Appendix B
Professional Organization Position Statements

American College of Occupational and Environmental Medicine
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These are position statements of national and state professional organizations and the Texas Education Agency. Local school districts should use the information based on evaluations of what is appropriate for their curriculum.
American College of Occupational and Environmental Medicine

The Use of Contact Lenses in an Industrial Environment

Guidelines

More than 34 million Americans wear some type of contact lenses. Of this number, many are employed as part of the industrial workforce. As the health professional most familiar with the hazards encountered in the industrial setting, the occupational and environmental medicine (OEM) physician must be able to address employee and employer concerns regarding the proper use of contact lenses in this environment. This guideline of the American College of Occupational and Environmental Medicine (ACOEM) addresses the use of contact lenses and personal protective equipment by the industrial worker under the guidelines of the Occupational Safety and Health Administration (OSHA). It is also intended to inform the occupational and environmental physician of specific standards regarding the use of contact lenses as authorized by OSHA.

Individuals wear contact lenses for cosmetic or medical reasons; some simply prefer to wear contact lenses instead of glasses for correcting refractive errors or visual ergonomic reasons. Contact lens wearers have sometimes been disqualified from industrial employment. Some individuals must wear contact lenses for medical reasons in order to obtain their best visual performance or efficiency and to increase their safety and/or proficiency in order to be able to perform the essential functions of their position.

OSHA Regulations

Regardless of the reason for wearing them, contact lenses do not fulfill the personal protective equipment requirements for ocular safety when worn by individuals performing eye hazardous tasks. OSHA, in the Code of Federal Regulations, requires individuals who wear contact lenses in the workplace to combine them with appropriate industrial safety eyewear.

OSHA has codified the voluntary ANSI Z87.1 consensus standard, which makes compliance mandatory. The OSHA rule states, “The required industrial-safety eyewear for the specific hazard identified in ANSI Z87.1 must be worn over the contact lenses.” Therefore, individuals who wear contact lenses are required to combine them with appropriate industrial safety eyewear (ANSI Z87.1) since contact lenses do not provide ocular protection from hazards such as particles, chemicals, and radiant energy. For example, medical personnel must wear eye- and face-safety devices to protect themselves from HIV or laser radiation, and cosmetologists should wear such devices to protect themselves from aerosol spray. Zelnick et al. showed that when a respirator was worn even without spectacles, there was a loss of visual field, which varied depending on the type of full-face respirator. Since the frames of glasses have been shown to be an obstruction of the full field of vision, the combined use of a respirator plus glasses compounds the loss of visual field.

The use of “intra mask corrections” (lenses suspended inside mask) and lenses built into a facepiece as a substitute for spectacles, leads to poor visual ergonomics.

Individuals who wear soft contact lenses may present with symptoms of “dry eyes” due to dehydration of the contact lenses especially if there is a low blink rate. For those whose tear flow is...
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not adequate, sometimes using artificial tears is necessary to minimize these symptoms. This may be worse in air fed respirators but the problem is minimal in return for better visual function, work proficiency, and safety.

Challenges to federal regulations and voluntary ANSI standards which disallowed the use of contact lenses with a respirator, resulted in an OSHA-funded research project conducted by Lawrence Livermore National Laboratories (LLNL). The research concluded that the “prohibition against wearing contact lenses while using a full-facepiece respirator should be revoked or withdrawn in spite of the limitations stated. Wearers of corrective lenses should have the option of wearing either contacts or eyeglasses with their full-facepiece respirators.” In consideration of LLNL’s research and other articles that support contact lens use, OSHA considered the prohibition unwarranted. OSHA published an enforcement procedure authorizing the use of rigid gas-permeable and soft contact lenses in all workplaces and with all types of respirators.

Contact lenses provide the best visual ergonomics for users of full face respirator masks. For those unable to wear contacts or those who experience problems with the contacts when using the mask (i.e. dryness), spectacles can be used. The spectacles must be of a type that will not interfere with the seal of the mask (elastic strap, intra-mask lenses).

OSHA, in paragraph (g) 1 (iii) of its preamble to Respiratory Protection rule states that “Because the final standard allows contact lenses to be worn, full facepiece respirators can be worn by persons needing corrective lenses; contact lenses obviously do not interfere with facepiece seal.”

Further, the preamble of the Personal Protective Equipment (PPE) for General Industry rule states, “Based on the rulemaking record, OSHA believes that contact lenses do not pose additional hazards to the wearer, and has determined that additional regulation addressing the use of contact lenses is unnecessary. The Agency wants to make it clear, however, that contact lenses are not eye protective devices. If eye hazards are present, appropriate eye protection must be worn instead of, or in conjunction with, contact lenses.”

Currently, OSHA statutes/rules recommends against contact lens use when working with acrylonitrile, 1,2 dibromo-3-chloropropane, ethylene oxide, methylene chloride, and 4,41- methylene dianiline chemicals. These recommendations are presumably based on best professional judgment of 1978 as no specific bases are provided in the preamble to these standards and must be adhered to until the rule is changed or a de minimus issued.

The 1978 National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards recommended that workers not wear contact lenses during work with chemicals that present an eye irritation or injury hazard. This policy was recommended by the 1978 Standards Completion Program and is based on the “best professional opinion of the committee membership based on literature data” (NIOSH 1978). The policy was also consistent at that time with general industry practice. The NIOSH Pocket Guide is strictly recommendations and not rules of law.

Recommendations

The following recommendations for contact lens use in an eye-hazardous environment will guide occupational safety and health professionals to safely implement the contact lens use policy.

1. Establish a Written Policy. Establish a written policy documenting general safety requirements for the wearing of contact lenses, including the required eye and face
position, and contact lens wear restrictions, if any, by work location or task. Evaluate restrictions on contact lens wear on a case-by-case basis. Take into account the visual requirements of individual workers wearing contact lenses as recommended by a qualified ophthalmologist or optometrist, in order to be able to perform the essential visual functions, and this policy statement.

2 Conduct an Eye Hazard Evaluation. Conduct an eye injury hazard evaluation in the workplace that includes an assessment of eye-hazardous environments per OSHA Personnel Protection Standards (29CFR 1910.132), and appropriate eye and face protection for contact lens wearers (OSHA 29CFR 1910.133 and ANSI Z87.1A 1998). The eye injury hazard evaluation should be conducted by a competent, qualified individual such as a certified industrial hygienist, a certified safety professional, toxicologist, or occupational health physician or nurse as appropriate. This information should be provided to the examining occupational health nurse or occupational medicine physician.

3 Provide Training. In addition to providing the general training required by the OSHA personal protective equipment standard (29 CFR 1910.132), provide training on employer policies on contact lens use, and first aid for contact lens wearers with a chemical exposure.

Routine training of medical and first aid personnel in the removal of contact lenses, management of pain, blepherospasm, and the appropriate equipment available. In the event of a chemical exposure, begin eye irrigation immediately and remove contact lenses as soon as practical. Do not delay irrigation while waiting for contact lens removal as the lens may come out with the irrigation or can be removed when irrigation is complete.

Instruct workers who wear contact lenses to remove the lenses at the first signs of eye redness or irritation. Removal of contact lenses should only be done in a clean environment and after the worker has washed his/her hands. Evaluate continued lens wear with the worker and an ophthalmologist (Eye MD). Encourage workers to routinely inspect their contact lenses for damage and/or replace them regularly.

4 Provide Personal Protective Equipment. Comply with current OSHA regulations on contact lens wear and eye and face protection. The Code of Federal Regulations Preamble on Respiratory Protectors (29CFR 1910.134) and Personal Protective Equipment (PPE) (CFR 1910.132) allows contact lenses to be worn under full-face respirators and other Personal Protective Equipment for the eyes.

Provide suitable eye and face protection for all workers exposed to eye injury hazards, regardless of contact lens wear. The wearing of contact lenses does not appear to require enhanced eye and face protection. For chemical liquid or caustic hazards, the minimum protection consists of well-fitting indirectly vented goggles or full-facepiece respirators. Close-fitting safety glasses with side shields provide limited chemical protection, but do not prevent chemicals from bypassing the protection. Face shields should be worn over other eye protection when deemed necessary for additional face protection, but workers should not wear face shields instead of goggles or safety glasses regardless of contact lens wear.

5 Notification to Visitors. Notify employees and visitors of any denied areas where contact lenses are restricted without appropriate eye and face protection.
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6 Notification to Supervisors, First Aid Responders and EMS Responders. Identify to supervisors and first aid responders all contact lens wearers working in eye hazardous environments.

Conclusion

ACOEM recommends that workers be permitted to wear contact lenses when handling hazardous chemicals and in other eye hazardous environments provided that the safety guidelines listed above are followed and that contact lenses are not: 1) banned by regulation; 2) contraindicated by medical or industrial hygiene recommendations; and 3) contact lenses cannot be utilized when working with acrylonitrile, 1,2 dibromo-3-chloropropene, ethylene oxide, methylene chloride, and 4,41-methylene dianiline until the rule is changed or a de minimus is issued. ACOEM concurs contact lenses are not eye protective devices and that contact lens wear does not reduce the requirement for eye and face protection.

Acknowledgements

This ACOEM guideline was developed by the ACOEM Eye and Vision Committee under the auspices of the Council on Scientific Affairs. It was peer-reviewed by the Committee and Council and approved by the ACOEM Board of Directors on May 4, 2003.

References

3 Blais, BR. Discrimination Against Contact Lens Wearers. JOEM. 40:10;876-880.
5 American National Standards Institute, Inc. ANSI Z87.1 1979 and Subsequent Revision.

Position Statements
Laboratory Safety

Council of State Science Supervisors

Laboratory Safety

The Council supports the premise that science should be taught in a space specifically dedicated to science classes with provisions for laboratory activities. A safe and well-equipped preparation and workspace for students and teacher must be provided. Adequate storage space for equipment and supplies, including a separate storage area for potentially dangerous materials, must be provided. An adequate budget for facilities, equipment, supplies, and proper waste management must be provided to support the laboratory experiences. They must be maintained and updated on a regular basis. Unique science supplies must be provided in sufficient quantity that students have a direct, hands-on experience.

The number of students assigned to each laboratory class should not exceed 24. Students must have immediate access to the teacher in order to provide a safe and effective learning environment.

Training in laboratory safety must be provided to the teacher. Necessary safety equipment, such as safety goggles, fire extinguishers, fire blankets, fume hoods, and eye washes, must be provided and maintained.
Science Education Safety: Key Issues in School Laboratory Safety

Students and teachers must be aware of the potential for safety problems in the science classrooms and laboratories. Schools should review available safety resources and develop safety training for their teachers and students as well as safety rules for the classroom.

Teachers must choose safe labs that cover important concepts. Thought must be given to the chemicals purchased by schools. Which chemicals are the safest for the proposed labs, how much is needed, where will the chemicals be stored and in what arrangement? Are the storage areas locked and well ventilated?

Schools needing to dispose of unwanted or unknown (no label) chemicals should contact their state science education supervisor, state ecology agency or regional EPA office. Teachers or school officials should be prepared to give the name or description of the chemical, amount, type of container, nearest landfill and local sewage system.

Some state education agencies have worked with their state pollution control agencies and have used polluter fines to conduct statewide school chemical clean-ups in their states. Where this can not be done, local schools should band together to engage in regional chemical clean-ups to conserve costs.

Scientific equipment must be maintained. Written lab instructions must be clear and safety rules emphasized in these instructions.

Most states have regulations on fume hoods, whole-room ventilation, chemical storage, eyewash, safety showers, eyewear, aprons, gloves, fire blankets, first aid kits, and fire extinguishers in science classrooms. Schools should check with their state science supervisor for regulations, laws, and liabilities.

**General Science Safety Checklist**

The following is a suggested checklist of safety concerns in K–12 science laboratories.

1. Appropriate protective equipment for the science laboratory
2. Enforcement of safety procedures
3. All students and teachers know the local policies on all protective equipment
4. All students read and sign a lab safety contract
5. Sufficient, accessible lab stations per number of students in each laboratory
6. All students must wear proper safety goggles whenever chemicals, glassware, or heat is used
7. Equipment and chemical inventory maintained
8. Chemicals properly arranged by compatibility and securely stored
9. Restricted amounts of chemicals
10. Adequate labeling on equipment, chemicals and hazards
11. Material Safety Data Sheets
12. Unobstructed exits from laboratory
13. Uncluttered laboratories
14. Master shut-off switches for gas, water and electricity
15. Safety Rules and charts posted
16. Records kept on safety training and lab incidents
17. Emergency exit/escape plan posted
18. Live animals and students are protected from one another
General Lab Safety Recommendations

1. Always perform an experiment or demonstration prior to allowing students to replicate the activity. Look for possible hazards. Alert students to potential dangers.
2. Safety instructions should be given orally and be posted each time an experiment is begun.
3. Constant surveillance and supervision of student activities are essential.
4. Never eat or drink in the laboratory or from laboratory equipment. Keep personal items off the lab tables.
5. Never use mouth suction in filling pipettes with chemical reagents. Use a suction bulb.
6. Never force glass tubing into rubber stoppers.
7. A bucket of 90% sand and 10% vermiculite, or kitty litter (dried bentonite particles) should be kept in all rooms in which chemicals are either handled or stored. The bucket must be properly labeled and have a lid that prevents other debris from contaminating the contents.
8. Smoke, carbon monoxide, and heat detectors are recommended in every laboratory. Units should be placed in the laboratory and related areas (storerooms, preparation rooms, closets, and offices).
9. Use heat-safety items such as safety tongs, mittens, aprons, and rubber gloves for both cryogenic and very hot materials.
10. A positive student attitude toward safety is imperative. Students should not fear doing experiments, using reagents, or equipment, but should respect them for potential hazards. Students should read the lab materials in advance, noting all cautions (written and oral).
11. Teachers must set good safety examples when conducting demonstrations and experiments. They should model good lab safety techniques such as wearing aprons and goggles.
12. Rough play or mischief should not be permitted in science classrooms or labs.
13. Never assume that an experiment is free from safety hazards just because it is in print.
14. Closed-toed shoes are required for labs involving liquids, heated or heavy items that may injure the feet.
15. Confine long hair and loose clothing. Laboratory aprons should be worn.
16. Students should avoid transferring chemicals they have handled to their faces.
17. Never conduct experiments in the laboratory alone or perform unauthorized experiments.
18. Use safety shields or screens whenever there is potential danger that an explosion or implosion of an apparatus might occur.
19. All persons engaged in supervising, or observing science activities involving potential hazards to the eye must wear proper eye protection devices.
20. Make certain all hot plates and burners are turned off when leaving the laboratory.
21. School staff should conduct frequent inspection of the laboratory’s electrical, gas, and water systems.
22. Install ground fault circuit interrupters at all electrical outlets in science laboratories.
23. A single shut-off for gas, electricity, and water should be installed in the science laboratory. It is especially important that schools in the earthquake zones have such a switch.
24. MSDS sheets must be maintained on all school chemicals. Schools should maintain an inventory of all science equipment.
25. Laboratories should contain safety equipment appropriate to their use, such as emergency shower, eye-wash station (15 minutes of potable water that operates hands free), fume hood, protective aprons, fire blankets, fire extinguisher, and safety goggles for all students and teacher(s).
26. Protective (rubber or latex) gloves should be provided when students dissect laboratory specimens.
27. New laboratories should have two unobstructed exits. Consider adding another to old labs if only one exit exists.
28. There should be frequent laboratory inspections, and school staff should conduct an annual, verified safety check of each laboratory.
29. Give consideration to the National Science Teachers Association’s recommendation to limit science classes to 24 students or less for safety.
30. All work surfaces and equipment in the chemical or biological laboratory should be thoroughly cleaned after each use.
31. Students should properly note odors or fumes with a wafting motion of the hand.
32. Chemistry laboratories should be equipped with functional fume hoods. Fume hoods should be available for activities involving flammable and/or toxic substances.
33. The several chemical authorities believe that contact lenses do not pose additional hazards to the wearer and that contact lenses are allowed when appropriate eye and face protection are used. The wearing of contact lenses in the science laboratory has been a concern because of the possibility of chemicals becoming trapped between the lenses and the eye in the event of a chemical splash. Check with your state science supervisor for your state’s recommendation.
34. All laboratory animals should be protected and treated humanely.
35. Students should understand that many plants, both domestic and wild, have poisonous parts and should be handled with care.

Criteria for scheduling special needs students into laboratory classes should be established by a team of counselors, science teachers, special education teachers and school administrators. Aides or special equipment should be made available to the science teacher.

*Adopted by the Council of State Science Supervisors*
The Role of Laboratory and Field Instruction in Biology Education

Philosophy

The study of biology provides students with opportunities to develop an understanding of our living world. Biology is the study of life and its evolution; of organisms and their structures, functions, processes, and interactions with each other and with their environments.

Scientific inquiry is the primary process by which scientific knowledge is gained. It involves the basic skills of questioning, prediction, qualitative and quantitative observation, classification, inference, communication and, additionally, integrated skills such as identifying and controlling for variables, generating procedures, planning strategies for testing hypotheses and answering questions, and for collecting and interpreting appropriate data. The knowledge of biology includes scientific data, concepts, hypotheses, theories, methodology, use of instruments, and conceptual themes.

Biologists recognize that knowledge based upon experimental results and accurate observations is gained through a variety of experiences, including the pursuit of cause and effect relationships. Thus, the role of the laboratory and field learning becomes a key component in understanding biology. Laboratory activities and inquiry provide students with opportunities to observe, sample, experience, and experiment with scientific phenomena in their quest for knowledge of living things.

The most effective vehicle by which the process of inquiry can be learned appears to be a laboratory or field setting where the student experiences, firsthand, the inquiry process. Laboratory and field studies have also been demonstrated to be effective means for comprehension, understanding and application of biological knowledge. Thus, study in a laboratory and/or field setting is an integral and essential part of a biology course. The following are recommendations regarding teaching strategies, physical resources, and curriculum development that will enhance the study of biology and improve the quality of biology instruction in our schools.

A Definition of a Laboratory Environment

In a laboratory or field learning environment, students work individually or in small groups on a question, problem or hypothesis; they use the processes and materials of science to construct their own explanation of biological phenomena. They will often observe, collect data and interpret data of life processes, living organisms, and/or simulations of living phenomena. The distinction between laboratory or field learning and traditional classroom learning is that activities are student-centered, with students actively engaged in hands-on, minds-on activities using laboratory or field materials and techniques.

Teaching Strategies

1. Direct experience. The laboratory and field components of biology instruction should provide experiences for direct student involvement which emphasize the above process skills and the tentative nature of science; knowledge is gained by observing cause and effect relationships among variables. It is essential for students to be provided opportunities for questioning, hypothesis formulation, experimental design, and data analysis. Also, students must be given opportunities to pursue procedural options rather than simply follow recipes.
They must be provided opportunities to design and carry out their own experiments. While computer-assisted instruction and video materials contribute to biology learning, they should not be used to substitute for direct observation of living organisms or for experiments in which students learn cause and effect relationships between and among biological phenomena. School administrators need to recognize the expenses related to offering experiential, hands-on laboratory courses and provide adequate funding.

2. Instructional time. Biology courses need to have an integrated laboratory and field experience component in which students spend at least one-half of their total instructional time. Provisions for this amount of laboratory and fieldwork should be made in the curriculum of a biology course.

3. Instruction. While we respect the professional teacher’s expertise in determining appropriate lessons and sequence of instruction, most of the student’s biology education should begin with experiences in a laboratory or field setting. These experiences allow students to construct new knowledge for themselves and can provide the basis for the introduction of more abstract concepts presented in lectures, discussions or reading assignments.

4. Quality of instruction. Biology laboratory instruction should provide students with frequent opportunities to observe and experiment with living materials, as opposed to nonliving specimens or artifacts. Every student should have direct, hands-on experiences with the laboratory materials.

5. Teacher education. Teachers of secondary biology laboratory instruction are expected to have a major in the biological sciences and should have formal training in laboratory and field teaching strategies (see NABT Biology Teaching Standards). Instruction in biology laboratory and field study should be an integral part of pre-service and in-service teacher training. Ideally, pre-service teachers should do “lab and/or field science” under the guidance of a research scientist. One cannot truly teach or truly understand process science until he/she has science research experience. Educational institutions should encourage their life science teachers to grow professionally by attending summer institutes and professional meetings, as well as taking graduate courses in biology and biology education. Administrators should seek educational funding from available sources to support and compensate teachers in their efforts to update their current knowledge and to network with colleagues from different schools.

Facilities, Classroom Environment, and Teacher Load

1. Laboratory space. Adequate and appropriate facilities, materials and equipment need to be provided for students to learn biology in a laboratory and field setting. This is essential at all levels of biology instruction, including elementary school, middle school, high school, college and university. The laboratory space should be (a) available to the teacher during the planning and preparation period and (b) available to students for special projects, makeup laboratories, etc. outside their regular class hours. Each student should have his/her own laboratory work space.

2. Facility. The laboratory classroom should be equipped with work areas that have sinks, a water supply, and natural gas and electrical outlets available in sufficient quantity to support a laboratory/field-oriented biology course. Adequate ventilation, fume hoods, and reference materials are also necessary, and the laboratory size must allow all students to participate in real hands-on activities. There should be adequate space for storage of materials and secure areas for storage of solvents, reactants, or potentially hazardous or dangerous chemicals as per guidelines set by the American
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Chemical Society. Facilities structure and configuration should be inspected for updating every 10 years. There should also be a space (living materials center) dedicated to growing living specimens for study in biology classes.

3. Materials budget. The National Science Education Standards address the need for making resources available; allocation of funds must provide opportunities to learn in an inquiry-based curriculum. To that end, biology teachers must be provided with an annual budget sufficient to purchase both expendable material and equipment necessary to conduct inquiry-based learning.

4. Safety. Approved guidelines for the safe use, maintenance and storage of laboratory materials must be followed. This includes classroom instruction on safety and emergency procedures. NABT Guidelines for the Use of Live Animals, Working with DNA & Bacteria in Precollege Science Classrooms (or safety guidelines from organizations such as NIH, the American Chemical Society, Flinn Scientific, etc.) and appropriate safety procedures for using plants and microorganisms should be followed. Each laboratory room must be equipped with safety goggles and laboratory aprons for all students, a first-aid kit, a fire blanket, and an all-purpose fire extinguisher. A safety shower and eyewash station should be available within a 20-second walk. Safety goggles, if used by different students, must be disinfected with an alcohol swab wipe before being assigned to another user. The state Department of Education guidelines for safety procedures should be rigorously followed.

5. Class size and supervision. A student-to-instructor ratio in the biology laboratory classroom must permit safe and effective instruction. Class size should be determined by the physical design of the classroom and should not exceed 24 students in a laboratory setting for any reason when students are assigned to a single teacher.

6. Teaching load. Due to the extra time and preparation that laboratory courses require, life science teachers should not be assigned more than five classes per semester. Since each laboratory requires a different repertoire of organisms, equipment, materials, supplies, solutions and planning, and also demands lessons plans and grading time, teaching load should not be more than two process-oriented science course preparations and have no more than 24 students assigned to each class. Teachers should have their own science classrooms and have access to those classrooms during their preparation times. Time must also be allowed within the teaching day for the setup and dismantling of laboratory preparations. Where possible, student or adult laboratory assistance should be provided, and in high school, we strongly recommend that a laboratory manager (or instructional aid) be hired to assist in preparation, setup, and dismantling of laboratory materials for experiential learning lessons.

Curriculum Development

Most laboratory and field activities used in the schools are prepared commercially; NABT urges these other developers to provide instructional activities that meet the above guidelines. The most productive curricula will be those with an abundance of active learning, such as laboratory and field investigations, upon which the teacher can base further indirect learning experiences, such as lectures, discussions and assignments.

Adopted by the Board of Directors, September 1990. Revised 1994. National Association of Biology Teachers
The Use of Animals in Biology Education

The study of organisms, including nonhuman animals, is essential to the understanding of life on Earth. NABT recommends the prudent and responsible use of animals in the life science classroom. Biology teachers should foster a respect for life and should teach about the interrelationship and interdependency of all things.

Classroom experiences that involve nonhuman animals range from observation to dissection. As with any instructional activity, the use of nonhuman animals in the biology classroom must have sound educational objectives. Any use of animals must convey substantive knowledge of biology and be appropriate for the classroom and for the age of the students. Biology teachers are in the best position to make this determination for their students.

NABT supports these experiences so long as they are conducted within the established guidelines of proper care and use of animals, as developed by the scientific and educational community. NABT encourages the presence of live animals in the classroom with appropriate consideration to the age and maturity level of the students (elementary, middle school, high school or college).

No alternative can substitute for the actual experience of dissection or other use of animals. NABT urges teachers to be aware of the limitations of alternatives. When the teacher determines that the most effective means to meet the objectives of the class do not require dissection, NABT acknowledges the use of alternatives to dissection including, models and the various forms of multimedia. NABT encourages teachers to be sensitive to substantive student objections to dissection and to consider providing appropriate lessons for those students where necessary.

To implement this policy, NABT endorses and adopts the “Principles and Guidelines for the Use of Animals in Precollege Education” of the Institute of Laboratory Animals Resources (National Research Council). Copies of the “Principles and Guidelines” may be obtained from the ILAR at 500 Fifth Street NW, Washington, DC 20001, phone 202 334-2590, e-mail ILAR@nas.edu. The Principles and Guidelines may be downloaded at http://dels.nas.edu/ilar/prin_guide.asp.

Adopted by the Board of Directors, May 2003. This policy supersedes and replaces all previous National Association of Biology Teachers statements regarding animals in biology education.
National Science Teachers Association

Safety and School Science Instruction

Preamble

Inherent in many instructional settings including science is the potential for injury and possible litigation. These issues can be avoided or reduced by the proper application of a safety plan.

Rationale

High quality science instruction includes laboratory investigations, interactive or demonstration activities and field trips.

Declarations

The National Science Teachers Association recommends that school districts and teachers adhere to the following guidelines:

• School districts must adopt written safety standards, hazardous material management and disposal procedures for chemical and biological wastes. These procedures must meet or exceed the standards adopted by EPA, OSHA and/or appropriate state and local agencies.
• School authorities and teachers share the responsibility of establishing and maintaining safety standards.
• School authorities are responsible for providing safety equipment (i.e., fire extinguishers), personal protective equipment (i.e., eye wash stations, goggles), Material Safety Data Sheets and training appropriate for each science teaching situation.
• School authorities will inform teachers of the nature and limits of liability and tort insurance held by the school district.
• All science teachers must be involved in an established and on-going safety training program relative to the established safety procedures which is updated on an annual basis.
• Teachers shall be notified of individual student health concerns.
• The maximum number of occupants in a laboratory teaching space shall be based on the following:
  1. the building and fire safety codes;
  2. occupancy load limits;
  3. design of the laboratory teaching facility;
  4. appropriate supervision and the special needs of students.
• Materials intended for human consumption shall not be permitted in any space used for hazardous chemicals and or materials.
• Students and parents will receive written notice of appropriate safety regulations to be followed in science instructional settings.

References

Section 1008.0 Occupant Load -- BOAC National Building Code/1996
Section 10-1.7.0 Occupant Load -- NFPA Life Safety Code 101-97
40 CFR 260-70 Resource Conservation and Recovery Act (RCRA)
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29 CFR 1910.1450 Laboratory Standard, Part Q The Laboratory Standard (Chemical Hygiene Law)

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Science Teacher Professionalism

Preamble

The teacher is the key to making science teaching a profession and to providing quality science education. For American society to accept science teachers as professionals, science teaching needs to conform to society’s professional practice model.

Society’s professional practice model is knowledge based and client oriented. It is a pact between society and members of an occupation whose work “requires discretion and judgment in meeting the unique needs of clients . . . (A profession organizes itself) to guarantee the competence of its members in exchange for the privilege of controlling its own work structure and standards of practice.” The profession assumes collective responsibility for defining, communicating, and enforcing professional standards of practice and ethics. It develops and maintains a process which ensures both the research and craft knowledge accumulated in the field are communicated and used effectively by all its members. That knowledge is also used to prepare, induct, certify, select, and evaluate new members. Further, the profession ensures continuous generation of new knowledge. Differences in knowledge levels, expertise, responsibility, and productivity result in differentiated roles, status, and compensation.

Science teaching requires an individual to exercise discretion and judgment in meeting the needs of students. Thus it is fitting for science teachers to assume the rights and responsibilities of professionals in our society. To do so, the educational enterprise in the United States must eliminate the existing hierarchy. The roles of all participants in the enterprise must change. Such initiatives are emerging throughout the country and are supported by research publications and position papers from professional societies. This position statement describes changes in structure and expectations which must occur to enable a science teacher to assume the role of a professional within society’s professional practice model.

Position Statement

NSTA supports the restructuring of schooling in the United States so that science teaching can become consistent with the professional practice model.

Teachers must collectively (1) establish and continually revise standards for the profession and (2) enable individuals to make choices exercising their own discretion and judgment in their professional work within the parameters of the collective standards.

Decisions

Since making decisions collectively is critical to establishing science teaching as a profession, interaction among teachers and the time to interact are essential. Sharing, mutual commitment, and caring about community must be facilitated. This means establishing new priorities for how teachers allocate their work time so they can collaborate with each other and other stake-holders to make policies and regulations relating to science teaching. Teachers’ success is evaluated in terms of these new priorities.

Decisions cover the entire range of school activities that impinge on science teaching. Some examples are monitoring science education programs and practice; identifying changes needed in schools so the needs of the local school population and the specific community in which students live are
met; relating disciplines, selecting curricula, materials, instructional approaches, and assessment procedures; allocating resources; hiring new teachers and influencing their preparation, induction, certification, selection and evaluation; and more.

Time

The multifaceted nature of professional science teachers’ responsibilities requires their work time be divided between interaction with students and interaction with parents, peers, administrators, scientists and other professionals, and other community members including people from business and industry. Community expectations and school structures (e.g., schedules, assignments) must be flexible enough to allow teachers to exercise discretion and judgment in meeting their obligations to the students and the adults with whom they interact.

Support

Teachers must have both technical and human support in order to make time available for the necessary interactions and to facilitate communication. Technical support includes ready access to a telephone, computer, modem, fax, photo copy machines, expertise to make maximum use of current hardware and software, and personal work space outside the classroom. Human support includes people such as a laboratory assistant, teacher assistant, and secretary to do tasks that do not require the unique expertise of the science teacher.

Professional Growth

Exercising discretion and judgment to make effective decisions requires information from many diverse sources about the specifics of each situation and current scientific, technologic, and pedagogic knowledge, information and skills. Therefore, teachers must continue to grow professionally, and life-long-learning must be supported. Teachers should determine what they need to learn and when they need to learn it.

Learning opportunities tailored to the point of need should be available to enhance teachers’ decision making and activities. Any behaviors which contribute to professional growth should be supported and rewarded (e.g., being active in professional associations, organizing and attending conferences, participating in bulletin board conferences and networks, taking courses and seminars, reading publications, visiting other classrooms, and informal interactions with other professionals). Learning opportunities should also include teachers as reflective practitioners who do research on their own experiences and their students’ experiences, thus continuing to increase the knowledge base of the profession.

Symbols of Professionals

Symbols are used in our society to nurture and build professional images. They identify a person’s professional status to others and aid in interaction and communication. For example, students and adults with whom one interacts can recognize the accomplishments and subsequent status of a teacher when teachers frame and display diplomas and certificates of licensing, of participation in study seminars, of appreciation, and awards. The code of ethics displayed on a wall announces the existence of professional standards. Business cards facilitate networking. The profession and individual teachers should develop deliberate public relations initiatives to build a public image supporting science teacher professionalism.
Position Statements

Science Teacher Professionalism

Responsibility

In order to effectively meet the needs of students, science teachers assume responsibility for enabling each learner to reach his/her own potential. This means cultivating the varied capacities of students by empowering them to think with all their senses; responding to their ethnic, cultural, and linguistic differences; focusing on learning in contrast to focusing on the content of the discipline and “covering the material”; and relating science to the whole of what students learn in schools.

Professional science teachers facilitate the construction of science concepts for learners. They are decision makers who employ knowledge of science, pedagogy, and change to fulfill their individual responsibilities. They are continuous learners who stay current in scientific, pedagogic, and change literature and are reflective practitioners who generate new knowledge and share knowledge. They assume collective responsibility for the profession, model ethical behavior in keeping with the profession’s standards of practice, and are accountable for their actions.

Science Teacher Professionalism

NSTA supports the restructuring of schooling necessary to enhance science teacher professionalism so that:

- Science teachers collaborate with each other and with stakeholders to make decisions about policies and regulations for science teaching.
- Science teachers allocate their time among students, parents, peers, administrators, scientists, and other community members.
- Science teachers have both technical and staff support in order to be available for interactions with students and other stakeholders.
- Science teachers’ professional growth continues throughout their careers. They select learning opportunities that meet their needs. They are reflective and share research findings from both their own and their students’ experiences.
- Science teachers use society’s symbols such as business cards, displaying diplomas, certificates, and awards to reflect professional images.
- Science teachers assume responsibility for enabling learners to reach their potential. Science teachers collectively establish and continually revise standards of practice, model ethical behavior, and account for their actions.

*Adopted by the National Science Teachers Association Board of Directors in January, 1992*

Science Teachers

Science teachers herein are defined as in the NSTA Visions paper which includes underrepresented groups: African Americans, Hispanic Americans, Native Americans, Asian Americans, the disabled, and women.

Laboratory Assistant, Teacher Assistant, and Secretary

Laboratory assistants collect, set up, and break down laboratory equipment, run inventories and order materials and equipment, and conduct safety inspections. Teacher assistants perform classroom clerical tasks, acquire teacher selected materials, and follow up on contacts within the community to set up field trips, guest speakers, funding etc. Secretaries do paperwork that includes attendance reports, book inventories, copying, running computer searches and making transparencies. Functions such as monitoring a hall, bus or cafeterias are also assumed by others.
Responsible Use of Live Animals and Dissection in the Science Classroom

Introduction

NSTA supports the decision of science teachers and their school or school district to integrate live animals and dissection in the K-12 classroom. Student interaction with organisms is one of the most effective methods of achieving many of the goals outlined in the National Science Education Standards (NSES). To this end, NSTA encourages educators and school officials to make informed decisions about the integration of animals in the science curriculum. NSTA opposes regulations or legislation that would eliminate an educator’s decision-making role regarding dissection or would deny students the opportunity to learn through actual animal dissection.

NSTA encourages districts to ensure that animals are properly cared for and treated humanely, responsibly, and ethically. Ultimately, decisions to incorporate organisms in the classroom should balance the ethical and responsible care of animals with their educational value.

While this position statement is primarily focused on vertebrate animals, NSTA recognizes the importance of following similar ethical practices for all living organisms.

Including Live Animals in the Classroom

NSTA supports including live animals as part of instruction in the K-12 science classroom because observing and working with animals firsthand can spark students’ interest in science as well as a general respect for life while reinforcing key concepts as outlined in the NSES.

NSTA recommends that teachers
- Educate themselves about the safe and responsible use of animals in the classroom. Teachers should seek information from reputable sources and familiarize themselves with laws and regulations in their state.
- Become knowledgeable about the acquisition and care of animals appropriate to the species under study so that both students and the animals stay safe and healthy during all activities.
- Follow local, state, and national laws, policies, and regulations when live organisms, particularly native species, are included in the classroom.
- Integrate live animals into the science program based on sound curriculum and pedagogical decisions.
- Develop activities that promote observation and comparison skills that instill in students an appreciation for the value of life and the importance of caring for animals responsibly.
- Instruct students on safety precautions for handling live organisms and establish a plan for addressing such issues as allergies and fear of animals.
- Develop and implement a plan for future care or disposition of animals at the conclusion of the study as well as during school breaks and summer vacations.
- Espouse the importance of not conducting experimental procedures on animals if such procedures are likely to cause pain, induce nutritional deficiencies, or expose animals to parasites, hazardous/toxic chemicals, or radiation.
- Shelter animals when the classroom is being cleaned with chemical cleaners, sprayed with pesticides, and during other times when potentially harmful chemicals are being used.
- Refrain from releasing animals into a non-indigenous environment.
Dissection

NSTA supports each teacher’s decision to use animal dissection activities that help students
1 develop skills of observation and comparison,
2 discover the shared and unique structures and processes of specific organisms, and
3 develop a greater appreciation for the complexity of life.

It is essential that teachers establish specific and clear learning goals that enable them to appropriately plan and supervise the activities. Teachers, especially those at the primary level, should be especially cognizant of students’ ages and maturity levels when deciding whether to use animal dissection.

NSTA encourages teachers to be sensitive to students’ views regarding dissection, and to be aware of students’ beliefs and their right to make an informed decision about their participation. Should a teacher feel that an alternative to dissection would be a better option for a student or group of students, it is important that the teacher select a meaningful alternative.

Finally, NSTA calls for more research to determine the effectiveness of animal dissection activities and alternatives and the extent to which these activities should be integrated into the science curriculum.

Regarding the use of dissection activities in school classrooms, NSTA recommends that science teachers
• Conduct laboratory and dissection activities with consideration and appreciation for the organism.
• Plan laboratory and dissection activities that are appropriate to the maturity level of the students.
• Use prepared specimens purchased from a reputable and reliable scientific supply company. An acceptable alternative source for fresh specimens (i.e., squid, chicken wings) would be an FDA-inspected facility such as a butcher shop, fish market, or supermarket. The use of salvaged specimens does not reflect safe practice.
• Conduct laboratory and dissection activities in a clean and organized work space with care and laboratory precision.
• Conduct dissections in an appropriate physical environment with the proper ventilation, lighting, furniture, and equipment, including hot water and soap for cleanup.
• Use personal safety protective equipment, such as gloves, chemical splash goggles, and aprons, all of which should be available and used by students, teachers, and visitors to the classroom.
• Address such issues as allergies and squeamishness about dealing with animal specimens.
• Ensure that the specimens are handled and disposed of properly.
• Ensure that sharp instruments, such as scissors, scalpels, and other tools, are used safely and appropriately.
• Base laboratory and dissection activities on carefully planned curriculum objectives.
• Be prepared to present an alternative to dissection to students whose views or beliefs make this activity uncomfortable and difficult for them.

Adopted by the National Science Teachers Association Board of Directors, June 2005
References


Additional Resources


Elementary School Science

The National Science Teachers Association supports the notion that inquiry science must be a basic in the daily curriculum of every elementary school student at every grade level. In the last decade, numerous reports have been published calling for reform in education. Each report has highlighted the importance of early experiences in science so that students develop problem-solving skills that empower them to participate in an increasingly scientific and technological world.

- The elementary science program must provide opportunities for students to develop understandings and skills necessary to function productively as problem-solvers in a scientific and technological world.
- Elementary school students learn science best when -
  a. they are involved in first-hand exploration and investigation and inquiry/process skills are nurtured.
  b. instruction builds directly on the student’s conceptual framework.
  c. content is organized on the basis of broad conceptual themes common to all science disciplines.
  d. mathematics and communication skills are an integral part of science instruction.
- The learning environment for elementary science must foster positive attitudes towards self and society, as well as science.
- Elementary school students value science best when -
  a. a variety of presentation modes are used to accommodate different learning styles, and students are given opportunities to interact and share ideas with their peers.
  b. the scientific contributions of individuals from all ethnic origins are recognized and valued.
  c. other subject areas are infused into science.
  d. inquiry skills and positive attitudes are modeled by the teacher and others involved in the education process.
- Teacher preparation and professional development must enable the teacher to implement science as a basic component of the elementary school curriculum.
- Teacher preparation and professional development must provide for -
  a. experiences that will enable teachers to use hands-on activities to promote skill development, selecting content and methods appropriate for their students, and for design of classroom environments that promote positive attitudes toward science and technology.
  b. continuing science inservice programs based on current educational research that encompass content, skills, techniques, and useful materials.
  c. participation in workshops, conferences, and meetings sponsored by local, state, and national agencies.
- The school administrators must be advocates for elementary science.
- Administrators must provide instructional leadership by -
  a. building consensus for an elementary science program that reflects state and national standards.
  b. implementing and monitoring the progress of the science program.
• Administrators must provide support systems by -
  a. supplying appropriate materials, equipment, and space.
  b. recognizing exemplary elementary science teaching.
  c. encouraging special science events.
• The instructional implementation and support system for elementary school science must include the combined efforts of all aspects of the community: parents, educators, businesses, and other organizations.
• The community must be advocates for elementary school science by -
  a. participating in ongoing planning, assessment, and funding of elementary science programs.
  b. promoting informal science learning experiences.
• Assessment must be an essential component of an elementary science program.
• Assessment must be aligned with -
  a. what is of value, i.e., the problem-solving model of instruction: concept application, inquiry, and process skills.
  b. the curricular objectives and instructional mode.
  c. the purpose for which it was intended: grading, diagnosis, student and/or parent feedback, or program evaluation.
• Elementary school science instruction must reflect the application and implementation of educational research.
• Elementary school science programs are improved when -
  a. teachers keep abreast of appropriate science education research.
  b. educational research becomes the premise for change or innovation in elementary school science, and teachers participate in action research in elementary science.

*Adopted by the National Science Teachers Association Board of Directors, July 2002*
Laboratory Science

The inquisitive spirit of science is assimilated by students who participate in meaningful laboratory activities. The laboratory is a vital environment in which science is experienced. It may be a specially equipped room, a self-contained classroom, a field site, or a larger place, such as the community in which science experiments are conducted. Laboratory experience is so integral to the nature of science that it must be included in every science program for every student. Hands-on science activities can include individual, small, and large group experiences.

Problem-solving abilities are refined in the context of laboratory inquiry. Laboratory activities develop a wide variety of investigative, organizational, creative, and communicative skills. The laboratory provides an optimal setting for motivating students while they experience what science is.

Laboratory activities enhance student performance in the following domains:

- process skills: observing, measuring, manipulating physical objects
- analytical skills: reasoning, deduction, critical thinking
- communication skills: organizing information, writing
- conceptualization of scientific phenomena.

Since the laboratory experience is of critical importance in the process of enhancing students’ cognitive and affective understanding of science, the National Science Teachers Association makes the following recommendations.

Preschool/Elementary School Level

- Preschool/Elementary science classes must include activity-based, hands-on experiences for all children. Activities should be selected that allow students to discover and construct science concepts; and, after the concept is labeled and developed, activities should allow for application of the concept to the real lives of students. Provisions also need to be included for inquiry activities in which students manipulate one variable while holding others constant and establish experimental and control groups.
- Children at all developmental levels benefit from science experiences. Appropriate hands-on experiences must be provided for children with special needs who are unable to participate in classroom activities.
- A minimum of 60 percent of the science instruction time should be devoted to hands-on activities, the type of activities where children are manipulating, observing, exploring, and thinking about science using concrete materials. Reading about science, computer programs, and teacher demonstrations are valuable, but should not be substituted for hands-on experiences.
- Evaluation and assessment of student performance must reflect hands-on experience. The full range of student experience in science should be measured by the testing program.
- Hands-on activities should be revised and adapted to meet student needs and to enhance curricular goals and objectives. There should be ongoing dissemination of elementary science education research results and information about supplementary science curricula.
- Hands-on activities must be supported with a yearly building science budget, including a petty cash fund for immediate materials purchase. Enough supplies, e.g. magnets, cells, hand lenses, etc., should be purchased, permitting each child to have hands-on experiences. Many science activities can also be taught using easily accessible, free and inexpensive materials.
- Reasonable and prudent safety precautions should always be taken when teachers and students are interacting with manipulative materials. (See NSTA publication: Safety in the Elementary Science Classroom)
• Preschool/Elementary science should be taught in a classroom with sufficient workspace to include flat moveable desks or tables/chairs, equipment, and hands-on materials. Consideration should be made for purchase and storage of materials with convenient accessibility to water and electricity. Computers, software, and other electronic tools should be available for children’s use as an integral part of science activities.

• Parents, community resource people, and members of parent/teacher organizations should be enlisted to assist preschool/elementary teachers with science activities and experiences. For example, these individuals could act in the role of field trip chaperones, science fair assistants, material collectors, or science classroom aides.

• The number of children assigned to each class should not exceed 24. Teachers and children must have immediate access to each other in order to provide a safe and effective learning environment.

Middle Level

• All middle level science courses must offer laboratory experiences for all students. Students at all developmental levels benefit from the laboratory experience.

• A minimum of 80 percent of the science instruction time should be spent on laboratory-related experience. This time includes pre-lab instruction in concepts relevant to the laboratory, hands-on activities by the students, and a post-lab period involving communication and analysis.

Computer simulations and teacher demonstrations are valuable but should not be substitutions for laboratory activities.

Investigations should be relevant to contemporary social issues in science and technology. (Note the NSTA Position Paper on Science-Technology-Society.) In those schools where team teaching is practiced, science topics should be integrated with the other academic areas.

• Evaluation and assessment of student achievement in science should reflect the full range of student experiences, especially laboratory activities.

• Laboratory activities in science need to be subjected to continual professional review. A need exists for ongoing research to evaluate the merit of certain laboratory activities, especially some traditional verification labs. Laboratory activities should be screened for safety and new activities need to be developed. An emphasis must be placed on disseminating new information to teachers.

• An adequate budget for facilities, equipment, and supplies must be provided to support the laboratory activities. The budget needs to provide funds for the purchase of locally available materials, as needed, during the course of the school year.

Training in laboratory safety must be provided to the teacher. Necessary safety equipment, such as safety goggles, fire extinguishers, and eye washes, must be provided and maintained.

• Due to the nature of middle level science activities, teachers should not have to share a laboratory with other teachers. A combination science-laboratory room should be used by only one teacher. This room should have at least one resident computer.

In schools where students are grouped together in interdisciplinary teams, it is more important for science to be taught in a well-equipped science laboratory than to have all students in a team in close proximity to one another learning science in a regular classroom.

• A competent student laboratory assistant should be provided to assist with laboratory preparation. It is a valuable experience for the student and helps alleviate some of the teacher’s time spent setting up and cleaning up activities.
Position Statements

Laboratory Science

- The number of students assigned to each class should not exceed 24. The students and teacher must have immediate access to each other for there to be a safe and effective learning environment.

High School Level

- All high school science courses must offer laboratory experiences for all students. Experiences must be provided for students who are unable to participate in specific laboratory activities.
- A minimum of 40 percent of the science instruction time should be spent on laboratory-related activities. This time includes pre-lab instruction in concepts relevant to the laboratory, hands-on activities by the students, and a post-lab period involving communication and analysis. Computer simulations and teacher demonstrations are valuable but should not be substitutions for laboratory activities.

Investigations relevant to contemporary social issues in science and technology should be encouraged. (Note the NSTA Position Paper of Science-Technology-Society.)

- Evaluation and assessment of student performance must reflect the laboratory experience. The full range of student experience in science should be measured by the testing program.
- Laboratory activities in science need to be subjected to continual professional review. A need exists for ongoing research support for evaluating laboratory activities and their appropriate use at particular grade levels, for screening activities to ensure safety, and for developing new laboratory activities. Special emphasis must be placed on disseminating the results of this research to teachers.
- An adequate budget for facilities, equipment, supplies, and proper waste management must be provided to support the laboratory experiences. Equipment and facilities must be maintained and updated on a regular basis. Unique instructional supplies must be provided in sufficient quantity that students have a direct, hands-on experience. For some activities, funds for field experiences must also be included in the budget.
- Science should be taught in a space specifically dedicated to science classes with provisions for laboratory activities. A safe and well-equipped preparation and workspace for students and teacher must be provided. Adequate storage space for equipment and supplies, including a separate storage area for potentially dangerous materials, must be provided. Special considerations should be given to ensure laboratory safety for the teacher and the students. Accommodation must also be made for computers and other electronic equipment in order to provide easy access for students to use these devices as laboratory tools.
- A competent paraprofessional should be provided to assist with preparation for laboratory experiences, including set-up and clean up, maintaining community contacts, resources searching, and other supportive services.
- No more than two different preparations should be assigned to the teacher for any academic term. The development, implementation, and evaluation of effective laboratory activities require extensive time by the teacher.
- The number of students assigned to each laboratory class should not exceed 24. The student must have immediate access to the teacher in order to provide a safe and effective learning environment.
College Level

- All introductory science courses must include laboratory experiences for all students, both science majors and non-majors. Studies in all sciences and at all levels are enhanced by laboratory experience. Appropriate hands-on experiences must be provided for students with special needs who are unable to participate in laboratory activities.
- College science curricula and/or programs must include a minimum of 40 percent and generally more than 50 percent of science instruction time on laboratory-related activities. This time includes pre-lab instruction in concepts and skills relative to the lab, hands-on activities by the students and post-lab discussion.

Computer simulations, video presentations, and teacher demonstrations are valuable and may be desirable at times but should not be substitutions for lab activities.

Investigations relative to contemporary social issues in science and technology should be encouraged.

- Evaluation and assessment of student performance must reflect the laboratory experiences. The full range of student experiences in science should be measured.
- Reduced teaching assignments should be provided for college teachers for the evaluation of laboratory activities and the development, implementation, and evaluation of new, effective, and safe laboratory activities.
- An adequate budget for facilities, equipment, supplies, and proper waste management must be provided to support the laboratory experiences. Equipment and facilities must be maintained and replaced on a regular basis. Computers and other instrumentation must be accommodated in order to provide secure and easy access for students to use in laboratory activities. Instructional supplies must be provided in sufficient quantity that students have a direct, hands-on, experience. Funds for pertinent field experiences, including supplies, transportation, and professional guides, where needed, should be available.
- Special attention should be given to ensure laboratory safety for the teacher and students. Science should be taught in facilities with provisions for laboratory activities. Sufficient work space and storage space for equipment and supplies, including a separate storage area for potentially hazardous materials, must be provided.
- Competent assistance should be provided to help with laboratory preparation and clean up, activities which represent an inefficient use of teacher time.
- The same teaching credit should be given to one hour of laboratory time as is given to one hour of lecture time. Teachers in the laboratory must constantly monitor student learning and anticipate, recognize, and respond to problems that arise.
- The number of students assigned to each laboratory class should not exceed the allotted work space or available equipment. In general, no more than 25 students should be assigned to a laboratory where a single instructor is present. Students must have immediate access to the teacher to provide a safe and effective learning environment.

*Adopted by the National Science Teachers Association Board of Directors in January 1990*
Students with Disabilities

Introduction

Since the passage of the Individuals with Disabilities Education Act (IDEA) in 1997, schools have been committed to working toward inclusion of students with physical, mental, sensory, and emotional challenges in the classroom. Yet even with the best of intentions, barriers to learning science have emerged. These barriers include inadequate equipment, communication difficulties, insufficient numbers of instructional assistants and tools in the classroom, and lack of overall administrative support. In accordance with the National Science Education Standards, NSTA is strongly committed to developing strategies to overcome these barriers to ensure that all students have the benefit of a good science education and can achieve scientific literacy. While NSTA is aware of the importance of these issues for practicing educators with disabilities, the declarations focus on the preK-12 classroom.

Declarations

To overcome educational and physical barriers, NSTA recommends science teachers and administrators

- Have appropriate assistance, such as instructional aides or sign language interpreters, available to students with disabilities so that they can master the science material.
- Ensure that the instructional aides and tutors are competent to help students with disabilities learn science content.
- Ensure that educational aids, such as computers and assistive technologies, are available to help students with disabilities learn the science material.
- Provide literacy and mathematical tools to help students with disabilities access the science resources.
- Ensure that the classroom and work stations are accessible to students with different kinds of disabilities, including physical, visual, and auditory.
- Ensure that the classroom and the work stations are safe for all students by making necessary accommodations, such as modifying counter height, adjusting lab groups as appropriate, and bringing in instructional assistants on an as-needed basis.
- Ensure that high-stakes assessment tests are not used in a punitive way for students with disabilities and that positive decisions are made as a result of these tests.

In selecting science curriculum, NSTA recommends that science teachers, administrators, and community members

- Make every effort to select quality curriculum print materials and multimedia products that promote inclusiveness of people with disabilities through their text, illustrations, and graphics.
- Make every effort to select quality curriculum materials that present culturally diverse people with disabilities as role models working in all disciplines and at all levels of science.
- Work with curriculum developers and publishers to ensure that multimedia science materials, such as videos, CD-ROMs, and software, are accessible to students with disabilities through the use of closed captioning and other devices.
- Ensure that the science materials meet the educational needs of students with a range of learning styles so that the quality and depth of science investigations are equivalent for all students in the classroom.
To overcome barriers in the way assessment tools are developed and used with students with disabilities, NSTA recommends that science teachers, administrators, and evaluators

- Design and implement varied kinds of assessment tools or models so that all students, regardless of their disability, can be tested fairly and can communicate fully what they know and are able to do in science.
- Provide administrative support for the development and use of a range of assessment tools that evaluate students with disabilities fairly.
- Work with individuals and agencies that administer high-stakes assessments to ensure that assessment scores are interpreted and used in ways that respect unique differences.

To help overcome attitudinal barriers and educate science teachers about what is involved in teaching students with disabilities, NSTA recommends that administrators

- Help students understand the importance of using a variety of teaching aids and assistive technologies so that they can be integrated into the classroom.
- Make professional development programs available to teachers and instructional assistants so they can learn about the unique needs of students with disabilities and how to meet those needs in the science classroom.
- Work with the school staff to ensure that everyone has an open mind toward students with disabilities and is prepared to help them master the science content.
- Ensure that adequate funding is available to meet the unique needs of students with disabilities in the science classroom.

In helping students prepare for careers, NSTA recommends that guidance counselors and science teachers

- Encourage students with disabilities to consider science and science-related careers by exposing them to a range of school and community activities.
- Provide students with disabilities with the most recent information about the kinds of opportunities available in the sciences.

*Adopted by the National Science Teachers Association Board of Directors, May 2004*

**References**

Individuals with Disabilities Education Act Amendments, Public Law 105-17. (June 4, 1997).

Liability of Teachers for Laboratory Safety and Field Trips

Laboratory investigations and field trips are essential to effective science instruction. Teachers should be encouraged to use these instructional techniques as physical on-site activity important to the development of knowledge, concepts, processes, skills, and scientific attitudes. Inherent in such physical activities is the potential for injury and possible resulting litigation. All such liability must be shared by both school districts and teachers, utilizing clearly defined safety procedures and a prudent insurance plan. The National Science Teachers Association recommends that school districts and teacher adhere to the following guidelines:

1. School districts should develop and implement safety procedures for laboratory investigations and field trips.
2. School districts should be responsible for the actions of their teachers and be supportive of the use of laboratory activities and field trips as teaching techniques.
3. School districts should look to NSTA for help in informing teachers about safety procedures and encouraging them to act responsibly in matters of safety and related liability.
4. School districts should provide liability and tort insurance for their teachers.
5. Teachers, acting as agents of the school districts, should utilize laboratory investigations and field trips as instructional techniques.
6. Teachers should learn safe procedures for laboratory activities and field trips and follow them as a matter of policy.
7. Teachers should exercise reasonable judgement and supervision during laboratory activities and field trips.
8. Teachers should expect to be held liable if they fail to follow district policy and litigation ensues.
9. School districts and teachers should share the responsibility of establishing safety standards and seeing that they are adhered to.

Adopted by the National Science Teachers Association Board of Directors in July 1985
Texas Education Agency

Dissection and Science

The Texas Education Agency Texas Administrative Code (TAC) Title 19, Part II Chapter 112 Required Curriculum, states “The Texas Essential Knowledge and Skills for Science require that as part of the regular instruction in science, students participate in and conduct investigations.” In addition to the requirements found in the Texas Essential Knowledge and Skills for science, the State Board of Education defined the percentage of instructional time that is to be used specifically in laboratory instruction: “high school courses shall include at least 40% hands-on laboratory investigations and field work using appropriate scientific inquiry.”

Laboratory and field experiences are also vital at the middle school level. Science equipment for laboratory and field investigations is necessary at the middle school level for student attainment of the required curriculum. Hands-on experiences help assure student retention of critical knowledge and skills. The science equipment and supplies listed in TEKS 4(A) at all middle school grades are required for student success on TAKS. Middle School students must retain knowledge and skills for the Exit-level assessments in science given at Grade 11. It is recommended that middle school students have at least 40% to 60% of instructional time in laboratory and field experience as part of their curriculum.

Elementary school students must also develop and retain knowledge and skills throughout their school career. The science equipment and supplies listed in TEKS 4(A) at all elementary school grades are required for student success on the Elementary Science TAKS given at grade five. Students with a variety of learning styles can be successful in science when they experience vertically-aligned science instruction that fosters concept and process skill development. Hands-on experiences help assure student retention of critical knowledge and skills at the elementary level. Research suggests 60%-80% of instructional time should be used in hands-on experience for K-5th grade students. Dissections of seeds, owl pellets, frogs, and assorted plant and animal specimens have traditionally been an integral part of laboratory science at the high school level and increasingly at middle and elementary school levels as well. Dissection laboratory experiences are excellent in engaging student interest in science. They allow students an incomparable learning opportunity that most students enjoy.

While it is not the purview of the Texas Education Agency to specify pedagogy, it is important to make the following recommendations when considering dissection labs:

1. Ethical Issues: Investigations should not be performed on any animal that might cause suffering, pain, or be a possible health hazard to the student, teacher, or environment. Teachers must be careful to be aware of endangered plant and animal species protected by state law and should enforce those laws in the classroom. Students should be made aware of the care and respect for plants and animals and the environment. Dissection for the sake of dissection is not an ethical choice for teachers or students.

2. Cognitive and Curricular Issues: The maturity of the students and the cognitive ability of students to appreciate the concepts to be learned from the dissections are important to consider.
Position Statements
Dissection and Science

Texas students should have multiple experiences in different contexts to understand the essential knowledge and skills appropriate for their abilities. All learning should be approached as it pertains to the curriculum the students are expected to learn in science. Making sure that the “big ideas” of science are an integral part of any laboratory or field experience is recommended.

3. Experiential Learning Issues: Students learn best through experiential learning. While there is value in demonstrations and simulations, it is recommended that all students be allowed to have “hands-on” experiences in the laboratory and field. In addition, The National Science Standards advise: “STRUCTURE THE TIME AVAILABLE SO THAT STUDENTS ARE ABLE TO ENGAGE IN EXTENDED INVESTIGATIONS. Building scientific understanding takes time on a daily basis and over the long term. Schools must restructure schedules so that teachers can use blocks of time, interdisciplinary strategies, and field experiences to give students many opportunities to engage in serious scientific investigation as an integral part of their science learning. When considering how to structure available time, skilled teachers realize that students need time to try out ideas, to make mistakes, to ponder, and to discuss with one another. Given a voice in scheduling, teachers plan for adequate blocks of time for students to set up scientific equipment and carry out experiments, to go on field trips, or to reflect and share with each other. Teachers make time for students to work in varied groupings--alone, in pairs, in small groups, as a whole class--and on varied tasks, such as reading, conducting experiments, reflecting, writing, and discussing.”

4. Student Sensibility Issues: At all times, teachers should consider the sensibilities of students regarding dissections. Students who object to dissections should be allowed alternatives to the activities. In addition, students with allergies, who have ethical or religious objections, should never be made to perform any activities that they find hazardous or offensive. Students should notify teachers prior to any situations that might offend sensibilities. A teacher or other responsible adult should always oversee any dissection laboratory.

5. Policy Issues and Local Control: Local schools should develop their own policy on such activities to ensure sound science programs. To learn more about laboratory and field experiences please access: Texas Safety Standards @ http://www.tenet.edu/teks/science/safety/safety_manual.html or The National Science Standards@ http://www.nap.edu/readingroom/books/nses/html/

I hope this helps you gather information on this vital part of the teaching and learning of science. If you should have further questions, please feel free to contact me for further discussion.

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Science Laboratory Materials

Recently science teachers around the state have been unable to use easily available products for lab materials. Such items as food products defined as “candy” have been termed as unacceptable for classroom use.

While district policy has the ultimate definition of such matters as a local control issue, and district guidelines supercede suggested practice, it is important to discuss guidelines for using any substance including materials defined as candy as lab materials.

Teachers of science are urged to engage student interest in science and to use inexpensive, everyday items to help students understand important TEKS-based scientific concepts and skills whenever possible. The National Science Standards highlight the need for science teachers to connect new learning based on tactile, sensory models.

The Texas Safety Standards: Kindergarten–Grade 12, a TEA publication, that is available at: http://www.tenet.edu/teks/science/safety/safety_manual.html encourages the active learning of science as “Science experiences allow students to inquire, explore, and observe things that are brought into the classroom specifically to stimulate student investigation.” Further it states that “When conducting field and laboratory investigations, students are to follow home and school safety procedures and environmentally appropriate and ethical practices. Students must demonstrate safety practices during the field and laboratory investigations and make wise choices in the use and conservation of resources.”

When substances, including food items and candy, are used as learning tools in a laboratory setting with specific and well defined TEKS related concepts, these substances become powerful learning lab materials, and do not interfere with regulations regarding students eating candy at school.

It should be strongly noted that laboratory safety rules state that students NEVER eat or drink any substance during laboratory use unless the teacher instructs otherwise. Allergies and student preferences are also very important for teachers to be careful to address.

Materials exposed to laboratory surfaces and/or handled by students may provide unsanitary conditions. Many teachers offer leftover candy as an incentive for student progress and have the students return at the end of the day to recover these items to take home with the approval and supervision of parents.

Administrators should use discretionary judgment to allow lab materials connected to sound instructional use. When the proper precautions have been taken, and articulated lesson plans clearly show benefits to using candy as a lab material, such permission is warranted.

If you have further questions, or need any assistance, please contact Chris Comer, Director of Science at chris.comer@tea.state.tx.us or Irene Pickhardt, Assistant Director of Science at ipickhar@tea.state.tx.us or phone TEA curriculum division at 512-463-9556.

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Position Statements