CSSS ELEMENTARY STEM TOOL SAFETY DOCUMENT

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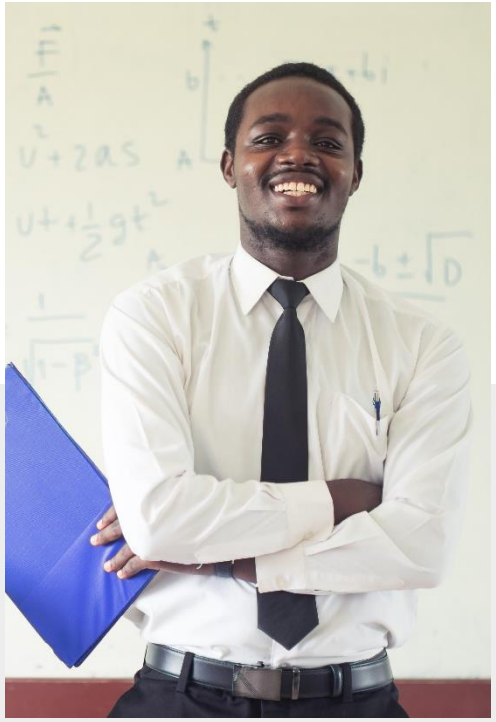
THE COMMON SAFETY CONCERNS IN ELEMENTARY STEM PROGRAMS INVOLVING TOOLS

Council of State Science Supervisors

2021



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Guidance on Common science lab safety concerns in the elementary schools across the USA based on proven best-practices and trusted safety protocols.

Many science teachers and supervisors have asked for an updated safety resource to use in their elementary science classrooms and labs to raise the level of awareness, and compliance in an effort to prevent any potential unsafe situations in the science & STEM department.

FLINN and the CSSS understands the situation that you are in currently and we have compiled a listing of common concerns and remedies for them which you can use in your school.

James Palcik, Director of Education, Safety and Compliance, and Tom Trapp, Director of National Accounts at FLINN Scientific Inc.

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Council of State Science Supervisors

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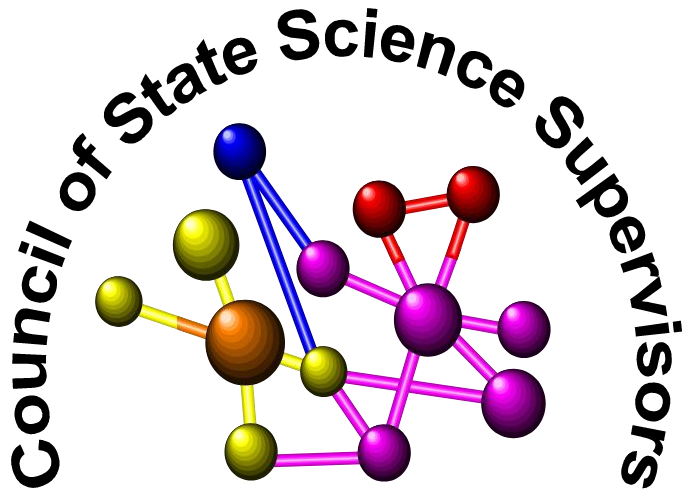
OVERVIEW OF THIS RESOURCE



Our mission is to sustain and nurture a dynamic learning community that empowers its members to be effective and articulate advocates for quality science education at the local, state and national levels.

Council of State Science Supervisors

"The voice and vision of science education for the states"

CSSS is the only professional science organization whose members have direct accountability to the government agencies given the constitutional authority for education. Within their own jurisdictions, each of these supervisors plays a key role in directing efforts at improving school science and to ensure excellence and equity in science education.

CSSS can offer state and national organizations a direct science education link to every school building in their state or territory. These science supervisors can provide information on the types of science programs their schools are using and how well each of the programs are working in their state. Most of the members serve on the state science teacher's organizational boards and are on a first name basis with their leaders. The Council members are proactive change agents in science for their state. Their responsibilities link the Council members by leadership and service to a broad constituency.

1. http://cosss.org/
2. http://cosss.org/page-18148

Science & Safety: Making the Connection

With the increasing emphasis on hands-on, minds-on inquiry instruction at all grade levels in the multiple science education frameworks that exist across the various states as a baseline for scientific investigation and courses of study, it becomes more incumbent upon science teachers to be as knowledgeable as possible about laboratory safety issues and their own responsibilities and accountabilities.

As recognized science supervisors/specialists, the members of the Council of State Science Supervisors (CSSS) are constantly receiving questions from teachers and administrators about safety issues, responsibilities, and liability. This resource document, which addresses some of the most commonly asked questions, is one response to those frequent inquiries.

The objective of this document is to provide a handy, concise reference for science teachers, primarily at the secondary (9–12) level. They can refer to it for information and resources on some of the most commonly asked questions that concern science teachers. Resources cited are in paper, electronic, and web accessible forms. It should be clear that this document cannot be com prehensive because of limitations of the format and purpose. It is hoped that the most important information needed about the topics is incorporated.

1. http://cosss.org/
2. http://cosss.org/page-18148

Special Notice to the Reader About this Resource

No implication of endorsement or lack of omission of any referenced material within this document. For more information about specific questions in the document as they pertain to a particular locale or state, contact your local or state fire marshal, building commission, health department/poison control center, environmental regulatory and state Occupational Safety and Health Administration (OSHA) agency, or science specialist at the local or state board of education/education agency (DOE).

The Council of State Science Supervisors, an organization of state science supervisors/specialists throughout the United States, has a long history of working collaboratively with other science education organizations and professional groups to improve science education on a national scale.

For more information about CSSS and its membership, direct your browser to http://cosss.org/

1. http://cosss.org/
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Legal Disclaimer

DISCLAIMER: The materials contained in this safety resource document have been compiled using sources believed to be reliable and to represent the best opinions on the subject. As stated above, the goal of this document is to provide a handy, concise reference that science teachers, primarily at the secondary (9–12) level, can refer to for information and resources on some of the most commonly asked questions that concern science teachers working in science departments in schools.

The document as a whole does not purport to specify minimal legal standards. No warranty, guarantee, or representation is made by the Council of State Science Supervisors or its consulting partners as to the accuracy or sufficiency of the information contained herein, and the Council and its supporting partners assume no responsibility in connection therewith. The document is intended to provide basic guidelines for safe practices and facilities.

Therefore, it cannot be assumed that ALL necessary warnings and precautionary measures are contained in this document and that other or additional information or measures may not be required. It is advised that users of this document should also consult pertinent local, state, and federal laws pertaining to their specific jurisdictions, as well as legal counsel, prior to initiating any safety program. Registered names and trademarks, etc., used in this publication, even without specific indication thereof, are not to be considered unprotected by law.

Key Safety Checklist General Items to recognize

1. **Have** and enforce a safety contract signed by students and parents.
2. **Identify** medical and allergy problems for each student to foresee potential hazards.
3. **Assess and minimize** barriers for students with disabilities.
4. **Model, post, and enforce** all safety procedures. Display safety posters and the numbers for local poison control centers and emergency agencies.
5. **Know** district and state policies concerning administering first aid and have an adequately stocked first-aid kit accessible at all times.
6. **Report** all injuries, including animal scratches, bites, and allergic reactions, immediately to appropriate personnel.
7. **Be familiar** with your school's fire regulations, evacuation plans, and the location and use of fire fighting equipment.
8. **Post and discuss** emergency escape and notification plans/emergency phone numbers in each space used for science activity.

1. http://cosss.org/
2. Flinn Scientific Inc. Professional Learning Series 2021
3. COSS: Science Safety: It's Elementary!

General Safety Considerations

9. **Make certain** that the following items are easily accessible in elementary classrooms, classrooms with labs, and science resource rooms:
   - appropriate-size chemical splash goggles that are American National Standards Institute (ANSI) Z87 or Z87.1 coded and of type G, H, or K only
   - non-allergenic gloves (nitrile are best choice)
   - non-absorbent, chemical-resistant protective aprons
   - eyewash units
   - safety spray hoses/shower
   - ABC tri-class fire extinguisher(s)
   - flame retardant treated fire blanket
10. **Make certain** that you, your students, and all visitors are adequately protected when investigations involving glass (not recommended), heat, chemicals, projectiles, or dust-raising materials are conducted.
11. **Implement** a goggle sanitation plan for goggles used by multiple classes.

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General Safety Considerations

12. **Keep** spaces where science activities are conducted uncluttered.
13. **Limit size** of student working groups to a number that can safely perform the activity without causing confusion and accidents.
14. **Prepare** records including Safety Data Sheets (SDS) on all chemicals used on safety training and laboratory incidents.
15. ***Provide** adequate workspace (45 square feet) per student as well as low table sections for wheelchair accessibility that can be supervised by recommended ratio of teacher to student of 1:24.
16. **Do not permit** eating and drinking in any space where science investigations are conducted.
17. **Do not store**, under any circumstances, chemicals and biological specimens in the same refrigerator used for food and beverages.
18. **Do not use** mercury thermometers with elementary students, since their use is inappropriate. Any mercury thermometers still present should be disposed of properly.

during the pandemic, spacing requirements are modified based on evidence-based research and prevention protocols

1. http://cosss.org/
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3. COSS: Science Safety: It's Elementary!

Science in Elementary School is all about DISCOVERY and EXCITEMENT!

Flinn Scientific understands that the elementary has an innate curiosity about the world surrounding them.

Most students in grades 1-6 are not overly concerned with safety practices and are more focused on learning about science concepts and doing fun and cool 'science experiments'.

With the emphasis on design-inquiry learning outcomes, sometimes students have great visions of their solutions, but are not always mindful of the safety protocols in place.

Basic Safety Protocols in Elementary School

Being proactive (prevention) is the best remedy to any situation. Teachers modelling proper behaviors in the classroom (wearing goggles or gloves) is a solid foundation towards setting the culture in the classroom. Safety exists as a standard in the workplace – and so it should be the same standard in the school classroom.

Additionally, teachers having an awareness of the potential hazards that exist with the use of tools, science equipment and apparatus, and especially with the use of chemicals is very important. Make sure that the students are washing hands often and that you sanitize all equipment and tools prior and post usage with the class. This is the new normal.

Teachers should be able to properly recognize safe procedures in the classroom and to identify areas of concern to minimize the risk of injury to students. **This is often referred to as a ‘Hazard Identification or Assessment’ across various platforms of teaching.**

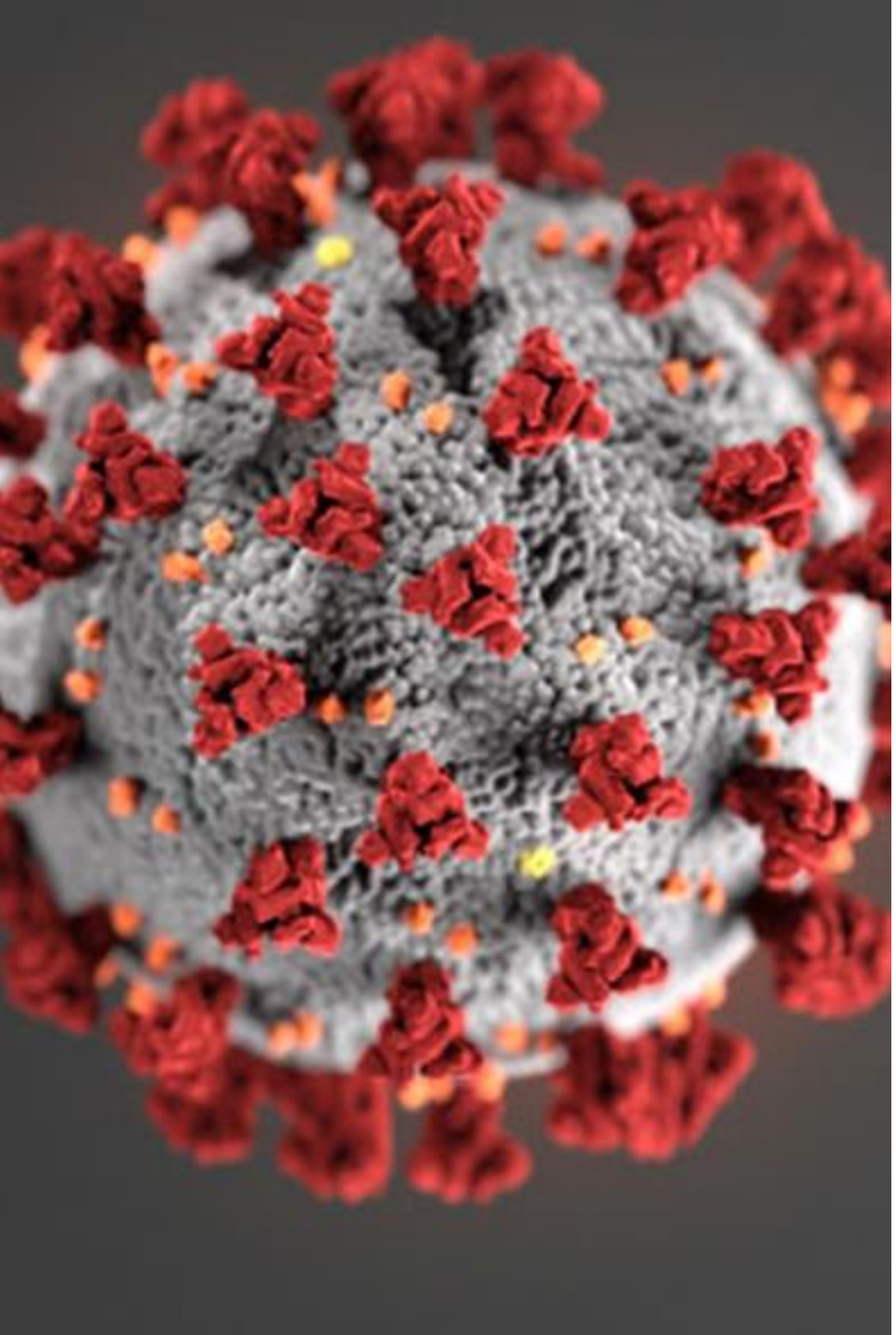
What types of preventative measures can we take to minimize the spread of a contagious virus?

Wash your hands! It seems very basic, but this is highly effective mechanism to prevent this virus from spreading through contact. 20 seconds of rigorous hand washing is the accepted amount of time. Soap and water is ideal, followed by alcohol-based sanitizer gels or liquids if you cannot access soap and water.

Sanitize your mobile phone, computer keyboard and work area. Use a disinfectant wipe to thoroughly clean your workspace before and at the end of your work or school day. Viruses can survive on surfaces for long periods of time. The same applies to the science equipment and hand tools used in the STEM classroom. Be vigilant about cleanliness.

Social distancing has also proven effective since maintaining a safe distance from a person who is coughing or sneezing (1m or 3 feet or more) minimizes the potential that the small liquid droplets released by the sick person will be inhaled or absorbed by you. The COVID-19 virus could be inside the droplets – so be mindful for your sake!

1. CDC Considerations for Schools



Prevention – continued

Don’t touch your face, eyes, ears, nose or mouth. Your hands are in contact with many surfaces and these are all potential sources of the Coronavirus or similar virus. By then touching your face and other organs, you increase the chance of contaminant transmission to your body and getting sick. It’s amazing how often you touch your face in an average day. **This is why sanitizing your classroom is important and non-negotiable in the STEM environment including items used.** Students are not always the most sterile people.

Make sure you and your students cough or sneeze into your elbow or some tissues. Seems simple, but it minimizes the droplets being distributed and increasing the chance of viral spread. Employing common sense hygiene techniques are effective. The virus can survive on your hand, clothing smartphone and work area tools and utensils for hours and potentially days just waiting to be transmitted through touch. Ensure your students follow your lead in this action.

1. CDC Considerations for Schools

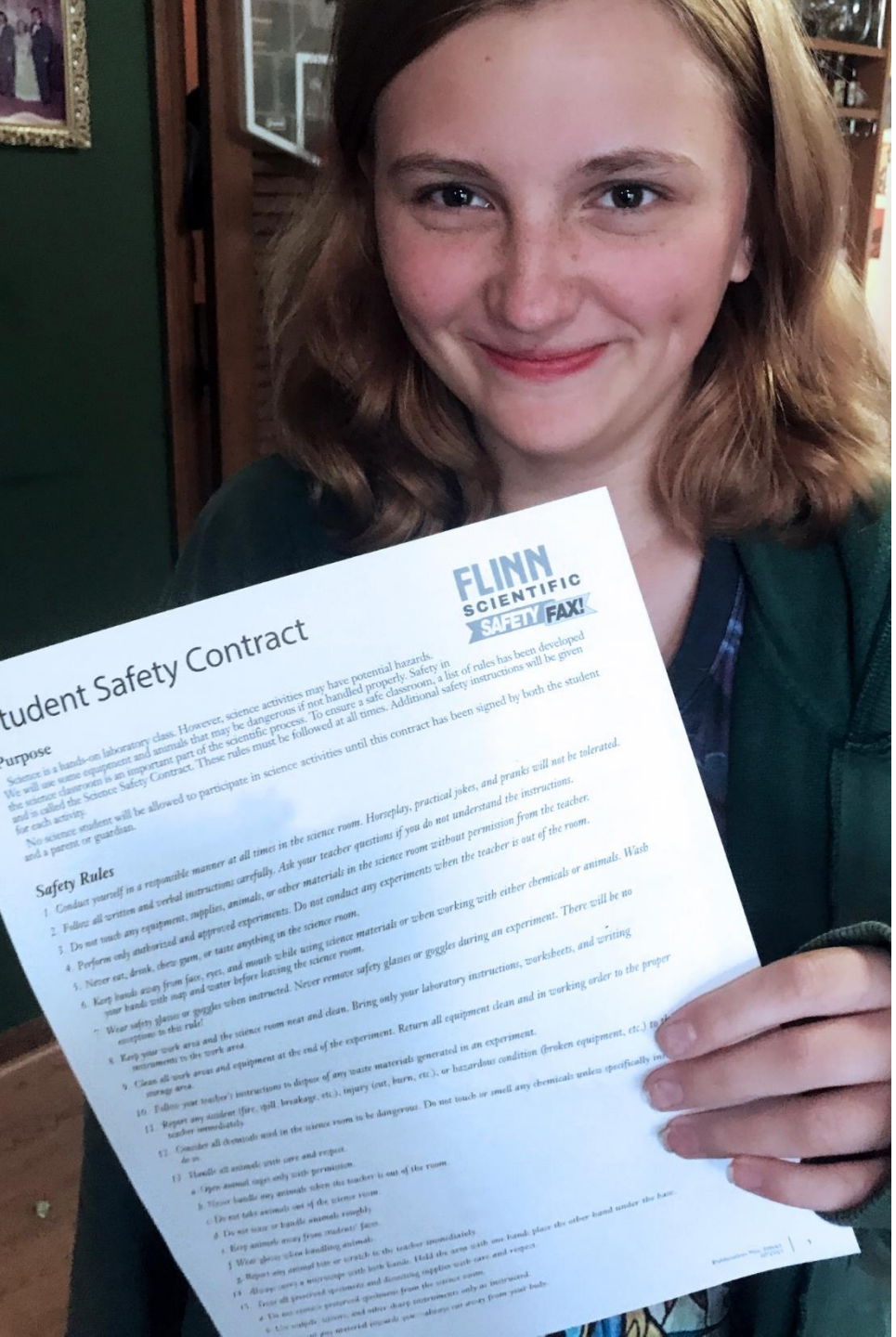
How Can You Minimize Potential Risks/Injury in the Classroom?

1. Teacher training and planning-ahead for science / STEM activities can help to mitigate possible risks/hazards/injury.
   - **Could you identify the safety hazards in the activities you have planned?**
   - **Did you sanitize/disinfect the tools and equipment prior to use?**
2. By planning for the classroom materials you will use and where they will be placed/handed out to the class
   - **Do you typically leave materials in one area and let students work independently or do you employ station-based learning?**
   - **Did you sanitize/disinfect the tools and lab equipment prior to storing them away?**
3. Teachers need to demonstrate proper safety practices (scissors, tools, sharp blades, goggles etc.) and tell students why these are critically important rules to be followed.
   - **Do you review the instructions with your classroom prior to the activity?**
   - **Demonstrate washing hands and sanitizing work spaces often and ensure students do the same.**
4. Teachers should also plan for potential problem situations and how to manage them.
   - **Do you practice fire drills? How about safety rules if a student was injured? Consider a role-play activity for students around safety.**

How Can You Minimize Potential Risks/Injury in the Classroom?

Teachers should make sure there are first aid kits, fire extinguisher, adequate PPE (goggles/gloves/aprons/ear plugs), hand sanitizers & soap available and ready prior to conducting any science/STEM investigation.

- **Do you know how to use each of these safety items? Insist on proper handwashing and sanitizing of equipment and spaces.**
- The best teachers look at the cradle-to-grave aspect of the activity including how/where/when the materials are distributed / collected / wastes disposed / post-activity procedures such as hand washing and return of all PPE (personal protective equipment)
- **Do you plan your lessons with an emphasis on safety? Do you structure your learning as stations or desk-based locations?**



Use of a Safety Contract (Rules) with Students

Please review a copy of the Flinn elementary science & STEM safety contract. One has been provided to you. You can download a complimentary version here: **Lab Safety STEM Contract**

You should adopt the practice of providing and reviewing a safety contract with your students that is age and grade-level appropriate.

Make sure that you discuss each safety point with your class and also reiterate these prior to conducting the science / STEM activities that these specific safety rules apply.

You may need to make accommodations for certain students based on their learning styles, skill sets, abilities and more. Make sure that safety remains a primary concern for the class and activity.

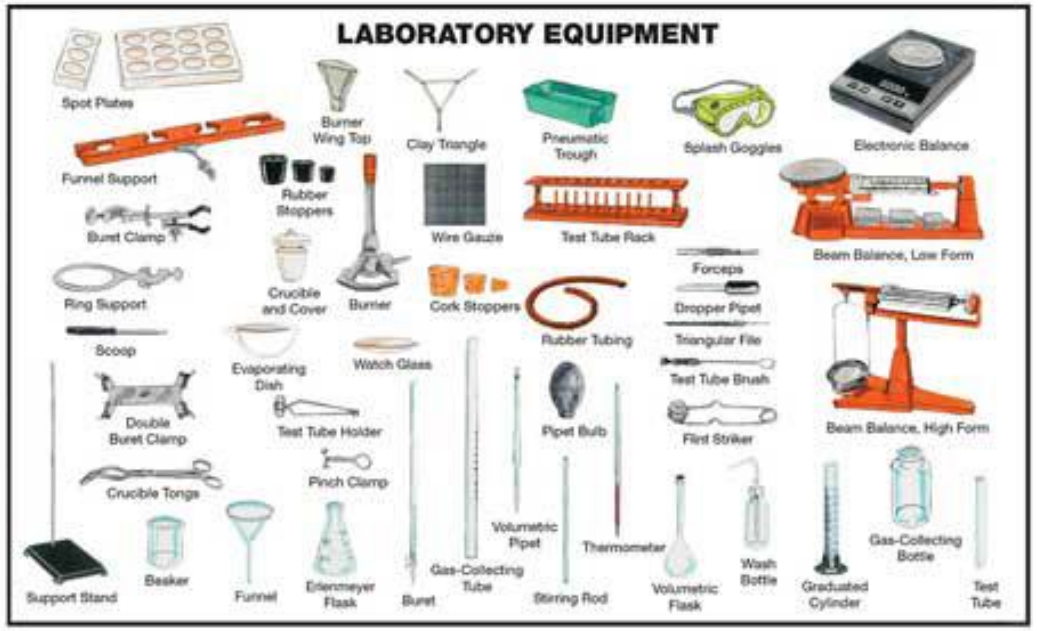
Other safety considerations for Elementary Teachers

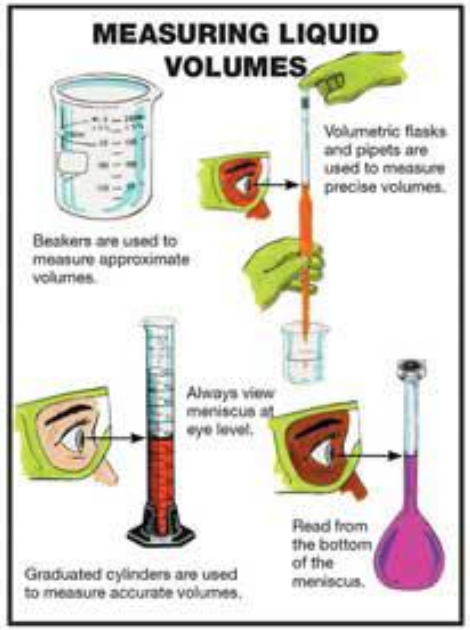
Teachers and students both love the excitement that accompanies the exploration of the natural world – biology – ecology – geology – chemistry – physics – engineering – technology and more. The innate curiosity in students is inspiring and fuels future innovation and understanding!

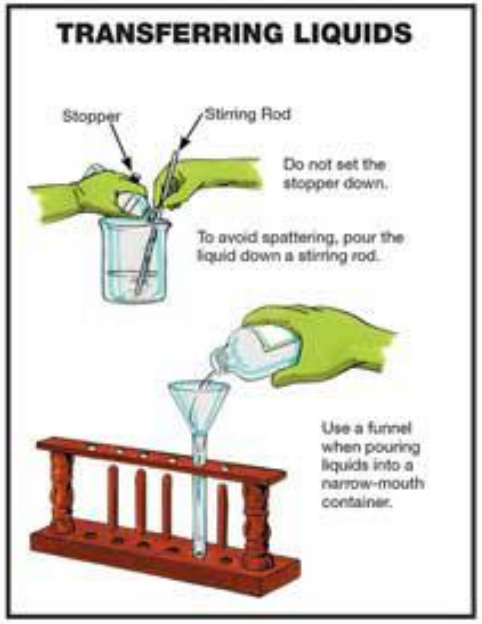
This is the baseline for problem-solving and scientific discovery for years afterwards. That reason alone is the driving force for elementary science and STEM programs.

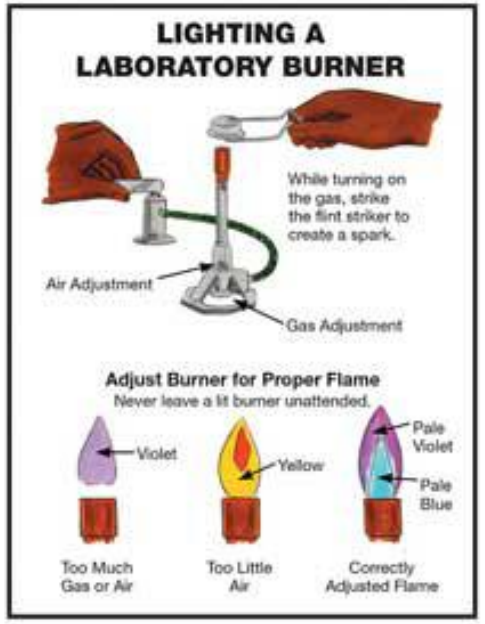
Teachers need to be mindful about activities that they see online and when considering what lessons will be the most impactful in the classroom, **they should only use trusted, reliable sources for activities or use of kits.** Responsible school suppliers will always identify safety concerns and clear usage instructions that are student friendly and safe.

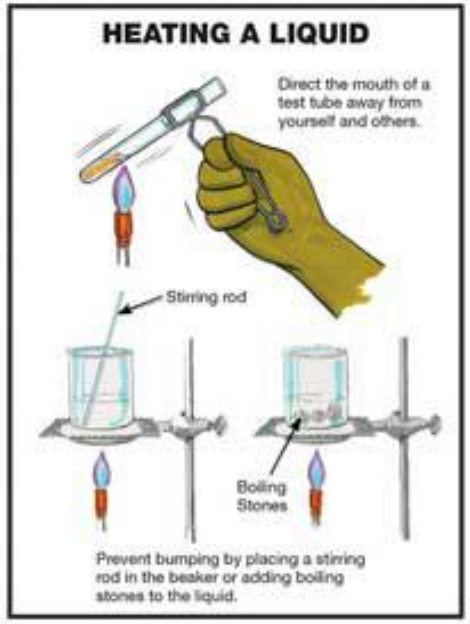
Know Your Science Equipment, Apparatus, Materials and Tools in the Elementary STEM Classroom











FLINN Laboratory Techniques Guide

Tools – Common Safety Concerns in STEM

Before allowing students to use power tools or common hand tools, teachers are expected to demonstrate the safe and practical application of that tool and the corresponding personal protective equipment needed. Don't assume that students know the names and functions of the tools you will be using.

Are you confident in how to use tools safely and demonstrate their safe use for your students? School districts are required to provide training on this under OSHA 2002 Hand & Power Tools regulations – so please ensure that you are compliant and trained in this aspect of STEM. https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910SubpartP

Your School District will have a SOP (Standard Operating Procedure) listing for the tools in your classroom and the necessary products and safety equipment in place to ensure you and your students are in the safest learning environment possible. Never use any tool you feel uncomfortable with!

Tools Used in the Classroom

Are you aware of the proper usage of various hand tools (hammer, screwdriver, pliers, hand saws, scissors, wrenches, wire cutters/strippers, sockets etc.) ?

It is REQUIRED that you demonstrate and properly model the safe use of ALL tools with your students. Typically, they like to act inappropriately at first when presented with tools to use in their quest to solve problems using engineering and inquiry.

Tools need to be used and stored appropriately in a secure location and sanitized prior and post usage.

Common Hazards with Hand Tools in the STEM Program

Hand tools are tools that are powered manually. Hand tools include anything from axes to wrenches. The greatest hazards posed by hand tools result from misuse and improper maintenance.

Some examples include the following:

- **If a chisel is used as a screwdriver, the tip of the chisel may break and fly off, hitting the user or other employees.**
- **If a wooden handle on a tool, such as a hammer or an axe, is loose, splintered, or cracked, the head of the tool may fly off and strike the user or other employees.**
- **If the jaws of a wrench are sprung, the wrench might slip.**
- **If impact tools such as chisels, wedges, or drift pins have mushroomed heads, the heads might shatter on impact, sending sharp fragments flying toward the user or other employees.**

Different tools for Different Applications….

Students sometimes don't use hand tools for their intended use. It is this misuse that results in many preventable injuries. STEM educators realize the importance of proper tool usage and recognize that proper modelling with clear instructions are essential to the student's overall safety.

There are four classes of common hand tools, with each presenting a unique set of hazards:

1. **Cutting Tools**
2. **Torsion Tools**
3. **Shock (Impact) Tools**
4. **Thermal Processing Tools**

Cutting Tools

Cutting tools include saws, chisels, planes, files, knives, taps and dies, snips and abrasive materials. Concentration and control are essential for safe operation of all tools, cutting tools being no exception. It is very important that cutting tools are kept sharp and in good working order. The sharpness of a tool is essential for safety. Dull blades have the potential to reduce control and cause greater physical harm.

Given the material the tools are designed to cut, the cutting edge should be sharpened to the proper angle. Teachers should ensure that students are instructed in the proper selection process of each cutting tool for a variety of materials and operations. Selecting the proper size and type of tool allows students to learn and follow through with each correct procedure.

Many injuries are a result of burrs and chips created while cutting. Care should always be used in chip removal – never brushing the material with their hands. Gloves may protect students' hands from accidental injury and should be a consideration for PPE when using saws, sharp instruments and other cutting tools.

Torsion Tools

Torsion tools include wrenches, pliers, Allen wrenches, and screwdrivers. These tools are found to be the most abused and misused set of tools. The availability of screwdrivers leads to unnecessary abuse and subsequently becomes a source of frequent injury.

Several unnecessary abuses of screwdrivers, which may be prevented, include being used improperly as punches, wedges and pry bars. The tips of screwdrivers should always be kept clean and ground to their original shape, when possible, to ensure the proper fit into a screw slot. To reduce the misuse of screwdrivers, an adequate selection of drivers should be readily available.

Torsion Tools

To safely use any wrench, the user is required to always be alert and prepared for the possibility that the wrench may slip off the fastener and cause injury. Wrenches are made in many different sizes; therefore, it is essential the proper size wrench be used.

Generally, socket wrenches are the safest to use and offer the most flexibility, while box wrenches offer greater safety over an open-ended wrench. Adjustable wrenches are recommended for light-duty jobs and should have limited applications.

It is imperative for students to learn the proper tool choice for each type of job. Torsion tools proving to be too large or too small will require extra force. Proper fit, coupled with the degree and direction of force, ensures safer procedures. The insulation of tool handles is necessary when working with electricity.

Impact Tools

Impact tools, or shock tools, are best exemplified by hammers in various types and sizes with varying degrees of hardness. Different configurations are used for specific purposes. They should be selected and used for their intended purposes only.

Discard any hammer if it is dented, chipped, mushroomed, has a loose head, split handle or shows excessive wear. As with any impact tool, discarded debris may fly readily, and every student within the work area should always wear safety glasses. Non-negotiable safety practice.

Thermal Processing Tools

One way to condition and assemble materials is through a process of heat energy known as 'thermal processing'. Some commonly used thermal tools include hot glue guns, hot wire cutters, soldering irons, heat guns, strip heaters, torches, welders, lasers, kilns, furnaces and ovens. While not all of these will be present in the elementary STEM lab, they can be found in certain school settings.

Any heat-producing tool carries with them the potential to severely burn the user and are sources of ignition. In order to minimize impending hazards, proper protective safety equipment should be worn by students and the teacher, and the work area should be kept clear of all flammable materials.

Natural gas, acetylene and other energy sources are very dangerous. This increases the need to inspect equipment often and keep it in good working condition. If you are uncomfortable using any thermal processing tools or equipment, Do Not Use them – ask for help or guidance before using anything.

Tools Typically Found in an Elementary Classroom Include the Following:

- C-Clamps
- Vise & Jigs
- Hand Saws & Miter Boxes
- Hand Drills & Various Bits
- Claw Hammers
- Wire Cutters/Bolt cutters
- Allen Wrenches/Keys
- Squares—Framing / Carpenter
- Pliers—needle nose, slip joint
- Ratchet and Sockets
- Wrenches—adjustable/fixed
- Screw Drivers—Philips, Slot
- Standing Drills—Bit/Brace Style
- Files—Triangular and Regular
- Glue Guns—Safety Style/Low Heat
- Knives & Sharp Edges—Grade 4 and Above

Considerations for Using Tools in the STEM Classroom

Instruction and supervision must be provided by a qualified instructor. Teachers who are uncertain about the safe use of a particular tool or material with students should first consult with someone having the appropriate science or technology expertise. **Do NOT use anything that you are unfamiliar with.**

Hand tools should be introduced by the teacher, including its proper use and demonstrate the safety precautions needed before each lesson/activity. This may be the first exposure that students have to using tools, and care must be taken to ensure that the proper safe handling techniques are taught and reinforced for safety across the STEM activities in school.

Students must be at the proper developmental level and possess adequate motor skills for individual use of tools. Tools should be the proper size for the age and size of the students. ENSURE THAT THESE TOOLS ARE SANITIZED OFTEN according to the protocols in your school jurisdiction for occupation health and safety.

Considerations for Using Tools in the STEM Classroom

Students should demonstrate understanding of safe tool and equipment use to the instructor before working independently. Make sure they are using it safely.

Wherever possible a jig or vise should be used to hold materials, allowing students to have both hands free. This is a skill set that students should know.

Classroom hand tools must be kept in good working order (e.g., saws kept sharp, hammers with intact handles and secured heads, glassware without cracks or sharp edges). Inspect ALL tools prior to and before storing them away.

If a student identifies that a tool is damaged or not working properly, the teacher must inspect it, use their judgement, and dispose of the broken tool to prevent any future potential injury or damage. Refer to the rules from the four main types of tools used in STEM programs for guidance on this or ask a colleague.

More About Tool Safety

There are some basic rules that should be followed to prevent the hazards associated with hand and power tools as directed by **OSHA** which are mandated by federal prevention legislation:

- **Keep all tools in good condition with regular maintenance.**
- **Do not put tools in your pockets.**
- **Do not run with tools in your hand.**
- **Use the right tool for the job / task at hand.**
- **Examine each tool for damage before use and do not use damaged tools. Notify the teacher if it seems broken or damaged.**
- **Operate tools according to the manufacturer's instructions.**
- **Provide and use properly the right personal protective equipment.**

1. OSHA

Risk or Hazard Analysis for Activities

Are you aware of what to look for when students bring you an outline of their inquiry-based activity?

Looking at the procedures, there are a handful of red flag items or processes that you should recognize and prevent students from continuing onwards in their planned pursuit of knowledge.

Students often develop a plan or sequence of procedures that do not always align with the safety protocols in place on their quest to solve an inquiry or design problem. Reminders are a good way to start this conversation without dampening their innate curiosity as a student into studying the world around them. Once you establish benchmarks, it gets easier.

3D Printers in the STEM Lab – Safety Concerns

3D printers have become a useful and practical tool in K-12 classrooms because they allow for problem-solving and creativity to combine by bringing together the ideas and designs to life from students minds. 3D printers are engaging, provide innovative learning opportunities and promote CTE and workplace behaviors and skills needed in the workplace.

However, 3D printing technology has become more affordable in recent years, can potentially pose a health risk because of its potential to release volatile organic chemicals (VOCs) and ultrafine particles (UFPs) into the air during operation. This could affect indoor air quality and may expose people to pollutants that may lead to adverse acute and chronic health concerns depending on the technology used in the classroom / laboratory and the HVAC on-site.

Therefore, educators should be aware of the risks associated with 3D printers and how to best manage the risk and educational reward especially since young K-12 students could be more susceptible to their potentially harmful effects of the printers and the media used.

3D Printers – Safety Concerns Continued…

We are not saying that schools should avoid using 3D printers. However, school administrators and teachers should be mindful to make every attempt to minimize exposure of emissions to students who are among the most sensitive to environmental exposure.

These are the best-practice strategies when using 3D printers in the classroom:

- **Ensure they are used in well-ventilated areas, have local exhaust fans or are operated under a fume hood;**
- **Keep students from standing beside or hovering over a printer while it is in operation;**
- **Set the printer nozzle temperature to the lower end of the suggested temperature range;**
- **Use filaments that are specifically recommended by the manufacturer for the printer; and**
- **Only use printers and filaments that have been tested and verified to have low chemical and particle emissions.**

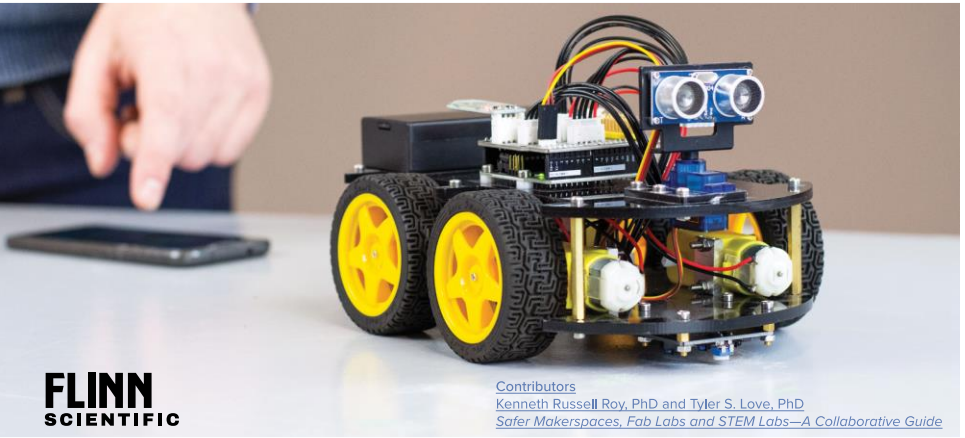
3D Printer Safety Protocols / Best Practices

- **Enclosed printers – so children can't get their fingers at the hot extruder. Some variations:**
  - Some printers will automatically stop when the doors open (and some don't) – Afinia H800 / Up Box
  - Some printers will shield the hot extruder from children's fingers – BEE THE FIRST
- **Enclosed printer with air filter – so fumes are contained**
  - Important if there is no way to vent the printer
  - Newer printers have HEPA air filters – Cubicon Single, Afinia H800 / Up Box
- **Only print PLA (not ABS)**
  - The two most common types of filament are PLA and ABS plastic.
  - ABS is made from oil and is similar to the plastic used in Lego
  - PLA is made from cornstarch, is bio-degradable and is generally considered safer
  - Some printers will only print one or the other material – some print both
- **Scrapers, tools etc**
  - Some printers require a 'perforated board' to be used to stick the print to the board. These usually require a sharpened 'scraper' to remove. This is not kid-friendly.

Things That Should Not Be Found in Your STEM/Science Classroom:

- Aerosols with organic propellant
- Alcohol burners
- Bacterial cultures
- Body fluids - blood/saliva/urine etc.
- Common allergens—pollens, animal furs, treenut/peanut products, mold, etc.
- Flammable liquids—methyl alcohol, acetone, carbon disulfide, ether, etc.
- Formaldehyde-preserved animal specimens & homemade jars
- Glues—"instant," epoxy, airplane, Superglue, etc.
- Mercury thermometers—replace with alcohol-filled thermometers
- Nail polish remover solutions
- Oil-based paint thinners and turpentine
- Organic-based craft dyes & paint strippers (harsh solvents)
- Poisonous plants—poison ivy, mistletoe, poinsettia, azalea, invasive species etc.
- Poisonous animals—spiders, stinging insects, centipedes, millipedes, some snakes and lizards
- White-out type solutions—Liquid Paper
- Strong acids—undiluted hydrochloric, nitric, sulfuric; boric acid powder
- Strong bases—undiluted ammonia, sodium hydroxide (lye), chlorine bleach

8 Tips for a Safer STEM Lab



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Contributors
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Safer Makerspaces, Fab Labs and STEM Labs—A Collaborative Guide

Entry and Exit
Labs over 1,000 sq. ft. need two outward-opening doors in the event an emergency exit is needed. Avoid blocking doors.

Lighting
Include a mixture of natural and atrificial light for safer lab operation.

Sound
Place noise-producing equipment in a dedicated lab space and provide acoustical treatment on ceilings and walls within the lab.

Temperature
Keep chemical storerooms within your lab between 60—80 °F along with continuous airflow to prevent or reduce rate of decomposition of chemicals.

Ventilation
Ventilation that is directly at the source (e.g. a dust collector hose hooked directly to a belt sander) protects against hazardous particulates, gases or vapors.

Electrical Power Sources
Keep outlets at least three feet away from any water source and unplug any cords when the lab is not in use to avoid a fire hazard.

Showers and Eyewashes
A must in any STEM Lab, Makerspace or Fab Lab to minimize effects of accidental exposure to chemicals, specimens, particles and other airborne objects.

Safety Zones
Safer operator zone markings, the appropriate Personal Protective Equipment, machine guards and instructor supervision reduce accidents and injuries.

www.flinnsci.com/stem

Checklist for STEM Classroom Safety

Flinn has created a poster with **8 Tips for STEM Safety** and we encourage you to use this resource for your classroom activities.

Take the time to consider to the safety & risk assessments for the activities and investigations involved with your curricular framework in your local jurisdiction.

Planning your STEM program and activities will take some thought and time, but the results will be much richer learning and deeper understanding (safely) for your students.

1. Flinn 8 Tips for a Safer STEM Lab

How to incorporate STEM into your Lessons/Student Activity Remotely?

This can be as simple as using approved “At Home” activities with your students (ensuring that it is age and subject appropriate) as part of the weekly assigned tasks. There doesn’t need to be an activity each day. Strive for balance and progression in your program. Choose only readily available items typically located in a home and understand that not all students will have access to the same materials in their household.

STEM activities are also great ‘critical thinking or inquiry’ models that many students enjoy participating in. See our **STEM Activities for Intro Courses** video for ideas.

Be careful to not provide too many activities and also to provide too few. There is a balance that happens when you collectively work to achieve common goals and apply these to your own students.

References Used in the Publication

The following is a list of general references. It should be obvious that it is not exhaustive. The references provided are for those interested in obtaining additional information from primary sources. A much more exhaustive listing of references and resources can be found in two excellent state documents: Guidebook for Science Safety in Illinois, available from the Illinois State Center for Educational Innovation and Reform (contact Illinois State Board of Education) and Maryland Science Safety Manual, K-12, available from the Maryland Science Supervisors Association (con- tact the Maryland State Department of Education). No implication of endorsement or lack of endorsement should be read into inclusion or omission of any referenced material within this document.

Special thanks for the professional efforts provided by James Palcik, Director of Education, Safety & Compliance, and Tom Trapp, Director of National Accounts at Flinn Scientific Inc., Batavia, Illinois, 60510 to help update and review this safety resource for the Council of State Science Supervisors in March 2021.

1. http://cosss.org/
2. Flinn Scientific Inc. Professional Learning Series 2021
3. COSS: Science Safety: It's Elementary!

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