

enhancing the technology and engineering in elementary classrooms:

safer tool usage

To truly embrace technology and engineering (T&E) in the elementary classroom, many teachers/administrators should not continue to think that the technology within STEM is talking about the use of computers. While information technology does have a place within our elementary schools, the type of technology that goes hand in hand with engineering allows children to build using hand tools. We must allow students to use tools so they can learn to design, build, and become a part of a society that is changing rapidly. It is imperative that we provide opportunities for students to use their minds and hands in a way that past generations were denied in elementary classrooms. My students built sailboats, magnetic levitation trains, airplanes, dams, race cars, birdhouses, and various other items that gave them the opportunity to use tools such as saws, miter boxes, hammers, drills, bolt cutters, and clamps. While some may have reservations about these tools being used in a first grade classroom, I believe that, with proper oversight, my students learn to be thinkers and active, rather than passive, learners.

I have been fortunate to have the opportunity to help teachers integrate T&E into their classrooms. Inevitably, when I share pictures of children using tools, there are surprised faces and tensed bodies. There are several reasons for these reactions; many of the participants have never used tools before and



may therefore be uncomfortable around them and/or they are uncertain as to how to properly use them and supervise student safety in their classrooms. The following tips can help teachers use T&E tools more safely in elementary classrooms.

Tips for Introducing Tools:

- Don't assume that students know the tool names and functions.
- Introduce each tool to your students before allowing its use. Show the children each tool and have them tell you what it is and its purpose in order to gauge what they know and what they need to know.
- Demonstrate the safer method for using each tool. Allow children to ask questions.
- Once you have introduced each tool, you may want the students to create a class tool dictionary. Divide children into groups and assign a tool to each group. Have them trace or draw their specific tool, find the definition in a dictionary, and then write it

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on the piece of paper with the drawing. Create a title and front cover and bind all the pages together so that students can refer to it throughout the year. The goal is to teach children that each tool has a specific purpose (STL 2C and 2I). We use them to help us complete specific tasks safely.

Suggested Safety Rules:

- Once students have an understanding of each tool, a discussion needs to take place as to how they will be used so that everyone remains safer.
- With your guidance, the students should create rules to be followed.
- These rules need to be typed in large font and displayed in the area of the room where students will be using the tools.
- Before students work with tools during each project, the rules need to be reviewed.
- Students need to realize you are serious about the rules, and that if rules are not followed during a building activity, the child/children should not be allowed to use the tool/tools for the rest of that day.



Tips for Displaying the Tools:

- Set up an area in the classroom where the tools will be stored.
- Use containers to house the miter boxes, saws, clamps, etc. Label each container with the name and a picture of the tool.
- Bolt cutters, standing drills, etc., will not fit in a container, so it would be helpful to put the name of the tool and an outline of it in the spot where you want them to be placed. This way nonreaders and readers know where each tool belongs.
- You should work towards students being responsible for the neatness of this area. An incentive system can help ensure a clean work area/room. An example of a cleanup responsibilities list can be found in ITEEA's *Designing Safer Learning Environments for Integrative STEM Education* (ITEEA, 2014).

Tips for a Safer Working Zone:

- Designate an area with student desks or tables where students should use the tools.
- You may want one desk per tool or a table where several of the same type of tool can be set up. This will make it easier to supervise students when using the tools.
- Create signs that remind children to clean up the area and designate how many children are allowed in that area.
- You want children to keep the area clear of extra items. Younger children have a tendency to place pencils, rulers, etc., on top of the table where they are working. Measurements should take place at the child's seat or at a measuring area.
- The rules you create with your students should be posted in this area. You want them to be visible and bold so the students see them.
- At no time should the tools leave the areas you have set up. You do not want children walking around with the tools.
- Parent volunteers and trained students from upper grades can help monitor the work zone.



Tips for Eye and Hair Safety:

- ANSI Z87.1-rated safety glasses or goggles are a necessity. They need to be worn by students, teachers, and visitors any time there are tools being used in the classroom.
- Children should not be allowed in the working zone unless they have their safety glasses or goggles on.
- If funds allow, each child can be assigned a pair of safety glasses or goggles for the year. If not, alcohol pads or water and dish detergent can be used to clean the goggles in between usage.
- There is a proper way to tighten and loosen goggles with elastic straps, and children need to be taught how to do it. They should not try to adjust the goggles while wearing them. This will stretch the elastic bands out of shape and can break the goggles.
- If straps are stretched and hang too low, make sure they are cut so they do not get caught in any tool.
- Younger children have a tendency to put the safety glasses or goggles on top of their heads and forget to put them over their eyes. Students will get used to them and their importance, but always remain vigilant with reminders and rewards for safer use of eye protection.
- It is necessary that any child with long hair should have it pulled back and secured.

Recommended Tools

Vises are used to securely hold materials when using bolt cutters or saws.

- You need to securely attach two vises to a student's desk or small table several inches apart from each other.
- Students should be shown how the vises open and close using the handles. Discuss how fingers should never be in the area that open and closes. Their hands should always remain on the handles and/or on the piece of material being placed into the vises.



- Materials should be measured and marked before placing in the vises.
- Younger children may have to have one child hold the material in place while another child turns the handles. They should wiggle the material to make sure it is secure.
- Children need to make sure the handles are out of the way before cutting.
- Each time students use a vise they should make sure it is securely fastened to the table before use. If it is loose they need to alert the teacher.





Bolt cutters with short handles are mainly used when students are cutting steel rods (axles for cars) at the elementary level.

- This is a tool that should have adult supervision at all times.
- They are only used with materials that have been securely fastened in the vises.
- No one should be standing in the area except the child using the bolt cutters once the material being cut has been placed in the vises.
- The table should be used as a leverage for the child to place one handle on, it will allow him/her to safely press on the other handle to cut the steel rod.

Metal miter boxes and clamps allow students to cut wood/other materials in a straight/angular manner. They secure the material in place so children can cut safely when using a saw.

- The miter boxes should be placed on the edge of a desk/table.
- Children need to securely attach the miter box to a surface with two clamps.
- Before students place a material in the miter box, it should be measured and marked.
- Another clamp should be used to hold the material to the miter box. If a child saws with his/her right hand, the material should be clamped on the right side. He/she can hold the other end with the left hand so it doesn't move. Remind students their fingers should never be in the cutting area.
- Push the clamp handle out of the way of the cutting area.
- You will notice that some children will struggle with eye/hand coordination when opening and closing the clamp. These children may need some assistance.

Hand saws are used for cutting materials. If the saw has more than one part, be sure to pre-assemble and make sure the parts are secure.

- When using a saw in a miter box, students will find it is easier if they stand up and move their arm gently back and forth. When they tense up and force the movement, the saw does not move across the material smoothly making it difficult to cut.
- If at any time the blade feels "wiggly," the students should tell you immediately. They should not be allowed to tighten it because you do not want their hands on the blade section.
- You should emphasize that they are only to touch the handle of the saw because the blades are sharp and could cut them.
- At no time should students walk around the room with the saw in their hands.
- Their eyes need to remain on what they are cutting. Young children have a tendency to look around at other things, and you need to teach them the importance of paying attention to what they are doing so they don't get cut.

A **standing drill** is a fixture that securely holds a hand crank drill and works well with younger elementary students. Hand-held drills without the fixture are acceptable for older students.

- During the use of this tool, two children need to work together to drill a hole. One child should hold the handle down while the other spins the handle around, which in turn spins the drill bit.
- The student pushing the handle down to place the drill bit on the material (ex. wood) should not touch the handle until the other child has placed the material where he/she wants

it. The material should be secured in place, and then the handle can be pushed down.

- There needs to be a certain amount of pressure from the child pressing on the handle in order for the drill to create the hole in the material. If there is a grinding sound you know he/she is not pressing the handle down hard enough.
- For the child spinning the handle, it is helpful if you draw an arrow on the gear that spins so he/she knows which way to turn the handle. Otherwise, the drill bit will fall out frequently.
- Once the hole is drilled, both children should release their handles. If the material is caught on the drill bit, one child should hold the material away from the drill bit while the other one spins the handle backwards just a little bit.
- At no time should a child touch the drill bit. If it falls out, you should tighten it back into the drill. This should be emphasized repeatedly.

Hammers

- Smaller, lighter hammers with shorter handles are easier for younger students to use.
- The students and instructor should be sure the head is securely fastened to the handle before using.
- One student should never hold an object while another hammers. Inevitably, the one holding gets hit.

Low-temp **hot glue guns** adhere materials together quickly. The last thing you want is your students to become frustrated because pieces do not hold together.

- Kid garden gloves are highly recommended for children to wear when using glue guns.
- You need to emphasize that the metal part is hot. Their hands should only be on the handle.
- Students need to tell you immediately if they get burned.
- Young students have a tendency to look around, so they have to be reminded they have to pay attention to what they are doing.

Other tools can be used in the elementary classroom. When you select a T&E activity to implement in your classroom, remember to incorporate tools that you feel can be safely used and are appropriate for the grade level you are teaching. Tools for your classroom can be found from variety of places, including parents and garage sales—though tools from these sources should be

thoroughly inspected for safety hazard.

At least once each marking period instructors should test all tools for safer operation before allowing students to use them.

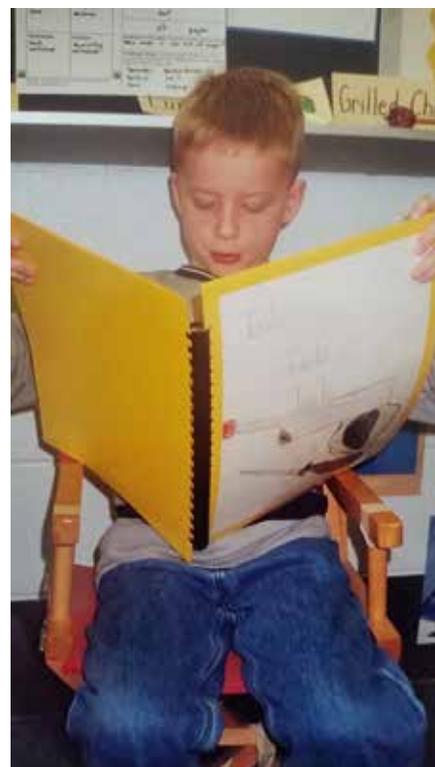
Resources for Safer Tool Usage in Elementary Classrooms:

International Technology and Engineering Educators Association (ITEEA). (2014). *Designing Safer Learning Environments for Integrative STEM Education* (4th Ed.). Reston, VA: Author.

National Science Teachers Association. (2016). *Safety in the science classroom: Resources for elementary schools*. Retrieved from www.nsta.org/safety/

Pennsylvania Department of Education. (2002). *Safety guidelines for technology education and elementary science/technology education*. Harrisburg, PA: Author. Retrieved from www.teeap.org/Publications/safety/PDE_safety_guide.pdf

Roy, K. (2013). Safety: The elementary mission. *Science and Children*, 51(2), 86-87.



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