science education, THIS is where it should be done... TRAINING.
- My high school building was built in 1970. The budget for yearly supplies has not changed in the 6 years I have been here. I have a supply budget of \$750 per year. I teach between 3 and 4 science subjects per year 7 classes per day, two of them being chemistry and physics. I have absolutely no supplies to teach electricity and magnetism or optics. My chemistry supplies are even worse. My lab facilities are set up for physics, but I am expected to teach chemistry in low benches. I don't know a chemist who will use a bunsen burner sitting down. Hence, I do not teach the labs that require bunsen burners because I feel it is unsafe to use the burners in my room. I also do not have a ventilation hood in my room.
- We do not have any rooms to use as actual laboratories. Although we have lots of equipment, we have no place to safely use it and few teachers who know how to use it. Currently the one room that had been a lab is used by teachers to sell

hot chocolate and nachos to students to raise money for trips to Washington, DC for a very small group of students...the lab cannot be used as a lab...they removed the lab tables and installed desks for all the student

- I have not learned how to facilitate real thinking and essential planning for authentic lab experiences. I don't know what students really need in an introductory chemistry experience at the high school level, and I cannot figure out how to teach logical thinking and sequencing to 20+ students in lab at the same time. My time management skills are lacking. There's much more, too.
- I teach chemistry and earth science in a room with 6 lab tables; it was originally designed to be a physics lab room. There is electricity to the tables, but it doesn't work. There are not sinks, therefore no eye-washes; there are no gas outlets. The sink at my instructor's table has the water turned off and the gas turned off. We were given a budget of \$5000 for each department last year, but the orders were not filled because .... who knows? I have not received the supplies I ordered for 8 out of the last 10 years. When first took over this class-lab room and associated storeroom, there was a great amount of equipment and glassware and old kits and a little of everything. It is not possible to do any other than the most elementary labs at this school. It would be unsafe and probably criminally liable to attempt most chemistry labs. The fire extinguisher doesn't work.
- While I do not teach high school science currently but do teach in a 2-year community college, I see many students entering with virtually no lab experience. While some students come quite prepared, it's very frustrating for me to have students coming into a college biology class with no knowledge of basic lab equipment and techniques, such as using beakers, graduated cylinders, pipettes, or even basic microscopy skills.
- Our school does not provide enough funding for lab experiments. In addition, senior members of the department do not believe that other than AP students and some honors classes - should have access to lab experiments. Therefore the classes I teach - college bound and special education - have little to no money that goes towards lab science in the Biology classroom. Furthermore, the set up of the classroom also is a problem when it comes time to do lab experiments.
- I teach biology in a portable without any sinks, no storage, and only four outlets. It's such a challenge to put together a real lab. My portable is far away from the real science labs so it's hard to even get materials over here. There's no prep area out here so I have to go to one of the main buildings to prep. Yet those prep rooms are not easily accessed if you don't have an attached classroom. My room has carpet so I am reluctant to use many chemicals because they are difficult to clean up if spilled.
- Our school has minimal funding for improving the quality of lab sciences. Individual teachers are encouraged to write for grants using their own time without pay. Three of our four science rooms do not have eye wash stations or proper venting equipment. There is no interest in funding the purchase of

electronic data collection equipment/computer based labs by the administration. Little effort is made in our district to train teachers to improve the quality of lab experiments and the necessary follow-up assessment.

- Several things need to be addressed.(1.) The large amount of time to get a lab ready, carried out and cleaned up. Teachers need more time or a paid lab assistant. (2.)The equipment and supplies are lacking due to inadequate budgets. (3.)I was not trained or shown how to conduct labs. I had to learn it on my own. (4.)Students have never been taught how to behave in a lab. They think it's playtime not learning time. (5.)Six teachers share 1 lab. Scheduling is a major problem.
- We do not have adequate materials for labs at our school. We have 1 set of materials for each discipline (earth science, biology, chemistry and physics) and 5 or 6 teachers trying to use the materials for their class. The budget for our science department (high school of about 1900 students and growing) is \$6,000/year.
- Besides funding for lab science, my own school has 1964 construction, which means, the science rooms were built in a time when the accepted teaching method was direct instruction and not inquiry based learning. There is no space for ongoing projects.
- If this country is serious about educating our children in science then we need to provide designated laboratory teachers and updated equipment to these 50 year old facilities. Administrators need to be adequately trained or have someone who is, to give advice and support. Each school needs a lab budget, and not be dependent on the pockets of the struggling teacher.
- I am our district's K-12 science coordinator and have taught high school for many years in our district and in other districts. The two biggest problems I see (and hear from other teachers) too many students in classes and not being supported financially. Some principals feel science is too expensive. Currently due to the lack of support our AP Chemistry labs are taught by the classroom teachers at the local university.
- I teach upper middle school Science. We have NO equipment to do Science labs. Our school is five years old and no equipment was bought when the school was built. There is no way I can do labs without the basic equipment. The students beg for lab work but I have to say no because lack of funding.
- In our school district, the quality of lab experiences are hindered by the large class sizes(36 in a class). Along with the large class sizes comes unsafe conditions, including lack of space. A number of teachers also lack lab experience and are not qualified to lead labs correctly. Our district would benefit from teacher trainings on lab experience and labs that meet state standards.

- The major problems are lack of storage space for equipment and lack of funds to repair equipment or replace equipment with more modern and student accessible equipment.
- When our building was redesigned, a dedicated room for chemical storage was left off of the plans. We have had to divide our chemical stockroom among 3 prep rooms, which after 2 years are still not equipped with the storage and safety features needed. The rooms designated for Chemistry do not have fume-hoods installed, making it hard to do many of experiments safely. In addition, a majority of our science classes have at least 30 students in a classroom, with some lab classes having between 40 and 50 students in one classroom. With poor organization of resources, a large student-to-teacher ratio, chemistry teachers not highly qualified to teach the subject, and numerous safety issues, labs become exceptionally difficult to do.
- My district has newly refurbished laboratories. I am qualified to supervise labs as I have both industry and academic experience in chemistry. However, even though the lab is set up to safely accommodate 24 students, the school administration insists this is just a guideline and insists of overcrowding the labs with up to 28 students. This makes it hazardous for the students, as they are crowded together. It also makes it hard for me to supervise the students, especially in classes where there are students with IEP's or other learning issues. One teacher cannot safely supervise that many students in a lab involving chemicals, hot plates, burners, and glassware. In fact, in a class with multiple IEP's, twenty four students is too many for one teacher to supervise. There needs to be a maximum of students per teacher (allowing for weighting of students with IEP's) in a lab environment, or schools should hire lab aides to help teachers if that number is exceeded.
- Many teachers in my district, which is well-funded and well equipped, lack the confidence to conduct lab experiences. They most often have poor classroom management and therefore believe that the students would not practice safety and that someone could be injured. Another factor is several science teachers are also coaches and therefore will not conduct lab experiences with their students because coaching takes priority over instruction. They say that they don't have time to set up the labs.
- I believe lab science should play a key role in science education. Our main problem is lack of funding. We are not allowed to charge lab fees and our budget is \$3000 for 1500 students (7 teachers). Over half of our budget is used for paper (copies) so less than \$1500 is available for science. That doesn't buy much. It limits not only what we do but also limits the use of technology in science. We have highly qualified teachers to teach labs but not the funds to support them. We just recently cleaned closest to literally get rid of the old equipment from the 1950's and 1960's which was the last time we had large amounts of funding.
- We are assigned 37+ students per class making it difficult if not impossible to provide worthwhile safe laboratory experiences. Additionally, the lack of preparation time and no lab technician support means if a science teacher wants

to provide his/her students with a laboratory experience he/she must work late into the evening to properly prepare.

- Most of the problems center around getting the individual teacher to accept that labs are integral to the understanding of science. Most of our freshmen science teachers do not want to bother with setting up the lab equipment or monitoring students while they do the lab. It's much easier to maintain control while the students are in their seats taking notes
- I teach Chemistry and Physics at a Catholic High School. We are hampered by a lack of resources. I have lots of glassware and other materials that do not wear out, but when I came here last year we had no chemicals. I have ordered a bare minimum of chemicals, but our budget is small. Physics is in a little better shape, but most of the equipment is circa 1970's.
- We currently have 3 chemistry labs for 7 teachers, 1 physics lab for 3 teachers, and 5 biology labs for 8 teachers. Class sizes frequently are 30+ students for biology, 26+ for chemistry, and 24+ for physics. The main problem we face is lack of space and time to do labs. Our classes are overcrowded to the extent that the chemistry teachers have cut back on labs due to safety concerns. Our class time for labs has been cut from 74 minutes to 48 minutes in all general and honors classes, and this also impacts ability to do labs, especially as we share lab space with other teachers. To compound these issues, in 2008 we are bringing the 9th grade into the high school (we are currently 10-12), and this will add about 700 students into the building who will all be required to take lab science classes. We as a staff have no idea how we are going to manage this. Many of us are doing paper "labs" and computerized lab activities because of our safety concerns
- I love labs, but I am not given very much money to spend. Last year I was able to purchase several LAB-Aids kits. This year I was not allowed to purchase refill kits for them. The schools should be forced to allow a set amount of money for the purchase of equipment and supplies. I can't afford to pay out of pocket. I took over physics this year. It has been taught as a math class for several years. I asked for lab equipment and was turned down.
- Maybe I am in the minority but we have a fantastic situation. Our district just remodeled our science labs. We have a great space and good equipment. Our district not only supports but encourages science.
- We do not have the funds needed to do labs as we should. I am lucky if I get to do 1 or 2 actual labs for each of our 7 units. We do lots of hands-on activities, but they just aren't the same as experimentation.
- In the past we have had funding for the equipment but recent budget cuts have prevented us from buying the annual consumables, so the equipment just sits there.
- I am currently an 8th grade Science Teacher and attempting to be as much help to High School Science Teachers as I can. I have taught for 30 years and have watched as funding, lab facilities and equipment have declined. As a Middle

School teacher we could assist the high school with preparation for the science experience of all students, however our funding has been drastically cut along with the liability issues of labs. Simple science is difficult when we can not even use pond water and are now required to purchase expensive purchased samples or pre-prepared slides. If science suppliers would assist with some financial breaks for the middle schools it would help our cause. I am sitting with microscopes which we can not use, aquariums that remain empty as districts take a close look at liability of mold, mildew and ventilation.

- As a private school, we have all the necessary equipment and materials to run excellent labs. All our teachers are trained as lab instructors, and we make sure even the general students perform labs at least three times a month. That being said, teenagers do tend to push the limits at every chance. I have at least five "firebugs" who look for opportunities to do something dangerous. Consequently, constant vigilance is required. It is exhausting to set up, and most set-ups need to be refreshed between classes. However, the nature of science requires lab experiences for a true inquiry approach. I can see why school systems would get rid of labs altogether, relying on on-line simulations, but it is certainly worth the effort. Perhaps having a specific lab instructor who would run and maintain the labs, similar to a college environment, would work.
- Current situation: 1 biology lab, 22 bio classes; 1 chemistry lab, 19 chemistry classes; no physics lab; bio and chem labs are unsafe, run-down, ill-equipped. Future (2007): new science wing to be built, 15 lab/classroom combos, fully equipped and technologically up-to-date; science educators expect science education here to go from mediocre at best to hands-on, interactive, interesting, creative, ...a very positive experience. There is a definite need for professional development in science labs. Today's teachers have so little experience because of the conditions offered at most public high schools.
- One of the biggest problems I have faced in my teaching is that I have too many students in my room to safely do lab activities. I have one room with the lab area around the perimeter of the room and desks in the middle of the room. I have so many students in my room that the desks are pushed right up next to the lab counters on all sides. To do any activity where the students need to stand at the lab benches, the desks need to be pushed to the center and then there is not enough room for all students to stand at the counters together. In teaching the physics portion of 9th grade physical science I am fortunate that I have not had a lab that uses the gas, I would be quite hesitant to do so in this room because I do not believe it could be done safely. There is no recourse in my district for the number of students in my class, in fact I have heard that next year they are going to try to put more in my room. Due to this space constraint, I have done fewer lab activities.
- Our primary hurdles are lack of funds and equipment. Since we are a small, rural district with limited industry and local income, our budget for the entire science program is \$1200. This is barely enough to replace consumables in chem, phys sci, and biology, much less order the more expensive equipment. In addition, emphasis is more readily placed on math and english as these are the primary areas of standardized testing. Additionally, our class size is sometimes such that

labs must be limited due to space and safety issues. For the most part, our science teachers do a good job of implementing labs to the best of our ability.

- As a suburban district in an affluent community, we have very frequent lab opportunities--we have lab activities 2-4 times per week in biology. We recognize the importance of laboratory experience and are limited primarily by time available
- Actually - we have a wonderful lab experience for our middle school. One day a week we have students for 80 minutes to do lab - this is balanced against their history class - so on the alternate day they have history for 80 minutes. Works well and our kids leave having a good grasp of good laboratory practices.
- My middle school does not have a lab. I have to use 2 desks side by side to get a large enough flat area so students can do what I call desk-top labs. Money of course is also a problem so to get around that I sometimes ask students to bring in items from home such as different liquids so we can use them to test for pH. I sometimes have students work in groups of 4 to cut back on expenses when the ideal would be to work in groups of 2. Due to lack of space in the classroom, labs requiring extended observation time can't be done. So students complete these as at-home experiments. I require them to bring in the evidence to prove the task was actually done along with a completed lab guide. I avoid dangerous chemicals and use votive candles if flames are necessary
- We have a wonderful lab science program for our 7-12 grade students. It is set-up as a college model with a full-time lab instructor who preps, runs, and grades the lab work. Lab procedures are consistently followed, and students know what to expect. Labs are scheduled on a regular basis since classroom teachers do not have to make time to set-up/take-down labs.
- The biggest obstacle to providing quality lab experiences for science students in my high school is funding. The budget simply does not allow for in depth or multiple labs. We must pick and choose which labs to do, which is often determined by which labs are the cheapest. I feel that we are doing a disservice to our kids in this area.
- Science labs used to meet for a double lab period once a week. That got cut in the 90's at many schools due to mandated testing for education reform. It is very difficult to run a lab investigation in a 45 min or 1 hr format. You end up carrying it into the next class and losing the point. Also many science or lab aid position have been cut requiring teachers to do all prepping, make solutions, order supplies, etc. This is very time consuming never mind grading, planning and of course teaching.
- As a chemistry teacher I am, as expected, adamantly in favor of integrating laboratory experience into my curricula. I am fortunate in that I work in a high school with a once spectacular laboratory facility that was for over 20 years maintained by a trained laboratory technician. Four years ago that technician's position was cut, and since then the state of our lab has declined. Routine maintenance of equipment as well as preparation for every experiment is left to

the instructors; in effect, doubling or tripling our work, depending on the experiment performed. Given these conditions, many teachers have opted to eliminate many of the more challenging experiments their students once performed. Wouldn't it be great if we science teachers received a check in the mail to spend on equipment rather than a half nod and a heap of rhetoric from our elected officials?

- No money for lab supplies...I buy almost all my lab supplies out of my own pocket...and there is very little equipment...I improvise all the time, using recycled bottles and jars from home, and plastic cups from the supermarket...
  - My chemistry lab is very outdated and worn out. The space provided is nowhere near the suggestions for science lab classrooms today. There is only one exit which has 22 desks between it and the lab area. I have to constantly fight to keep my eyewash & shower working "just in case"! The drains leak & are wrapped with towels, which is someone's idea of preventing slow leaks. It is very much inadequate, but that doesn't keep me from doing a lot of lab work. I just try to keep it very benign as much as possible. It would be GREAT to have a renovated lab. I have done research and put in the request, but funding is tight and it is just not in the school's budget.
  - I know the materials I want/need to teach my content, but I am inhibited by unnecessary (way stricter than state standards) safety requirements for chemicals by my district, lack of funding for equipment, disinterest by district administrators in providing resources for "regular" (not honors) classes. And it was only last year that safety equipment (proper eyewashes, showers...) were installed in the classrooms. I didn't have those in my prep room. The fume hoods don't all work. The lab benches aren't bolted to the floor and get bumped around easily. THERE ARE TOO MANY KIDS IN MY CLASSES.
  - I agree that lab science is a much-needed partner with other science deliveries. In my school, I try to do at least one lab a week (either myself or as a class). Our school was built in 1954, there are many experiments that simply aren't safe in our laboratory. We have no fume hoods and ventilation is poor at best. Also, I am given a \$1000 budget per year to spend on all classroom consumables including chemicals. I can only order (restock) certain chemicals every year as ordering just 30 items would put me over budget.
  - Though we are lacking some supplies, for the most part we have the bulk of items that we need to do basic experiments. However, many teachers do not do them for lack of understanding the science and fear of labs with "tough", hard-to-teach kids. Labs take a lot of teacher effort, especially labs that work (like inquiry). Many of my colleagues are not held accountable for the lab component; therefore, they do not do the lab component.
-