CODE
Council of Ontario Directors of Education

CODE HEALTH AND SAFETY COMMITTEE

Student Safety in Elementary Science and Technology Grades 7 and 8

A Resource for School Administrators

Revised November 2013

About this guide

This resource is designed to help principals, vice-principals and supervisory officers promote and address health and safety provisions and requirements in schools. Developed by a team of educators and health and safety professionals as a support to the Student Injury Prevention Initiative, this document will help school leaders to know, recognize and respond to their responsibilities and duties regarding student health and safety in grade 7 and 8 science and technological education classrooms *(Ontario Ministry of Education, Memorandum, George Zegarac, Deputy Minister, January 30, 2013)*. The information contained in this resource was compiled through a series of consultations with school board educators and school board health and safety representatives, and with partner organizations that offer health and safety services to the education sector.

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Background

Hands-on activities are an integral part of any science and technology program, linking the real world with the abstract concepts being studied. They promote critical thinking, collaboration and problem solving – skills identified as essential for 21st-century learners. Hands-on activities also introduce an element of risk to any science and technology program. However, most of these risks can be minimized with appropriate training and careful planning. The result will be a safe and engaging activity-based science and technology program.

It is crucial for everyone – administrators, teachers and students – to be actively engaged in promoting a positive attitude toward safety. This ensures a safe environment for all while teaching important lifelong skills. The significance of the teacher's role in modelling and promoting safety is clearly outlined in the Science and Technology curriculum document:

> "Teachers must model safe practices at all times and communicate safety expectations to students in accordance with school board and Ministry of Education policies." *(Ontario Ministry of Education, Science and Technology – Grades 1-8, 2007, p. 29)*.

Further, the STAO/APSO notes that:

> "As students approach the end of their elementary education they can be encouraged, and expected to, draw on earlier safety teaching in order to consider the health and safety implications of less routine practical activities which they plan for themselves" *(Be Safe. Science Teachers' Association of Ontario/L'Association des professeurs de sciences de l'Ontario, 2006, p. 4)*.

Purpose of this Resource

(Note: throughout this document, the word "principal" will be used to refer to both principals and vice-principals.)

The Science and Technology curriculum is diverse and complex, and classroom activities conducted on any given day may raise a broad range of safety concerns. For a principal with limited science and technology training, it is difficult to assess whether or not appropriate safety precautions are in place.

With these important considerations in mind, this resource provides a set of markers, called "look fors," that are characteristic of a safe learning environment. These markers are not intended to be a comprehensive checklist of science and technology safety; rather, they can be used to initiate an open and collaborative dialogue between principal and teacher for the purpose of enhancing safety. As a result, the principal is reassured that safety is sufficiently addressed, and that the teacher has conducted an objective assessment of the safety practices in his or her courses.

Examples of changes in practice that could result from this assessment include:

- Revising an experiment to use non-poisonous chemicals to grow crystals.
- Selecting a lower temperature glue gun to join pieces in a structure.

The use of this resource is not intended to replace regular inspections by experts trained to assess the degree to which observed practices comply with current health and safety legislation and best practices.

Safety and Grade Seven and Eight Science and Technology

An important characteristic of the elementary curriculum is that science and technology are blended into one cohesive program. An effective science and technology program challenges students to become proficient at both experimentation *and* technological problem solving. Experimentation often involves conducting a controlled investigation (or "fair test") in which one variable is altered to determine its effect on a specific outcome e.g., investigating the effect of temperature on the rate at which a substance dissolves. A successful experiment requires careful planning, the safe and effective use of materials and equipment, and analysis and communication of the results.

Technological problem-solving challenges students to design or evaluate creative solutions to specific problems. This could involve constructing, testing and modifying models of new devices or processes – for example, constructing different bridge designs to determine which structure can best support a load. A successful *solution* to these problems involves many of the same components required of a successful *experiment*, including testing, modifying and retesting the product or process.

Some tool use is required to meet the technology expectations. The selection of appropriate tools for an activity depends on the choice of materials and the skill levels of both teacher and students. While the expectations can be met using "repurposed or reused materials" such as cardboard tubes, tissue boxes, straws etc., the use of more sophisticated materials and tools increases the students' level of engagement and generally enhances their chance of success. The use of these tools also provides "real-world" relevance and a context to study theoretical concepts, and contributes to the students' overall technological literacy.

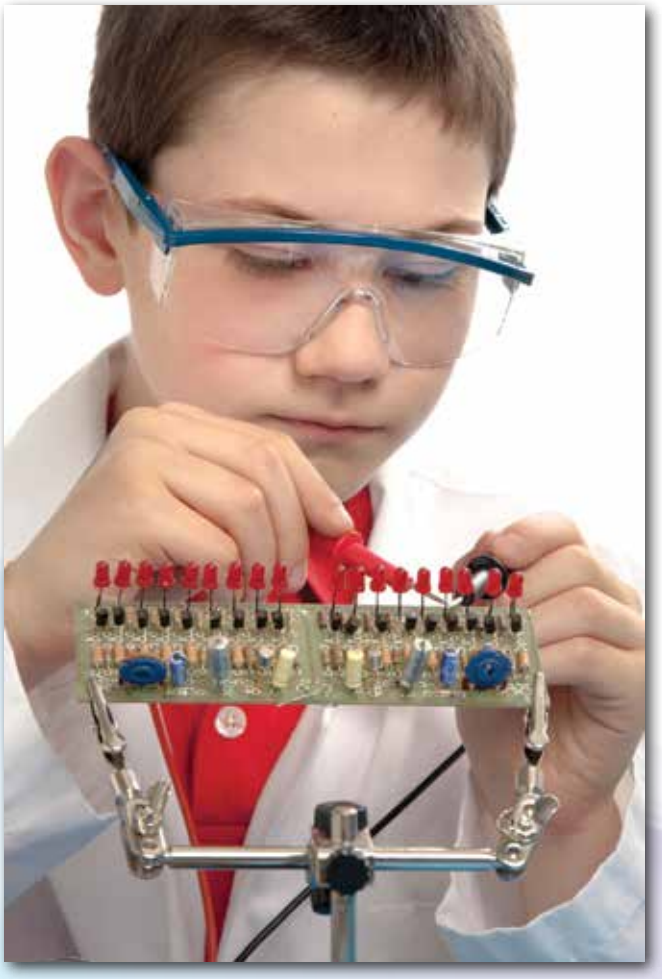
Safety must also be maintained during these activities. As the Curriculum Document reminds us, " . . . it is important not only that teachers have concern for their own safety but that they also have the knowledge necessary to use the materials, tools and procedures in Science & Technology safely. . . . " *(Ontario Ministry of Education, Science and Technology Grades 1-8, 2007, p. 8)*

The Curriculum Document also stresses the importance of teacher training: "Teachers supervising students using power equipment such as drills, sanders and saws need to have specialized training in handling such tools." *(Ontario Ministry of Education, Science and Technology – Grades 1-8, 2007, p. 29-30)*.

The materials and equipment required for a grade seven and eight science and technology program are typically less hazardous than those used in secondary school programs. However, there are also fewer subject specialists teaching in these grades. As a result, greater attention to teacher safety training is essential to ensure that mandated activities be conducted in a safe and effective manner.

Training is strongly recommended in:

- Selection and use of materials and equipment;
- Safer alternatives;
- Tool use; and
- Procedures to follow in case of an accident or unexpected outcome.



Shared Understanding and Sample Discussion Questions

This guide provides sample discussion questions intended to initiate an open and collaborative discussion between the teacher and the principal. In this conversation, the principal is not expected to be an expert. Instead, the questions are designed to enhance his or her knowledge of classroom safety precautions currently in place. At the same time, the discussion allows teachers to objectively assess the health and safety practices in their programs, and assure the principal that health and safety issues are being sufficiently addressed.

Sample discussion questions include:

1. What is your process to assess and minimize the hazards (e.g., selecting safer alternatives) in the activity?
2. What is your process for demonstrating the proper and safe use of the materials and equipment used in the lesson?
3. How do you model best practices with regard to health and safety?
4. What procedures are in place to ensure that students have the necessary skills and safety information for using the available tools? (For example, a "passport" system could be used in which students demonstrate their ability to use a tool effectively and safely, and are then "licensed" to use the tool. Other teachers keep an anecdotal record of when instruction was given and the date the student successfully demonstrated her/his ability to use the tool safely.)
5. What procedures do you follow to assist a student involved in an accident while maintaining the safety of the other students?
6. What is your procedure for the handling and disposal of waste?
7. Is there any additional training that you require?

Science and Technology Safety Checklist

The Science and Technology Safety Checklist is intended to offer principals, vice-principals and supervisory officers an overview of health and safety requirements in science and technology facilities, and to provide an opportunity for ongoing discussion with teachers. This checklist is not intended to provide a comprehensive assessment of science and technology safety; rather, it can be used to initiate an open and collaborative dialogue between principals and teachers to enhance safety in science and technology facilities.

Note: The following checklist for science and technology activities, facilities and instruction has been compiled using a range of resources, including health and safety publications, advice from boards and professional organizations, and consultation with science educators and health and safety professionals.

For the purposes of this document:

(i) "Lab" refers to a science classroom in which experiments are conducted.

(ii) "Activity" refers to both teacher demonstrations and student experiments.

Classroom or Facility	Comments
Although a specialized facility is not needed to deliver the technology expectations of the science and technology curriculum, any classroom used should have the following characteristics: • The room is organized to provide unobstructed sightlines. • Personal Protective Equipment (PPE) is readily available and easily accessible. • Secure storage facilities for materials and tools are evident. • Hazardous materials such as pressure-treated wood are not in use. • A first aid kit is clearly visible and well maintained. • A fire extinguisher is present in an appropriate location near an exit. • There is an eye wash station.	

Classroom or Facility *(continued)*	Comments
• A clearly-labelled container for broken glassware and a general-purpose spill kit capable of containing all the types of spills that could occur in the room are present. • Good housekeeping practices are evident i.e., lack of clutter, unobstructed aisles and doors. • Stable, secure work stations are available. • Students have sufficient, uncrowded work space. • WHMIS information is available where required. • Chemicals, equipment and tools are put away immediately after all classes have completed the activity. If power tools are being used: • The room has a dust collection system. • There is a mechanism for controlling crowding around machines i.e., lines on the floor in front of machines to indicate where the tool user is to stand, and where those waiting to use the machine should stand. • Safety rules pertaining to particular machines are posted at those machines. • There is a power lock-out switch to control power to the machines and therefore control access to the machines. (The key should not be left in the lock but should be controlled by the teacher.)	
Personal Protection	**Comments**
Use of Personal Protective Equipment (PPE): • Appropriate PPE is available and in use. • All students have eye protection on at all times regardless of what tools and materials are in use. • Goggles are sanitized before use if they are shared, as per board protocol. • PPE for hot materials is available and in use when required. • Students are not wearing gloves when using drilling, cutting and sanding machines. • Loose hair is tied back and secured. • Loose clothing is tucked in. • All jewellery is removed when working with tools, especially power tools. • Dust masks are available for students with dust sensitivity and allergies. • Eye wash stations are properly drained to prevent slip hazards.	

Safety Instruction	Comments
• A consistent set of safety rules is used in all labs. • Science and technology safety rules are posted in the classroom and provided to students e.g., as a safety contract and anchor charts. • Each student has demonstrated early in the school year that he or she has the knowledge, skills and habits needed to be safe. • Safety is included in pre-activity instructions to students e.g., proper use of equipment. • The teacher models appropriate use of personal protective equipment (e.g., eye protection) and other safety routines.	
Safety During Activities	**Comments**
• Activities that require special equipment – for example, chemicals or tools – are conducted only in the presence of a trained staff member (i.e., not a supply teacher). • Activities are appropriate for the maturity and skill level of the students. • Staff and students are dressed appropriately (e.g., closed toe shoes, no loose clothing, no dangling or distracting jewellery, long hair is tied back and secure). • Chemical splash goggles are worn when working with chemicals or heat. Impact goggles are appropriate when working with glass or rapidly moving small objects. • Appropriate accommodations are in place for students with special needs, such as providing a lower working surface for a student in a wheelchair. • Equipment is undamaged and in good working order. • The teacher approves procedures for student-designed experiments before they can be used. • All chemicals should be put away into their appropriate storage location at the end of class. Chemicals should not be left out after instruction has ended. • Suitable chemicals, as per *Safer Use of Chemicals in the School Science Laboratories (2004)*, are kept in limited quantities and stored appropriately in a locked cabinet. • Stored chemicals are grouped according to a board-approved classification system, e.g., STAO's Safe ON Science, p. 37. • Dispensed chemicals (e.g., dropper bottles) have appropriate WHMIS workplace labels. • Sufficient time is allotted for clean-up and waste disposal after each experiment.	

Safer Alternatives	Comments
• Chemical solutions are as dilute as possible. • Smallest possible quantities of chemicals are used. • Safer chemicals are substituted wherever possible. • Hot plates are used instead of open flames wherever possible. • Low voltage power sources are used for experiments involving electricity. • Microorganisms being cultured are safe (see Biosafety Level 1 organisms in STAO's Safe ON Science, p. 44).	

Emergency Procedures	Comments
(a) Eye Wash Stations are: • Accessible within 10 seconds of injury. • Clearly marked and unobstructed. • Capable of gently supplying water to both eyes for 15 minutes. • Tested regularly, as per board protocol. *(b) Plan and Procedures:* • A plan to deal with injuries is in place. • A board-approved first aid kit is readily available. • Procedures and equipment to deal with different spills (e.g., flammable liquids, corrosive liquids, solids) are in place. • MSDS is readily available for all substances being used in the classroom during an activity/experiment.	

Electrical Hazards	Comments
• All outlets are GFCI protected. • Electrical power cords are in good condition (e.g., insulation and ground pin are intact). • Extension cords are used on a temporary basis only to avoid creating a trip hazard. • The location of circuit breakers is labelled and is known to teachers, custodians and administration. • All electrical equipment is in good working order, and is grounded with an accessible shut-off switch and a magnetic switch. • All electrical equipment meets ESA (Electrical Safety Association) requirements (e.g. CSA, ULC, etc.). • Batteries are stored properly when not in use.	

Heating Hazards	Comments
• Hot plates are used instead of open flames wherever possible. • When heating substances, eye protection is worn, long hair is tied back and secured and loose clothing is tucked in. Jewellery that is dangling, distracting or might impede the safe use of the equipment must not be worn during any activity. • Open flames from tea lights or candles are never used in the presence of a flammable liquid.	
Fire Prevention and Control	**Comments**
• Dry chemical fire extinguishers are: – Located in each lab and chemical storage/prep room. – Checked regularly to ensure they are fully charged, as per board protocol.	
Master Shut-offs	**Comments**
• The locations of master shut-offs for gas, water and electricity are clearly labelled and are known to all science teachers, custodians and administrators. • All lab gas valves are checked to ensure they are closed at the end of each day under the supervision of the teacher. • The master shut-off for gas is closed when gas is not in use.	

Waste Disposal	Comments
• Disposal procedures for waste chemicals are consistent with board and local environmental protocols. • Lab waste (e.g. chemical, glass) is separated into properly labelled containers, as per board protocol.	

Chemical Storage	Comments
(a) General • Stored chemicals are: – Accessible by authorized personal using a specific key. – Well vented. – Away from sources of direct light and heat. • Chemical storage/prep rooms are off limits to students. • Chemical shelving is firmly secured to the floor or wall. • Large or heavy containers are stored below eye level. • Chemicals are not stored in an area where food or drink is consumed. *(b) Chemicals* • The handling and use of dangerous chemicals (e.g., ammonia, bleach, etc.) should only be performed by the teacher, if at all. • All new chemicals are labelled with the date received, the date first opened and the shelf life (if applicable). • The quantity of chemicals on hand is not excessive (e.g., one-year supply or less). *(c) Containers and Labelling* • All chemicals are stored in appropriate, sealed storage bottles (no food containers). • Chemical labels contain the purchase date or date of preparation. • Chemical labels comply with current WHMIS requirements.	

Documentation	Comments
• A complete set of current material safety data sheets (MSDSs) is readily available. • A current chemical inventory is readily available. • The record of equipment testing is readily available (e.g., fire extinguishers, eye wash station). • The list of staff with First Aid training is current and posted.