


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

How Does Utah Compare to the National Averages?



What are the Implications for School Systems?

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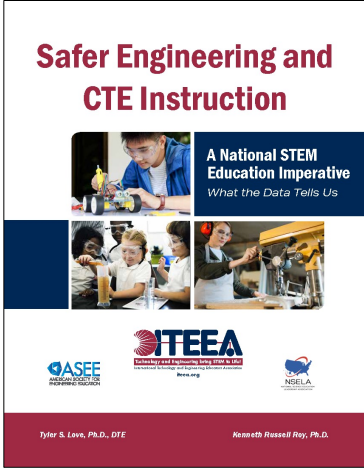

Guest Lecture to the T&E Education Program
at Utah State University
April 20, 2023

Permissions

These findings were derived from:

Love, T. S., & Roy, K. R. (2022). *Safer engineering and CTE instruction: A national STEM education imperative. What the data tells us.* International Technology and Engineering Educators Association. <https://www.iteea.org/SafetyReport.aspx>

FREE Download!



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CURRENTLY

- Professor, Director of CTE and Coordinator of T&E Education at the University of Maryland Eastern Shore in Baltimore, MD
- NSTA Safety Advisory Board Member
- OSHA Authorized Trainer for General Industry
- 2018 CareerSafe® Safety Educator of the Year



PREVIOUS EXPERIENCES

- Assistant Professor of Elementary/Middle STEM Education at Penn State University, Harrisburg
- Coordinator and Associate Professor of T&E Ed in MD
- Safety Editor for ITEEA
- Technology and Engineering teacher in Maryland's Public School System

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CURRENTLY

- ON STAFF AT Glastonbury Public Schools (CT)
 - Director of Environmental Health & Safety/Chemical Hygiene Officer

PRIVATE SAFETY PRACTICE

- National Safety Consultants, LLC – General Manager/Senior Safety Consultant
- National Science Teaching Association (NSTA)
 - Chief Science Safety Compliance Adviser and Blogger
- National Science Education Leadership Association (NSELA)
 - Safety Compliance Officer
- International Council of Associations for Science Education (ICASE)
 - Safety Committee Member
- Author of over 10 safety books and ~ 800 Professional Journal Articles on Safety



Background Info

- Last national survey on T&E safety is unknown
- Large focus on safety in T&E education due to:
 - Potential hazards, resulting risks, and teacher liability
 - Alternative certification
 - STEM/Makerspaces
 - After school clubs

Previous Research - CTE

- 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 surpassing legal occupancy loads
 5. Small classroom/lab space

Previous Research - Science Ed

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

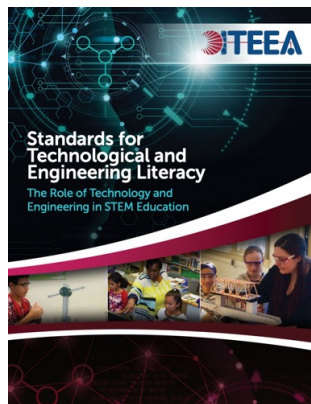
- 856 science teachers in TX
- 81 incident/accident report forms returned

-Incidents/Accidents increased:

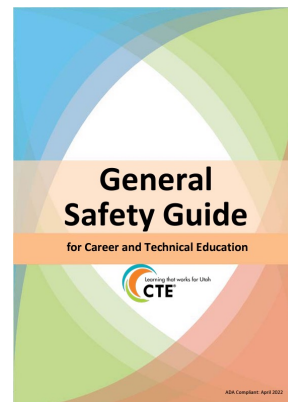
1. 8% to 62% as **class size** increases from <14 to >24 students
2. 11% to 66% as **room size** decreased below 60 sq. ft per student
3. 11% to 47% as **room size** decreased below 800 sq. ft
4. 35% did not have adequate training
5. Only 69% had a written safety policy

-Study redone in 2014, similar findings

Safety – Embedded in Standards and State Guides!



Love, T. S., Duffy, B. C., Loesing, M. L., Roy, K. R., & West, S. S. (2020). Safety in STEM education standards and frameworks: A comparative content analysis. *Technology and Engineering Teacher*, 80(3), 34-38.



Utah 2022 CTE Safety Guide:
<https://www.schools.utah.gov/file/5b51eed6-3987-4646-bac4-50df67dfbf6d>

T&E 2020 National Safety Survey

-TEE-FASS (T&E Ed Facilities and Safety Survey)

Adapted from Stephenson et al. study

April 2020 - sent out to ITEEA and state organization members

718 responses from 42 states, 39 UT responses

-Questions on:

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

Demographics

Gender and Race

Utah

Answer	%	Count
Male	79%	31
Female	21%	8
Total	100%	39
White	92 %	36
Black	0 %	0
Two or More Races	8 %	3
Asian	0 %	0
Hispanic or Latino	0 %	0
Native Hawaiian or Pacific Islander	2 %	1

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

Certification(s)

Utah

Answer	Percent	Count
Alternative or Emergency	3%	2
Elementary Education	3%	2
Technology Ed or T&E Education	42%	30
A Science Education area	4%	3
CTE area	38%	27
Other (please specify)	10%	7

National – T&E = 78%, Elementary = 3%, CTE = 8%

Total Years Teaching T&E/Tech Ed/Indust. Arts

Utah

Answer	%	Count
0-3	0%	0
4-8	28%	11
9-15	23%	9
16-25	23%	9
26+	26%	10

National

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

Grade Level Taught

Utah

Grade Level	%	Count
K-5	3%	1
Middle School	28%	11
High School	54%	21
6-12 (Middle & High School)	15%	6
K-12	0%	0

National

Grade Level	%	Count
K-5	3%	21
Middle School	29%	207
High School	55%	394
6-12 (Middle & High School)	11%	82
K-12	2%	14

Courses and Enrollment

Course Preps Per Semester

<u>Preps</u>	<u>Utah</u>	<u>National</u>
1	3%	3%
2	10%	14%
3	38%	31%
4	10%	25%
5	26%	13%
>5	13%	14%

Primary Focus of Your Courses

Utah

1. Engineering Design, T&E Literacy
2. Electronics/Programming/Robotics
3. Materials Processing (woods)

National

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

Enrollment in your classes: Average and Largest Class sizes

Utah

Average: 5% said 16-20
31% said 21-24
39% said 25-30
23% said more than 30

Largest: 31% said 25-30
62% said more than 30

National Comparison

Average: 33% said 16-20
25% said 21-24
22% said 25-30
8% said more than 30

Largest: 34% said 25-30
23% said more than 30

****Reported course enrollments in UT were much higher than the national average.**

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

Utah

Answer	%	Count
0-5%	26%	10
6-15%	54%	21
16-25%	13%	5
26-50%	8%	3
More than 50%	0%	0

National

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



Administrative and District Support



Administration's progressive disciplinary support?

Utah

Answer	%	Count
Poor	5%	2
Fair	21%	8
Good	59%	23
Excellent	15%	6

National

Poor	12%	79
Fair	21%	152
Good	42%	303
Excellent	26%	184

Have a sufficient budget to maintain safety

Utah

Answer	%	Count
Yes	74%	29
No	26%	10

National

Answer	%	Count
Yes	53%	380
No	47%	338

District Safety Practices

Does your district have a policy on PPE?

Answer	Utah	National
Yes	72%	51%
Unsure	18%	23%

Does your district conduct an annual inventory of chemicals?

Answer	Utah	National
Yes	44%	41%
Unsure	36%	33%

Does your district keep records or injuries that occurred in the past 12 months?

Answer	Utah	National
Yes	69%	70%
Unsure	26%	26%

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

Answer	Utah	National
Yes	74%	43%
No	13%	37%
Unsure	13%	21%

Do the Following Have A Written Safety Policy?

Answer	Utah	National
T&E Classes	82%	82%
T&E Department	46%	56%
School District	64%	44%

How does your district dispose of hazardous chemicals?

Answer	Utah	National
Hazardous waste contractor	21%	26%
Green disposal methods	0%	2%
Municipality	13%	11%
Down the drain/trash	8%	6%
Unsure	21%	37%
Do not use hazardous chemicals	38%	18%

Recommendations

- Work with your district safety compliance officer, legal counsel, fire marshal, administrators/supervisors, and teachers to **develop a written safety program**, including protocols, inspections, training, etc.
- Work with your **Board of Education** to help develop a written safety policy.
- Ask your district's chemical hygiene officer or safety officer how to properly **dispose of chemicals**
- Refer to **legal resources** (e.g. OSHA, NFPA) and professional resources (e.g. ITEEA, ACTE, NSTA) for additional information in developing the safety program.
- Enforce safety **consistently and fairly**

Further Recommendations

Refer to Utah's rules governing workplaces under the jurisdiction of the **Utah Occupational Safety and Health Division** office (<https://laborcommission.utah.gov/divisions/uosh/>). Utah has developed a state OSHA plan that applies to both public and private sector employees.

Safety Training

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

Answer	Utah	National
UG tech/eng or lab courses	77%	62%
UG teaching methods courses	69%	54%
Grad tech/eng or lab courses	41%	28%
Grad teaching methods courses	41%	32%

When initially hired did your district provide safety training?

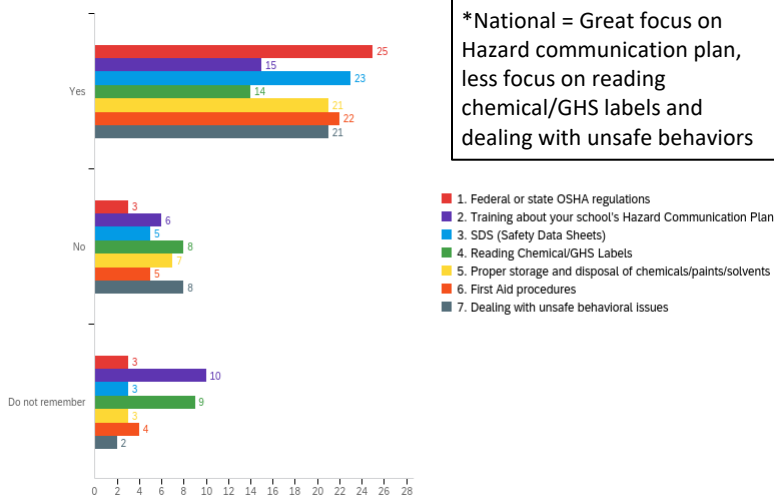
Answer	Utah	National
Yes	49%	32%
No	51%	68%

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

Answer	Utah	National
<6 months	21%	15%
6 months -1 year	28%	21%
1-2 years	8%	7%
2-5 years	15%	5%
>5 years	8%	7%
Never received training from my district	21%	44%

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

Utah



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

Utah

Answer	%	Count
Yes	15%	6
No	85%	33

***National = 18% said Yes**

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

UT Answer	UT %	UT Count	National %
Local training source (not my school district)	17%	1	26%
State teacher's association	0%	0	12%
State department of education	17%	1	6%
National teacher's association	0%	0	3%
A university	17%	1	11%
OSHA	33%	2	17%
Other (ex. PLTW)	17%	1	25%
Total	100%	6	

Recommendations

According to Federal OSHA

- Safety Training must be administered **upon initial hire**, again any time a **new hazard is introduced** (chemical, equipment, etc.), **change in teaching assignment**, and/or updates in safety plans
- Under duty or standard of care the employer (school) has a legal and professional responsibility to **provide these trainings**
- Employee can **request in writing** to receive these trainings
- Check with your school district safety compliance officer to request trainings and ask about training standards specific to Utah's state OSHA plan**

Facility Characteristics

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

Answer	Utah	National
Portable Classroom	0%	0.28%
Regular Classroom/computer room	8%	17%
T&E classroom/lab combo	74%	66%
T&E Lab	10%	12%
Makerspace	5%	2%
Varied due to floating	3%	3%

Approximate size of the instructional area?

Answer (Fire Code Capacity)	Utah	National
Less than 600 square feet (<12 students)	46%	8%
600-800 square feet (12-16 students)	23%	20%
800-1,000 square feet (16-20 students)	18%	22%
1,000-1,200 square feet (20-24 students)	10%	24%
Greater than 1,200 square feet (>24 students)	3%	26%

Review:

UT Average Enrollment:
62% said more than 24

UT Largest Enrollment:
93% said more than 24

Soldering Ventilation

	<u>Utah</u>	<u>National</u>
Do soldering activities	54%	52%
Under external vented fume hood	24%	15%
Under internal fume extractor	19%	12%

3D Printer Ventilation

	<u>Utah</u>	<u>National</u>
Have 3D printer(s)	82%	75%
Built in filter (HEPA)	3%	17%
Used inside of a fume hood	3%	2%
Used near internal vent system (ex. electrostatic air filter)	13%	6%
No ventilation used	81%	75%

Laser Engraver

	<u>Utah</u>	<u>National</u>
Have a laser engraver	62%	44%
Internal Exhaust	17%	31%
External Exhaust	79%	64%
No ventilation	4%	5%

Recommendations

Fire code NFPA 101 Life Safety Code requires **50 sq. ft. per student** (net square footage) in academic **labs and shops**

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

Research also suggests the odds of an accident increase significantly when there are more than 24 students for one instructor to supervise

School systems need to ensure safer class sizes in UT based on the data from this study and the information presented above.

Conduct at a minimum **annual safety inspections** to make sure your facilities have proper safety controls and space (ITEEA website and NIOSH have excellent checklists)

Recommendations cont.

Make sure the **instructional space meets all** OSHA, NFPA, and other legal safety **standards** and better professional safety practices like ANSI/ISEA, ITEEA, ACTE, etc. to make it safer for both teachers and students.

Use non-lead based **solder** when possible with ventilation at the source.

Research calls for 3D printers to be ventilated due to UFPs emitted.

Source: <https://www.iteea.org/102756.aspx>

Classroom Management Safety Practices

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

Question	Never	Rarely	Usually	Always
1. Sign a safety acknowledgement form?	10% (UT) 16% (US)	5% 6%	5% 10%	79% 69%
2. Be tested for their knowledge of safety procedures prior to participating in new hazardous T&E activities/using new hazardous equipment?	8% 8%	0% 5%	5% 12%	87% 76%
3. Safely demonstrate a new procedure or use of a new tool/piece of equipment while directly supervised?	0% 5%	5% 3%	18% 16%	77% 76%
4. Be tested on safety knowledge on their quizzes/exams?	5% 10%	5% 15%	18% 24%	72% 52%
5. Be provided both written and oral safety precautions by the instructor prior to each lab?	0% 7%	13% 14%	13% 24%	74% 52%

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

Question	Never	Rarely	Usually	Always
6. Secure long hair /tie it back?	5% (UT) 6% (US)	3% 2%	10% 14%	82% 78%
7. Remove loose jewelry , roll up long sleeves, secure baggy clothing?	5% 7%	0% 3%	15% 14%	79% 76%
8. Wear close toed shoes?	5% 7%	5% 4%	18% 20%	72% 69%
9. Wear safety glasses when working with solid hazards	13% 11%	0% 3%	5% 10%	82% 77%
10. Wear safety goggles when working with liquid hazards	26% 31%	15% 13%	10% 12%	49% 44%

Recommendations

Have all students be safety **trained**, **tested** and sign a **safety acknowledgement** form before starting any work involving hazards (ex. hand and/or power tools)

All students need **safety glasses with side shields** on when an activity is being conducted in a room or lab (**indirectly vented chemical splash goggles** for liquid hazards)

Students should be **directly supervised** when using any equipment (after meeting all other criteria like safety tests)

Include some key safety questions on unit tests/quizzes

Provide written and oral forms of safety instruction/reminders

No **open toed shoes** or **flip flops** allowed during lab activities

Always require students to **tie back** long hair/**secure** loose clothing and jewelry



Safety tests and posters used with students?

Answer	Utah	National
ITEEA's safety website	5%	10%
Virginia Tech's lab safety resource website	0%	1%
Power Tool Institute resources	0%	3%
School district/department developed resources	23%	15%
State developed resources	13%	4%
Student developed safety resources	0%	1%
Teacher (my own) developed resources	59%	58%
I do not use safety tests or posters	0%	8%

Teachers Reported Having the Following:

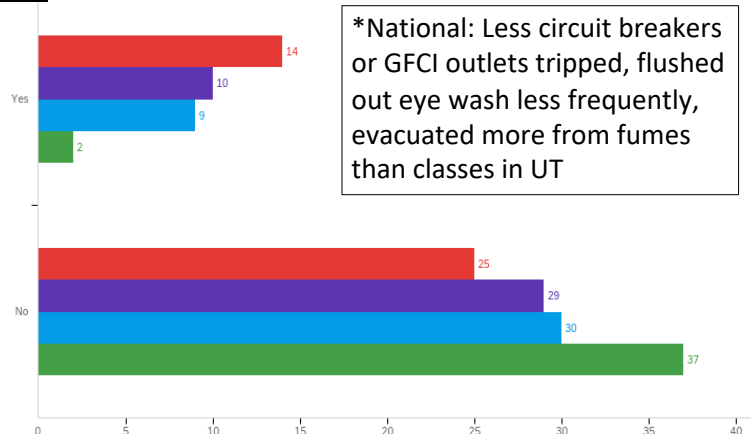
	Utah	National
Safety Zones on Floor	67%	48%
Non-skid strips near machines	36%	27%
Eyewash w/in 10 second access		
Plumbed	69%	47%
Portable	33%	22%
Adequate Ventilation	51%	45%
Workspace accessible to wheelchair bound students	67%	47%
Accessible master power shut offs	46%	61%
Sufficient number GFCI of outlets	69%	61%

Teachers Reported Having the Following:

	<u>Utah</u>	<u>National</u>
Lockable tool storage	67%	78%
Sufficient work space per student	74%	60%
Sufficient project storage	67%	61%
ANSI Z87.1 glasses for entire class	79%	83%
Cabinet to sanitize glasses/goggles	49%	50%
A sink in the facility	79%	76%
First Aid Kit	74%	61%
Lockable chemical storage cabinet	74%	67%
Fire extinguisher	87%	86%
Dust collector for woodworking	74%	64%

Have any of the following occurred/do they occur?

Utah



*National: Less circuit breakers or GFCI outlets tripped, flushed out eye wash less frequently, evacuated more from fumes than classes in UT

- 1. Within the last 12 months have circuit breakers or GFCI outlets tripped ...
- 2. Do you flush the eye wash every week for 2 or more minutes?
- 3. Does your school or district check your First Aid kit and restock missin...
- 4. Have you had to evacuate the lab or open the door because of fumes/poor ...

Recommendations

Flush out emergency eye wash & shower once a week for 1-3 minutes

Check first aid kit each semester to **restock**, work with school nurse

Use a U-V goggle **sanitizer** with a UV-C Germicidal bulb to sanitize eye protection devices after each individual's use.

Have at least one or more **sinks** with running cold and hot water sources dependent on class enrollment

Have a **lockable/secure** finishing or chemical storage room and chemical storage cabinet to prevent student access.

Have a **lockable/secure tool cabinet** to prevent student access when not in use instructionally.

Recommendations cont.

Have appropriate taped or painted safety **work zones** near all machines.

Have **non-skid strips** near machines to prevent slip/fall hazards.

Have appropriate **ventilation** to accommodate particulate and aerosol hazards.

Have a **wood dust collection system** with the intake vent placement **at the machine source** of wood dust production to prevent exposure to air-borne wood dust.

Have **workspace accessible to wheelchair** bound students per ADA requirements.

Have all electrical receptacles **GFCI** protected and ensure that they **work properly**.

Have easily accessible **emergency power shut-off** switches.

Have a **sufficient number of electrical receptacles** to eliminate use of extension cords.

Have a **lockable/secure tool cabinet** to prevent student access when not in use instructionally.

Accidents

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

Utah

Answer	%	Count
Yes	28%	11
No	28%	11
Unsure	44%	17

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?

Utah

Answer	%	Count
0	44%	17
1-10	56%	22
11-20	0%	0
21-30	0%	0
More than 30	0%	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?

Utah

Question	Involved	
1. Hot glue gun	41%	16
2. Broken glass	3%	1
3. Spills/splashes (of any kind)	26%	10
4. Student Operated Equipment/Machinery (ex. scroll saw, band saw, etc)	28%	11
5. Automated equipment (ex. CNC, laser cutter, 3D printer, robotics, etc.)	8%	3

Question	Involved	
6. Hand or portable power tools (ex. cordless drill, Dremel, etc.)	18%	7
7. Fumes	5%	2
8. Fires	0%	0
9. Projectiles	18%	7
10. Electrical Short	13%	5
11. Outdoor activities	8%	3

National = Less spills/splashes, automated equipment, and electrical short accidents

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

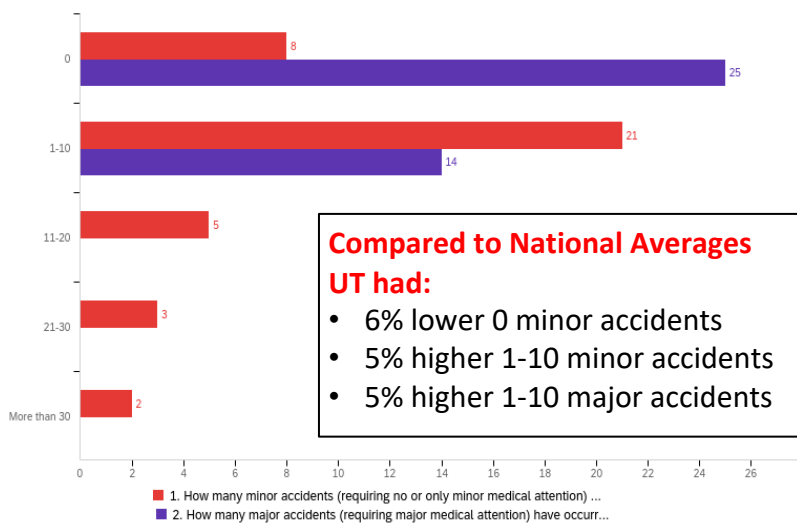
Utah

Question	0		1-5		6-10		11-15		>15	
1. How many minor accidents in the past 12 months?	28%	11	62%	24	8%	3	0%	0	3%	1
2. How many major accidents (requiring major medical attention) occurred in your classes within the past 12 months?	90%	35	10%	4	0%	0	0%	0	0%	0

National = Less teachers (20%) reported having no minor accidents.

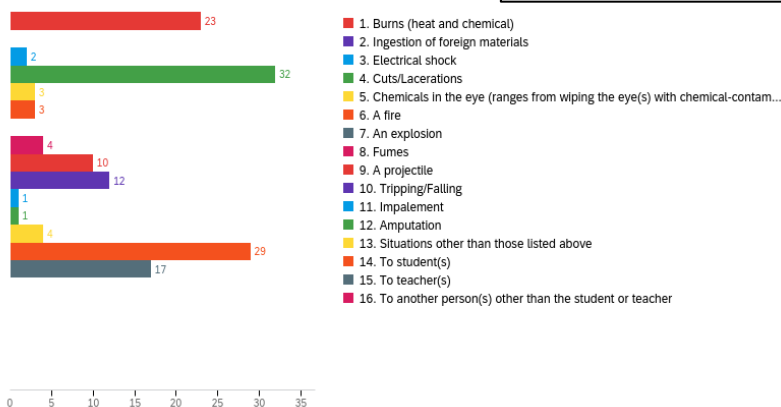
How many T&E lab accidents occurred within the past 5 years in your classes?

Utah



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

Utah



Similar to national findings. Mostly cuts/lacerations or burns to students. UT had 9% more trip/fall accidents

Utah

Most commonly injured body part?

Answer	%	Count
Did not have any accidents	18%	7
Fingers/hands	79%	31
Eyes/face	3%	1
Arms	0%	0
Legs	0%	0
Other body part	0%	0

National

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

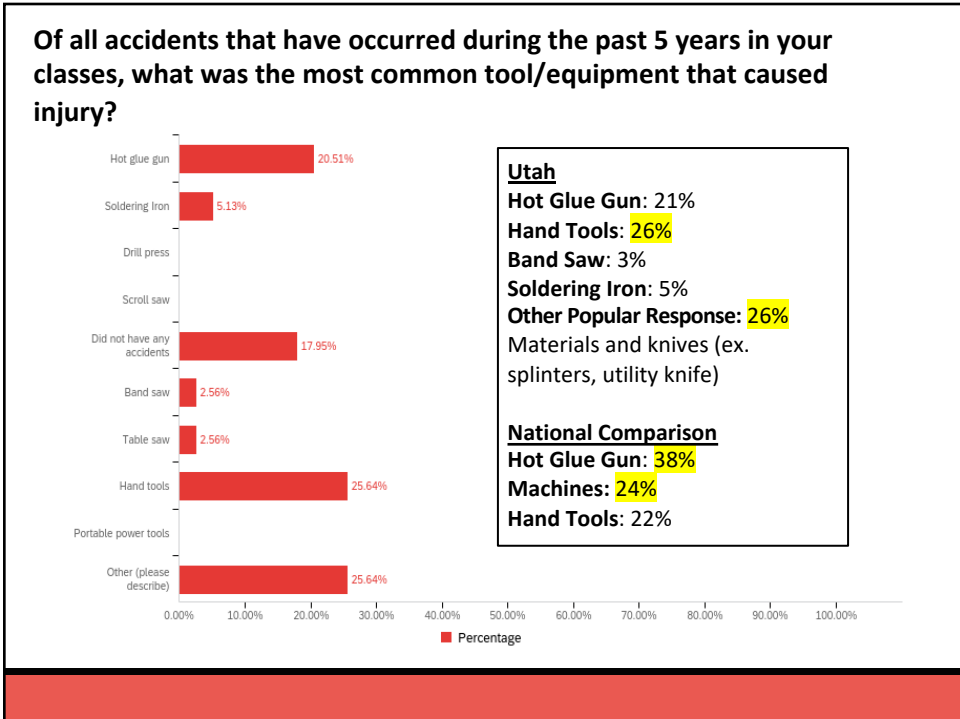


Table Saws

	<u>Utah</u>	<u>National</u>
Have a table saw	59%	65%
SawStop brand	100%	56%
Instructor only use	30%	34%
Student use with strict guidance	26%	31%
Student use with Teacher in Lab	44%	35%

Top Factors for Unsafe Conditions/Accidents in a T&E lab (in order of significance according to responses)?

Utah

1. Student Failure to follow safety protocols
2. Overcrowding
3. Classroom management/discipline
4. Tie - Lack of safety training
Tie - Multiple preps

National

1. Student Failure to follow safety protocols
2. Overcrowding
3. Classroom management/discipline
4. Percentage of Students with Disabilities in class
5. Inadequate facilities

Correlations and Predictors of Accidents

Correlations and Predictors of Accidents

Please see the following studies from the national dataset that discuss safety factors which were found to be significantly associated with accident occurrences:

Love, T. S., Roy, K. R., & Sirinides, P. (2023). A national study examining safety factors and training associated with STEM education and CTE laboratory accidents in the United States. *Safety Science*, 160(106058), 1-13. <https://doi.org/10.1016/j.ssci.2022.106058>

Love, T. S., Sirinides, P., & Roy, K. R. (2022). *Examining factors associated with accidents in CTE and STEM education labs: A national safety study*. Paper presented at the annual meeting of the American Educational Research Association, San Diego, CA. <https://doi.org/10.3102/1888047>

Questions?

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Additional Results:

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