

New Jersey's  
Results from  
the 2020  
National T&E  
Education  
Safety  
Survey

*How Does New Jersey Compare to the  
National Averages?*

*What are the Implications for School  
Systems?*

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October 28, 2020



## Permissions

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This presentation represents a subset from the larger data set cited below. It may not be redistributed without permission from the authors:

Love, T. S., & Roy, K. R. (2020). K-12 technology and engineering education safety and facilities survey. [Data set]. National Safety Consultants, LLC.

<https://sites.google.com/view/2020-te-safety-study/>

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\*This presentation merely represents the sample of participants who responded from NJ. It can't be generalized to represent all T&E teachers in the state.

# Presenter: Tyler Love, Ph.D.

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## CURRENTLY

- Assistant Professor of Elementary/Middle STEM Education at PSU Harrisburg
- Safety Editor for ITEEA
- NSTA Safety Advisory Board Member
- OSHA 511 General Industry Certificate
- 2018 CareerSafe® Safety Educator of the Year



## PREVIOUS EXPERIENCES

- Coordinator and Associate Professor of T&E Ed in MD
- Technology and Engineering teacher in Maryland's Public School System

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# Background Info

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- Last national survey on T&E safety is unknown
  - Last Related Study – Utah Dept. of Education 2007
- Large focus on safety in T&E education due to:
  - Liability
  - Alternative certification
  - STEM/Makerspaces
  - After school clubs

## Teaching Engineering Requires Specialized Safety Training!

- **Resources**

-NSTA Safety Advisory Board Paper -

<https://static.nsta.org/pdfs/SafetyAndNGSS.pdf>

-Love, T. S. (2018). The T&E in STEM: A collaborative effort. *The Science Teacher*, 86(3), 8-10.

-Love, T. S., & Roy, K. R. (2017). Tools and equipment in nontraditional spaces: Safety and liability issues. *Technology and Engineering Teacher*, 76(8), 26-27.

-Love, T. S., & Roy, K. R. (2018). Converting classrooms to makerspaces or STEM labs: Design and safety considerations. *Technology and Engineering Teacher*, 78(1), 34-36.

-Love, T. S. (2017). Perceptions of teaching safer engineering practices: Comparing the influence of professional development delivered by technology and engineering, and science educators. *Science Educator*, 26(1), 1-11.

## Previous Research - CTE

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-Recent studies on safety in various CTE areas by Threeton and Evanski (2014, 2015, 2019)

- 57 CTE teachers from 30 counties in PA
- 93% had safety plan in place

-Top 5 obstacles to implementing safety in CTE classes

1. Chronic student absences
2. SPED modifications/accommodations
3. Lack of funding
4. High class enrollment
5. Small classroom/lab space

## Previous Research - Science Ed

-Stephenson, West, Westerlund, & Nelson (2003)

- 856 science teachers in TX
- 81 incident/accident report forms returned

-Incidents/Accidents increased:

1. 8% to 62% as **class size** increases from <14 to >24 students
2. 11% to 66% as **room size** decreased below 60 sq. ft per student
3. 11% to 47% as **room size** decreased below 800 sq. ft
4. 35% did not have adequate training
5. Only 69% had a written safety policy

-Study redone in 2014, similar findings

## T&E 2020 National Safety Survey

-Adapted from Stephenson et al. study, face validity

April 2020 - sent out to ITEEA/NJTEEA members, county supervisors

- 718 national, 28 NJ responses (4% of national)
- About 19% response rate from NJTEEA members

-Questions on:

- Info and Demographics
- Experience and Certification
- Classroom Conditions
- T&E facilities
- Teacher and Student Safety Training
- Recent Incidents/Accidents

### Gender and Race

#### New Jersey

Answer	%	Count
Male	61%	17
Female	39%	11
Total	100%	28
White	93%	26
Black	0%	0
Two or More Races	7%	2
Asian	0%	0
Hispanic or Latino	0%	0

**National** - 74% male; 90% White, 5% Black (718 total responses)

### Certification(s)

#### New Jersey

Alternative or Emergency	0%	0
Elementary Education	11%	5
Technology Ed or T&E Education	53%	24
A Science Education area	11%	5
CTE area	4%	2
Other (please specify)	20%	9

\*Only 11% currently teaching K-5  
26% B.S. in Industrial Arts; 44% B.S. in Technology Ed/T&E ed

**National** - Very similar certification numbers

## Total Years Teaching T&E/Tech Ed/Industrial Arts

### New Jersey

Answer	%	Count
0-3	11%	3
4-8	18%	5
<b>9-15</b>	<b>36%</b>	10
<b>16-25</b>	<b>32%</b>	9
26+	4%	1

### National

0-3	10%	70
4-8	20%	142
9-15	20%	143
<b>16-25</b>	<b>28%</b>	201
26+	23%	162
Total	100%	718

## Course Preps

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<u>Preps</u>	<u>NJ</u>	<u>National</u>
1	4%	3%
2	18%	14%
3	18%	31%
4	<b>32%</b>	25%
5	<b>25%</b>	13%
>5	4%	14%

# Primary Focus of Your Courses

## New Jersey

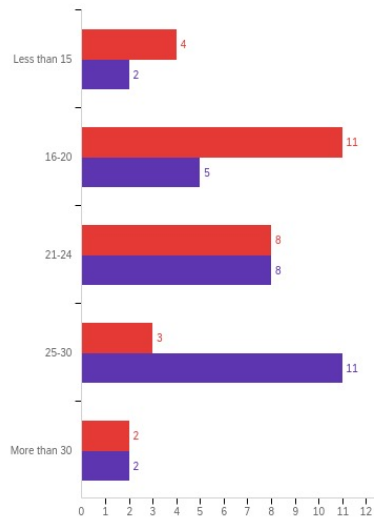
1. Engineering Design, T&E Literacy
2. CAD/3D Modeling/Architecture
3. Electronics/Programming/Robotics
4. Materials Processing (Woods)

## National

1. Engineering Design, T&E Literacy
2. Tie - Materials Processing, CAD, & Electronics/Programming/Robotics
3. Pre-engineering (ex. PLTW)

## Enrollment in your classes: Average and Largest Class sizes

### New Jersey



### New Jersey

Average: 68% said 16-24

Largest: 39% said 25-30

### National Comparison

Average: 46% said 21-30

Largest: 23% said more than 30

- 1. What was your average T&E class enrollment this past year?
- 2. What was the enrollment of your largest T&E class this past year?

**Percentage of students in your classes this past year that had special needs?**

**New Jersey**

Answer	%	Count
0-5%	25%	7
<b>6-15%</b>	<b>36%</b>	<b>10</b>
16-25%	29%	8
26-50%	11%	3
More than 50%	0%	0

**National**

0-5%	20%	146
<b>6-15%</b>	<b>41%</b>	297
16-25%	27%	191
26-50%	10%	73
More than 50%	2%	11
Total	100%	718

**Administration's progressive disciplinary support?**

**New Jersey**

Answer	%	Count
Poor	7%	2
<b>Fair</b>	<b>29%</b>	8
<b>Good</b>	<b>43%</b>	12
Excellent	21%	6

**National**

Poor	12%	79
Fair	21%	152
<b>Good</b>	<b>42%</b>	302
Excellent	26%	184



## Have a sufficient budget to maintain safety

### New Jersey

Answer	%	Count
Yes	50%	14
No	50%	14

### National

Answer	%	Count
Yes	53%	380
No	47%	338

## Does your district conduct annual safety audits of T&E facilities?

Answer	<u>New Jersey</u>	<u>National</u>
Yes	21%	43%
No	54%	37%
Unsure	25%	21%

### Do the Following Have A Written Safety Policy?

Answer	New Jersey	National
T&E Classes	64%	82%
T&E Department	25%	56%
School District	14%	44%

## Recommendation

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- Work with your district safety compliance officer, legal counsel, supervisor, and teachers to develop a safety policy
- Enforce consistently and fairly

### -Resources:

Gill, M., Koperski, K., Love, T. S., & Roy, K. R. (2019). Developing a culture of safety through departmental planning. *Technology and Engineering Teacher*, 79(1), 22-25.

Roy, K. (2009). The safety legal paper trail. *The Science Teacher*, 76(2), 12-13.

**Does school nurse have a copy of the SDS (Safety Data Sheets)?**

Answer	NJ	National
Yes	32%	33%
No	32%	22%
Unsure	36%	45%

**SDS Easily Accessible in T&E area (paper or electronic)**

Answer	NJ	National
Yes	50%	50%
No	32%	31%
Unsure	18%	20%

**Did you receive any form of safety training during the following?**

Answer	New Jersey	National
UG tech/eng or lab courses	86%	62%
UG teaching methods courses	79%	54%
Grad tech/eng or lab courses	25%	28%
Grad teaching methods courses	18%	32%

### Safety Training Upon Initial Hiring?

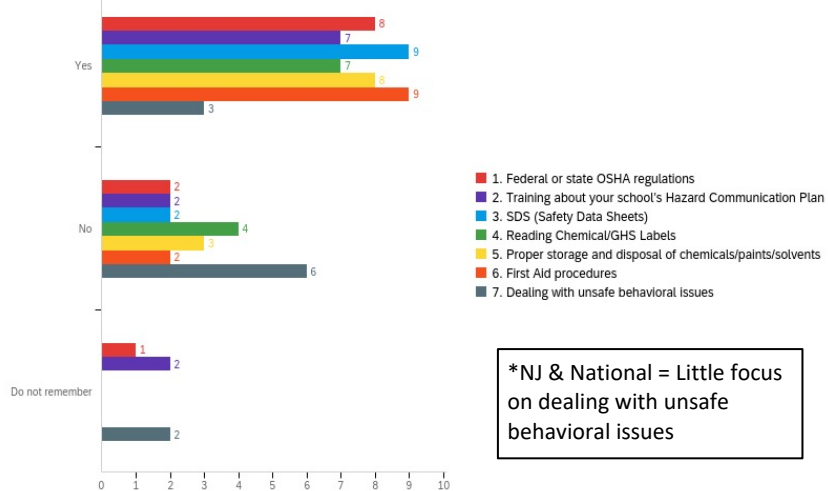
Yes: 25% in NJ vs. 32% Nationally

### How long has it been since your district last offered you safety training?

Answer	New Jersey	National
<6 months	7%	15%
6 months -1 year	18%	21%
1-2 years	7%	7%
2-5 years	7%	5%
>5 years	0%	7%
Never received training from my district	61%	44%

### Did the training mentioned in the previous question provide information on the following:

#### New Jersey



\*NJ & National = Little focus on dealing with unsafe behavioral issues

Have you participated in any T&E safety training provided by someone other than your district within the last 12 months?

**New Jersey**

Answer	%	Count
Yes	29%	11
No	71%	96

\*National = 18% said Yes

Who delivered the safety training you attended within the past 12 months?

Answer	NJ %	NJ Count	National %
Local training source (not my school district)	25%	2	26%
State teachers association	38%	3	12%
State department of education	0%	0	6%
National teachers association	0%	0	3%
A university	13%	1	11%
OSHA	13%	1	17%
Other (please describe)	13%	1	25%
Total	100%	11	

“Other” response from NJ was ITEEA

# Recommendation

New Jersey Public Employees Occupational Safety and Health (PEOSH) covers state and local government workers, but private sector workers fall under federal OSHA

According to OSHA:

- Safety Training should be administered upon initial hire, and again any time a new hazard is introduced (chemical, equipment, etc.)
- Employer has a duty to provide these trainings
- Employee can request in writing to receive these trainings

## In what type of room did you primarily conduct your T&E activities this past year?

Answer	NJ	National
Portable Classroom	0%	0.28%
Regular Classroom/computer room	21%	17%
T&E classroom/lab combo	50%	66%
T&E Lab	25%	13%
Makerspace	4%	2%
Varied due to floating	0%	3%

### Approximate size of the instructional area?

Answer (Fire Code Capacity)	NJ	National
Less than 600 square feet (<12 students)	32%	8%
600-800 square feet (12-16 students)	25%	20%
800-1,000 square feet (16-20 students)	18%	22%
1,000-1,200 square feet (20-24 students)	14%	24%
Greater than 1,200 square feet (>24 students)	11%	26%

## Recommendation

Fire code NFPA 101 requires 50 sq. ft. per occupant (net square footage)

Research suggests at a minimum 60 sq ft. limits accident rates

Conduct safety inspections to make sure your facilities have proper safety controls and space (ITEEA's safety website and the PA Dept of Education have excellent inspection checklists)

#### Resource:

West, S. S. (2016). Overcrowding in K-12 STEM classrooms and labs. *Technology and Engineering Teacher*, 76(4), 38-39.

Retrieved from <https://www.iteea.org/102756.aspx>

**How often are students in your T&E class required to:**

Question	Never	Rarely	Usually	Always
1. Sign a safety acknowledgement form?	10%	0%	14%	75%
2. Be tested for their knowledge of safety procedures prior to participating in new hazardous T&E activities/using new hazardous equipment?	7%	0%	14%	79%
3. Safely demonstrate a new procedure or use of a new tool/piece of equipment while directly supervised?	0%	0%	18%	82%

\*Nationally – 69% Always sign a form, 76% always tested, 76% always demonstrate

**Safety tests and posters used with students?**

Answer	NJ	National
ITEEA's safety website	18%	10%
Virginia Tech's lab safety resource website	0%	1%
Power Tool Institute resources	4%	3%
School district/department developed resources	7%	15%
State developed resources	0%	4%
Student developed safety resources	0%	1%
Teacher (my own) developed resources	65%	58%
I do not use safety tests or posters	7%	8%



## Teachers Reported Having the Following:

	<u>New Jersey</u>	<u>National</u>
Safety Zones on Floor	54%	48%
Non-skid strips near machines	32%	27%
Eyewash w/in 10 second access		
Plumbed	57%	47%
Portable	18%	22%
Adequate Ventilation	54%	45%
Workspace accessible to wheelchair bound students	36%	47%
Accessible master power shut offs	61%	61%
Sufficient number of outlets	64%	61%

## Teachers Reported Having the Following:

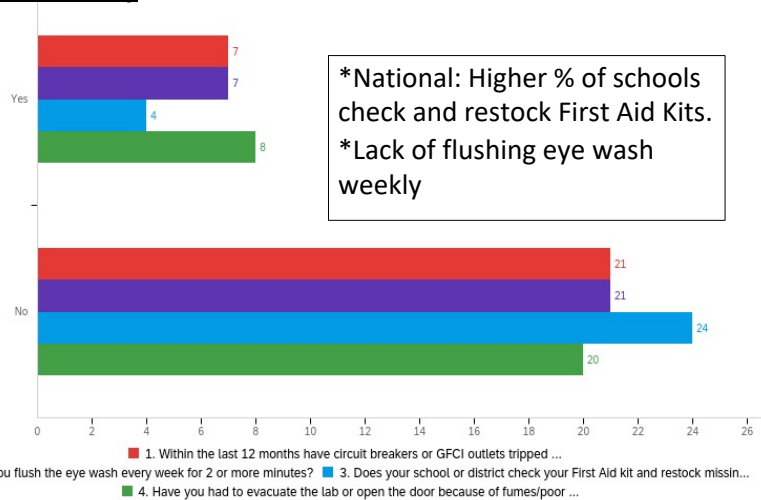
	<u>New Jersey</u>	<u>National</u>
Lockable tool storage	86%	78%
Sufficient work space per student	50%	60%
Sufficient project storage	60%	61%
ANSI Z87.1 glasses for entire class	79%	83%
Cabinet to sanitize goggles	71%	50%
A sink in the facility	68%	76%
First Aid Kit	43%	61%
Lockable chemical storage cabinet	71%	67%
Finishing or chemical storage room	50%	46%
External exhaust paint booth	71%	83%

## Students Are Always Required To Do the Following:

	<u>New Jersey</u>	<u>National</u>
Wear Close Toed Shoes	75%	69%
Wear Safety Glasses when working	71%	76%
Secure Long Hair/Tie Back	79%	78%
Wear goggles when using chemicals	43%	44%
Receive oral and written safety directions before an activity	64%	64%

## Have any of the following occurred/do they occur?

### New Jersey



# Recommendation

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- Flush out eye wash sink/shower once a week for 2 minutes.
- Check your first Aid kit each semester to restock, work with your school nurse to keep it stocked with the necessities.

### -Resources:

Roy, K. R., & Love, T. S. (2020). A clearer view of emergency shower and eyewash station requirements. *Technology and Engineering Teacher*, 80(1), 23-25.

Roy, K. (2016). Responding to laboratory accidents. *Science Scope*, 39(9), 74-76.

Roy, K. (2004). What is your first-aid policy? *Science Scope*, 27(4), 38-39.

**During your time of employment, has your school district been involved in litigation or a settlement because of a T&E laboratory accident?**

### New Jersey

Answer	%	Count
Yes	11%	3
No	75%	21
Unsure	15%	4

### National

Yes	7%	51
No	62%	444
Unsure	31%	223

**Within the last 12 months, how many T&E safety incidents (no injury) have occurred in your classes?**

**New Jersey**

Answer	%	Count
0	36%	10
1-10	57%	16
11-20	7%	2
21-30	0.00%	0
More than 30	0.00%	0

**National**

0	38%	274
1-10	60%	427
11-20	2%	15
21-30	0%	0
More than 30	0.3%	2

**If a T&E safety incident has occurred, did it involve any of the following?**

Question	Involved	
1. Hot glue gun	43%	12
2. Broken glass	25%	7
3. Spills/splashes (of any kind)	29%	8
4. Student Operated Equipment/Machinery (ex. scroll saw, band saw, etc)	32%	9
5. Automated equipment (ex. CNC, laser cutter, 3D printer, robotics, etc.)	14%	4

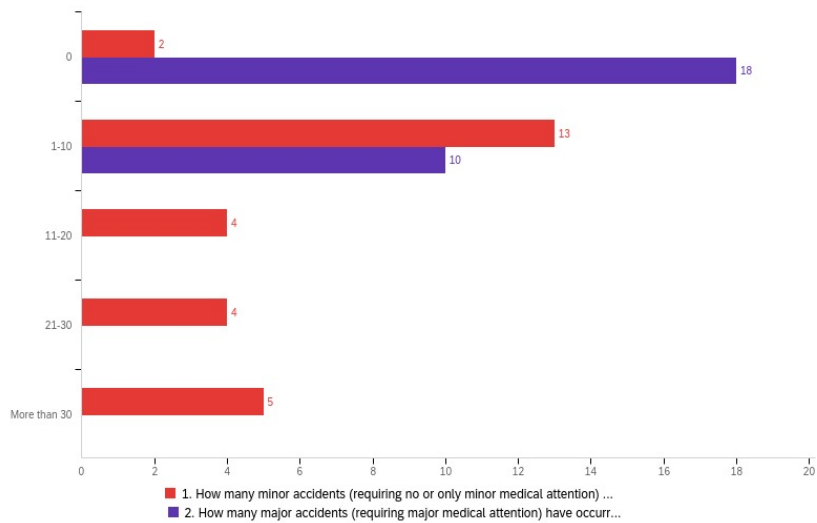
Question	Involved	
6. Hand or portable power tools (ex. cordless drill, Dremel, etc.)	25%	7
7. Fumes	25%	7
8. Fires	0%	0
9. Projectiles	18%	5
10. Electrical Short	21%	6
11. Outdoor activities	4%	1

**National Top 3: Hot Glue, Equipment, Hand/Power Tools**

**How many T&E lab accidents occurred within the past year in your classes?**

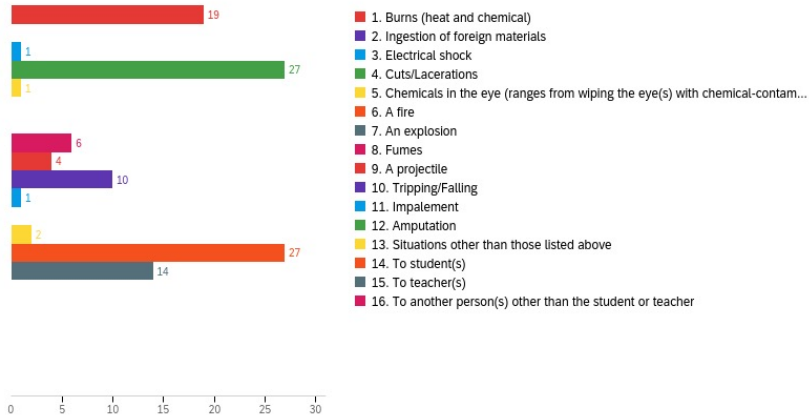
Question	0		1-5		6-10		11-15	
1. How many <b>minor accidents</b> in the past 12 months?	11%	3	57%	16	21%	6	7%	2
2. How many <b>major accidents</b> (requiring major medical attention) occurred in your classes within the past 12 months?	93%	26	7%	2	0%	0	0%	0

**How many T&E lab accidents occurred within the past 5 years in your classes?**



**If an accident (minor or major) has occurred in your classes within the past 5 years, did it involve any of the following:**

Similar to national findings.  
Mostly cuts/lacerations or burns to students



**New Jersey**

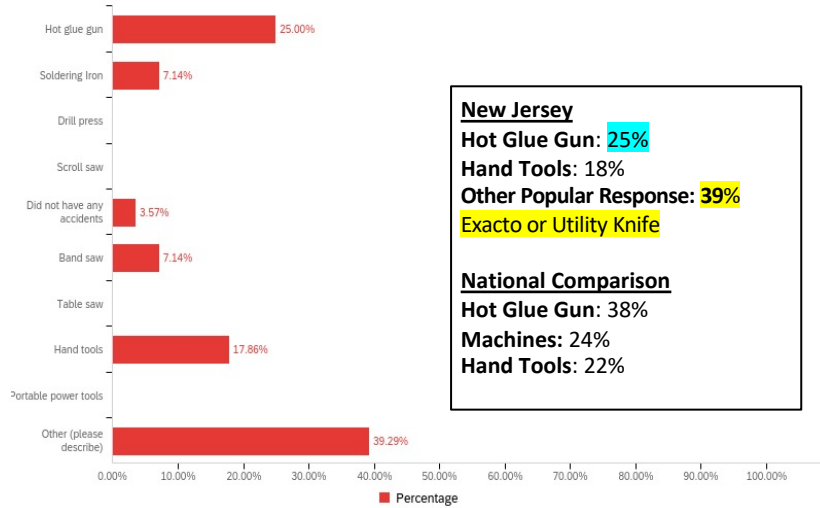
**Most commonly injured body part?**

Answer	%	Count
Did not have any accidents	4%	1
<b>Fingers/hands</b>	<b>96%</b>	27
Eyes/face	0%	0
Arms	0%	0
Legs	0%	0
Other body part	0%	0

**National**

Did not have any accidents	13%	93
<b>Fingers/hands</b>	<b>86%</b>	615
Eyes/face	0.4%	3
Arms	0.1%	1
Legs	0%	0
Other body part	0.8%	6

**Of all accidents that have occurred during the past 5 years in your classes, what was the most common tool/equipment that caused injury?**



**New Jersey**  
**Hot Glue Gun: 25%**  
**Hand Tools: 18%**  
**Other Popular Response: 39%**  
**Exacto or Utility Knife**

**National Comparison**  
**Hot Glue Gun: 38%**  
**Machines: 24%**  
**Hand Tools: 22%**

## 3D Printer Ventilation

	<u>New Jersey</u>	<u>National</u>
Have 3D printer(s)	79%	75%
Built in filter (HEPA)	9%	17%
Used inside of a fume hood	0%	2%
Used near internal vent system (ex. electrostatic air filter)	5%	6%
No ventilation used	86%	75%

## Recommendation

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-3D printer ventilation studies continue to present new findings each year. Current research suggests using PLA is safer but still requires 4 air changes per hour in the room.

**-Resources:**

<http://www.ehs.ufl.edu/programs/os/3d-printer-policy/>

<http://istl.org/17-summer/short.html>

<https://rh.gatech.edu/news/627220/particles-emitted-consumer-3d-printers-could-hurt-indoor-air-quality>

## Soldering Ventilation

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	<u>New Jersey</u>	<u>National</u>
Do soldering activities	64%	52%
Under external vented fume hood	22%	15%
Under internal fume extractor	17%	12%



## Recommendation

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-Even with non-led based solder manufacturers and health organizations still suggest ventilation such as a portable fume extractor

**-Resources:**

-Love, T. S., & Tomlinson, J. (2018). Safer soldering guidelines and instructional resources. *Technology and Engineering Teacher*, 77(5), 20-22. Retrieved from

<https://www.iteea.org/127705.aspx>

[https://www.iteea.org/Resources/Safety/Soldering\\_Iron.htm](https://www.iteea.org/Resources/Safety/Soldering_Iron.htm)

## Laser Engraver

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	<u>New Jersey</u>	<u>National</u>
Have a laser engraver	50%	44%
Internal Exhaust	21%	31%
External Exhaust	79%	64%
No ventilation	0%	5%

## Recommendation

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-Follow manufacturer recommendations for proper ventilation and cooling for your laser cutter.

**-Resource:**

<http://www.teachingenuity.com/2016/02/07/laser-cutters-in-schools-safety-tips/>

## Table Saws

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	<u>New Jersey</u>	<u>National</u>
Have a table saw	54%	65%
SawStop brand	67%	56%
Instructor only use	33%	34%
Student use with strict guidance	27%	31%
Student use with Teacher in Lab	40%	35%

## Welding/Casting/Molding

	<u>New Jersey</u>	<u>National</u>
Do these activities	18%	24%
Welding Fume Hood	40%	79%
Welding Booth with Shield	40%	81%
Approved Face Protection for all students doing these activities	60%	94%
Approved PPE for all students doing these activities	60%	89%

### Top 3 Factors for Unsafe Conditions/Accidents in a T&E lab?

#### New Jersey

1. Student Failure to follow safety protocols
2. Overcrowding
3. Tie: Inadequate Engineering Controls; Inclusion of Students with Various Special Needs

#### National

1. Student Failure to follow safety protocols
2. Overcrowding
3. Classroom management/discipline

# Questions?

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[https://sites.google.com/view/  
2020-te-safety-study/](https://sites.google.com/view/2020-te-safety-study/)