Council of State Science Supervisors

CSSS ELEMENTARY SCHOOL STEM SAFETY REFERENCE MANUAL

Council of State Science Supervisors Edition 2026

Safer Practices for Elementary STEM Instruction (Grades K–5)

A nationally aligned safety manual supporting sound professional judgment, developmental alignment, and safer hands-on learning in U.S. elementary schools

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In Partnership With

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ACKNOWLEDGMENTS

The Council of State Science Supervisors extends its appreciation to James Palcik, CHO, Dr. Brian Collins, Dr. Edward Cohen, and Dr. Kenneth Roy for their leadership in developing the CSSS Elementary School STEM Safety Reference Manual.

This manual was written with a clear purpose: to support high-quality, inquiry-based elementary STEM instruction while reinforcing the professional responsibility educators hold to protect young learners. It reflects the insight of classroom teachers, school leaders, state supervisors, and safety professionals who understand that safety is not separate from instruction. It is part of it.

The authors are grateful for the guidance of national organizations, including OSHA, NFPA, ANSI/ISEA, NIOSH, NSTA, NASBE, and NAEYC. Their standards and position statements inform the professional expectations that shape this work. The authors also recognize the contributions of safety leaders and reviewers across K–12 education whose feedback strengthened the clarity and practicality of this manual.

The authors and the Council of State Science Supervisors gratefully acknowledge Ward's Science, a division of VWR, for their valued partnership in supporting the development of the CSSS Safety Reference Manuals. Their sustained commitment to advancing science education and strengthening laboratory safety continues to benefit STEM classrooms nationwide. We are especially appreciative of their collaboration in providing high-quality scientific illustrations, imagery, and technical insight, which enhance clarity, reinforce safer practices, and support effective, engaging instruction across Science, STEM, and CTE programs.

About CSSS

The Council of State Science Supervisors is a national organization made up of the people who oversee science education at the state level. Its members are responsible for guiding how science is taught across K–12 systems, from setting policy and supporting standards implementation to shaping professional learning and statewide initiatives.

CSSS provides a space for states to learn from one another, share emerging challenges, and exchange practical solutions grounded in classroom reality.

Through collaboration, research-informed guidance, and partnerships with national organizations, CSSS helps states strengthen science education so that it remains rigorous, inclusive, and connected to real-world learning, while supporting educators in meeting their professional responsibilities, including student safety.

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EXECUTIVE SUMMARY

Elementary STEM instructional spaces (classrooms and laboratories) are places of movement, curiosity, and discovery. They are also environments where young learners depend entirely on adults to anticipate potential safety hazards and resulting safety risks and create safer STEM conditions for exploration.

This manual exists to support that responsibility.

The CSSS Elementary School STEM Safety Reference Manual offers practical, developmentally aligned guidance for safer hands-on STEM instruction in Grades K–5. It recognizes a simple truth: children at this age do not independently manage risk. Adults design the environment, select the materials, structure the routines, and supervise the learning.

Safety failures in elementary settings rarely result from complex equipment. More often, they stem from unclear expectations, inconsistent supervision, materials that exceed developmental readiness, or transitions that are not carefully managed. This manual proactively addresses those predictable pressure points in elementary STEM instructional settings.

Key themes include:

- Safety as a form of adult design and professional judgment
- Heightened duty and standard of care based on age and developmental dependence
- Alignment with professional standards adapted appropriately for young learners
- Learning space design and supervision as primary safety tools
- Careful material selection as the first line of risk reduction
- PPE introduced as habit formation
- Structured transitions to prevent common injuries
- Calm, clear emergency response
- Ongoing training, documentation, and reflection as essential to continuous improvement
- Inclusive space for students with diverse additional needs

Elementary STEM safety is not about limiting exploration. It is about designing exploration wisely and cultivating a sense of wonder in these elementary student minds.

When educators intentionally structure their instructional spaces, model expectations consistently, and reflect on practice, they create environments where curiosity and safety reinforce one another.

SAFETY IN ELEMENTARY STEM LEARNING

Developmentally appropriate safety is not simplified safety. It is strategically designed safety.
— James Palcik, CHO, Safer STEM

Elementary STEM learning is built on curiosity, exploration, and movement. At this younger developmental stage, students are eager to engage with materials and ideas, but they do not yet possess the cognitive maturity to recognize potential safety hazards and resulting safety risks or regulate risk independently.

Safer STEM instruction in elementary settings depends entirely on adult planning, structure, and modeling. The elementary student has an abundance of innate curiosity about the world around them, and inquiry-based challenges should be designed to capture this sense of wonder while remaining developmentally appropriate.

From a professional and legal standpoint, this establishes a heightened duty and standard of care. Educators must anticipate what could reasonably go wrong, remove or control those conditions in advance, and design learning experiences that align with each student's developmental readiness. This includes selecting safer materials, limiting access to tools, structuring movement, and maintaining continuous active supervision (NSTA; CDC). Safer elementary STEM instructional spaces do not rely on student judgment. They rely on adult foresight, intentional design, and consistent instructional routines that prevent incidents before they occur. Students with additional needs may require modifications or accommodations to participate in STEM activities. (ADA; IDEA)

1.1 Purpose and Scope

Purpose

This manual provides clear, developmentally appropriate guidance for creating and maintaining safer STEM learning instructional spaces in elementary schools. It supports teachers in delivering hands-on, inquiry-based instruction while reducing preventable injuries and establishing strong learning habits appropriate for early learners.

It addresses instructional design, supervision, materials selection, STEM instructional space use, emergency response, and habit development appropriate for Grades K–5 students (CSSS).

Please refer to your local school or school district policies on safety and compliance for teaching STEM disciplines such as a chemical hygiene plan and/or a hazard communication standard.

Scope

This manual applies to:

- Elementary science and STEM instruction
- Engineering and design challenges that are age- and stage-appropriate
- Inquiry-based learning activities at the K-5 grade levels
- Classroom demonstrations and guided investigations
- Preparation, setup, and cleanup activities using safer strategies

Intended Audience

This manual is intended for:

- Elementary classroom teachers teaching science and technology
- STEM specialists and instructional coaches
- School and district administrators
- State science supervisors and curriculum leaders
- CHOs, Directors of Facilities, Safety Compliance Officers

Figure 1

This figure shows a well-organized elementary STEM instructional space where materials, space, and routines are intentionally designed for young learners. It reminds teachers that safer learning begins with thoughtful setup, clear expectations, and active supervision.

1.2 Safety Through Implications for Elementary STEM

Elementary students require constant supervision, explicit routines, and simplified safety expectations. They are not expected to assess potential safety hazards and resulting safety risks or make independent safety decisions.

Safety expectations must be designed around child development, not adult assumptions (CDC; NAEYC). This makes material and activity selection and forward planning more important for the teacher at these grade levels.

At the K–5 level:

- Impulse control is still developing for most students
- Curiosity frequently overrides caution
- Peer behavior strongly influences actions
- Abstract warnings are less effective than established routines

Safer STEM instruction must be designed around these elementary STEM realities.

> **Elementary students learn safety through repeated, guided action, not verbal warnings alone.**

Implications for Elementary STEM

Developmentally appropriate safety practices include:

- Clear, simple rules stated in student-friendly language
- Visual cues and teacher demonstrations of expected behavior (model proper behavior)
- Structured movement and clearly defined work areas
- Distribution of materials only when needed and clean up immediately afterwards
- Immediate correction of unsafe behavior

Independence in safety is taught gradually through guided practice, not assumed.

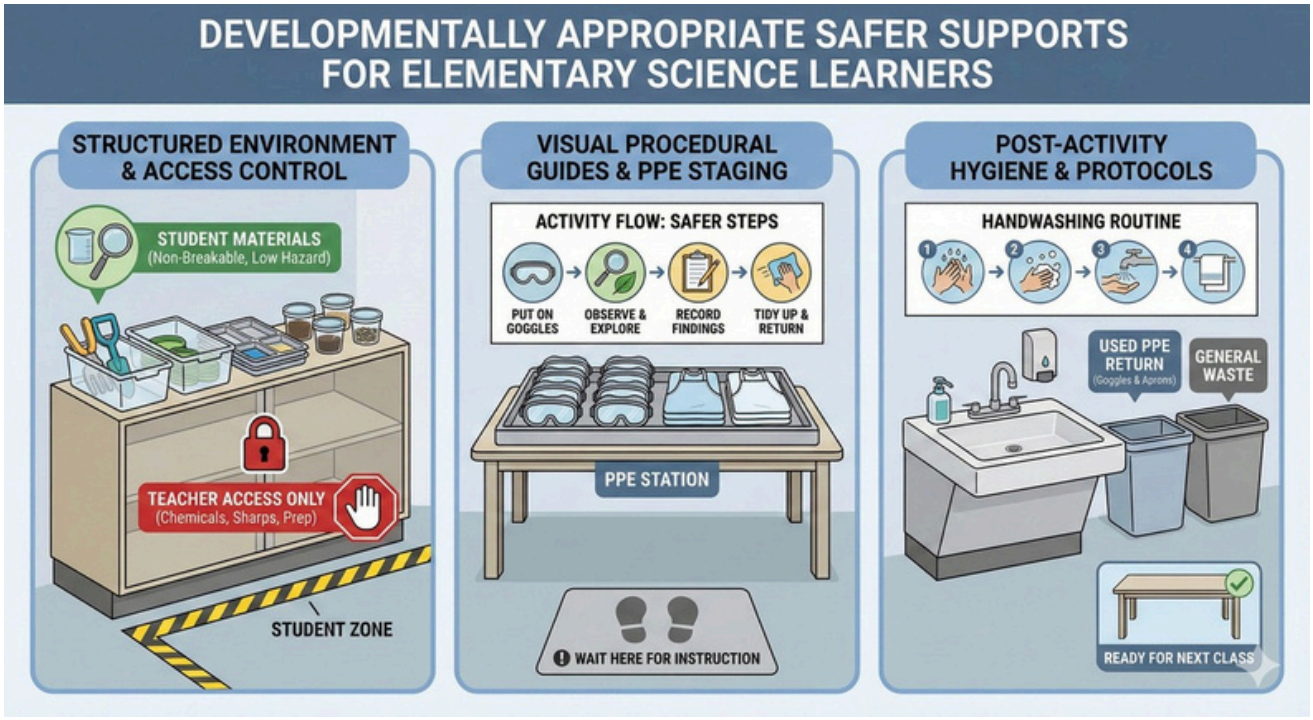
Students learn safety by repeatedly practicing simple routines, observing adult modeling, and receiving consistent feedback. When safety behaviors are embedded in meaningful activities, they become habits rather than reminders.

Discipline-Specific Context

- **Science:** Materials are distributed and collected by the teacher
- **Engineering:** Building challenges use soft, low-risk materials
- **Inquiry Learning:** Exploration occurs within clear physical and behavioral boundaries

Figure 2

This illustration highlights how safety is built through simple routines, visual supports, and teacher-controlled materials. It reinforces that elementary students learn safer behaviors through structure, modeling, and repeated practice, not independence.



Elementary students do not consistently translate verbal safety directions into action. Telling a student to “be careful” or “watch what you are doing” assumes a level of cognitive processing and impulse control that is still developing at this age. As a result, verbal reminders, while important, are not reliable safety controls when used in isolation.

Effective safety practice at the K–5 level requires layered supports, including visual cues, structured routines, teacher modeling, and controlled access to materials. Safety expectations must be demonstrated, practiced, and reinforced within the context of the activity itself. When safety is embedded into how materials are distributed, how students move, and how transitions occur, it becomes actionable rather than abstract (National Association for the Education of Young Children [NAEYC]; CDC).

In elementary STEM instructional spaces, safer behavior is not told; it is taught, modeled, and repeatedly practiced.

1.3 Building Safer Habits Early

Elementary STEM safety focuses on habit formation rather than formal hazard analysis and risk assessment. The goal is to establish simple routines that support safer learning throughout a student's academic career.

Safer habits include:

- Waiting for directions before touching materials
- Keeping hands to oneself unless instructed
- Wearing required personal protective equipment (PPE) when directed
- Cleaning up materials carefully and completely

These habits must be modeled, required, and reinforced consistently by adults.

Implications for Elementary STEM

Effective habit-building practices include:

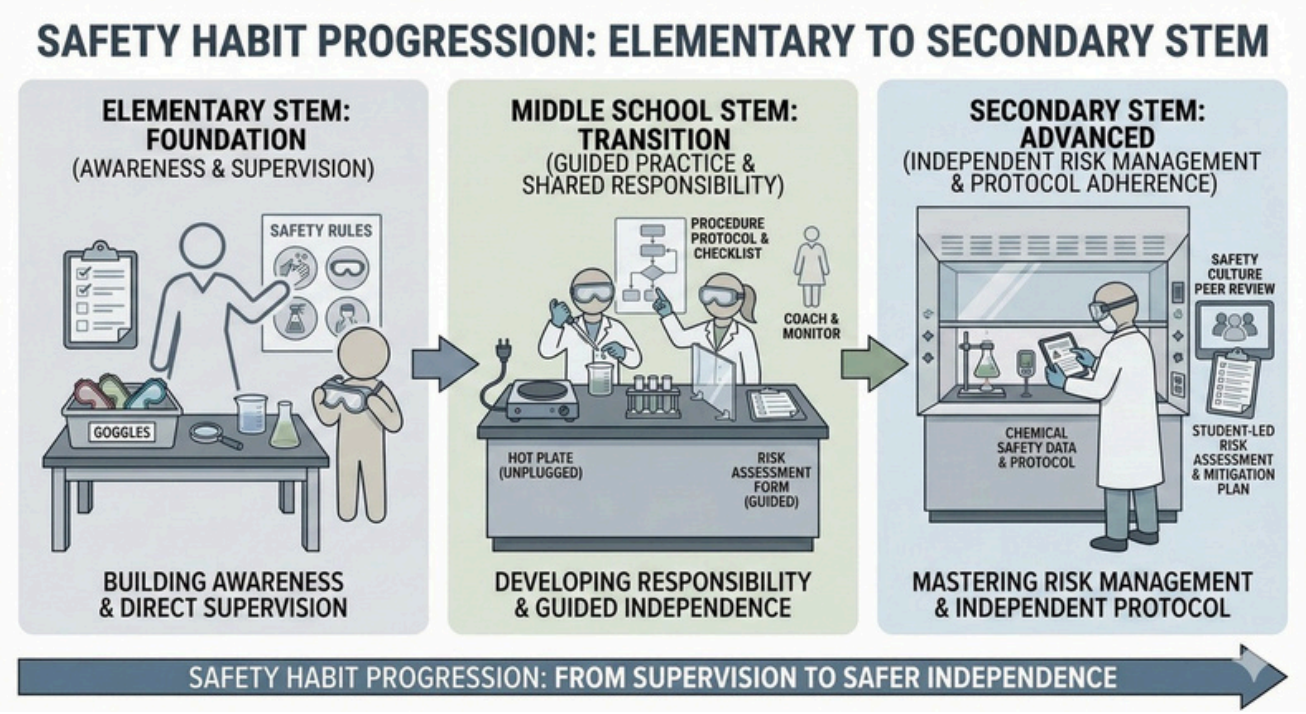
- Practicing routines before introducing materials
- Using consistent language and expectations across STEM instructional spaces
- Reinforcing positive behaviors immediately
- Treating safety corrections as instruction, not punishment

Habits formed in elementary school become expectations in middle and high school.

Elementary students are naturally curious, energetic, and eager to explore. They are not yet capable of independently recognizing potential safety hazards and resulting safety risks. Designing STEM lessons without accounting for this reality is like building a playground without soft surfaces and assuming children will never fall. At this level, safety is not something students manage. It is something adults intentionally design.

Figure 3

This figure shows how early safety routines grow into more advanced safety practices over time. It helps teachers see that the habits they build now lay the foundation for future STEM learning.



Closing Note from the Safety Desk

Elementary STEM safety is about preparing students for a lifetime of learning. When educators design instruction around developmental needs, model expectations, and reinforce safer routines consistently, they create learning environments that are engaging, orderly, and measurably safer.

II LEGAL & ETHICAL RESPONSIBILITIES

“Professional judgment means asking not only ‘Can we do this?’ but ‘Should we do this with eight-year-olds?’”
— James Palcik, CHO, Safer STEM

Elementary STEM instruction operates within a legal and ethical framework designed to protect young learners who are not yet capable of independently recognizing or managing potential safety hazards and resulting safety risks. In elementary settings, safety responsibilities rest almost entirely with adults. Understanding these responsibilities supports consistent decision-making and defensible instructional practice (NSTA).

2.1 Duty and Standard of Care in Elementary STEM

Educators and institutions have a legal duty of care to anticipate foreseeable hazards and corresponding risks and take reasonable steps under standard of care to prevent harm. In elementary STEM instructional spaces, this duty is heightened due to students' age, developmental stage, and reliance on adult supervision (NSTA; NASBE).

Duty of care refers to the legal obligation that individuals or organizations have to act in the best interest of others, preventing harm or injury through reasonable actions. Standard of care defines the level of competence and caution that a reasonable person is expected to exercise while providing care or services. A breach of duty occurs when an individual fails to meet the established standard of care, resulting in harm. Evaluating both concepts is essential to determining liability in negligence legal claims.

Duty and standard of care in elementary STEM includes:

- Selecting developmentally appropriate activities and materials
- Providing continuous, active supervision
- Establishing and enforcing clear safety routines and use of PPE
- Maintaining learning spaces, tools, and materials in safer working condition

Elementary students are not expected to manage potential safety hazards and resulting risks. Responsibility lies with the adults who plan, approve, and supervise instruction.

> **If a hazard is foreseeable for a child, it must be removed or controlled before the activity begins.**

Discipline-Specific Context

- **Science:** Materials and tools are handled and distributed by the teacher
- **Engineering:** Design challenges limit force, speed, and complexity
- **Inquiry-Based Learning:** Exploration occurs within clearly defined boundaries

In elementary STEM instructional spaces, foreseeability is defined by what a reasonable educator should anticipate given the age, behavior patterns, and developmental characteristics of young learners. This includes predictable actions such as placing objects in the mouth, misusing materials as toys, moving impulsively, or becoming distracted during transitions.

Because these behaviors are developmentally typical, they must be treated as expected conditions, not exceptions. As such, materials, tools, and procedures must be evaluated not only for their intended use but also for how they might be misused under normal classroom conditions.

Professional responsibility requires that educators design instruction to account for these realities in advance. When foreseeable safety hazards are not addressed proactively, the resulting risks are no longer accidental; they are preventable (NSTA; Consumer Product Safety Commission [CPSC]).

Figure 4

This image emphasizes that responsibility for safety rests primarily with the teacher, not the student. It supports educators in making intentional decisions that anticipate potential safety hazards and resulting risks and protect young learners.

2.2 Professional Standards and Best Practices

While many national safety standards are written for secondary or workplace environments, their principles inform best practice in elementary STEM instruction. Alignment with recognized legal safety standards (OSHA, NFPA, ANSI/ISEA) and professional guidance (NSTA, NSELA, ACTE) helps define reasonable and responsible practice.

Professional guidance supports:

- Activity selection appropriate for student age and maturity
- Supervision expectations during hands-on learning
- Material controls and storage practices
- Emergency readiness and response

Standards are applied through professional judgment, not direct replication of secondary laboratory practices.

> **Standards guide educator decisions, even when activities look simple.**

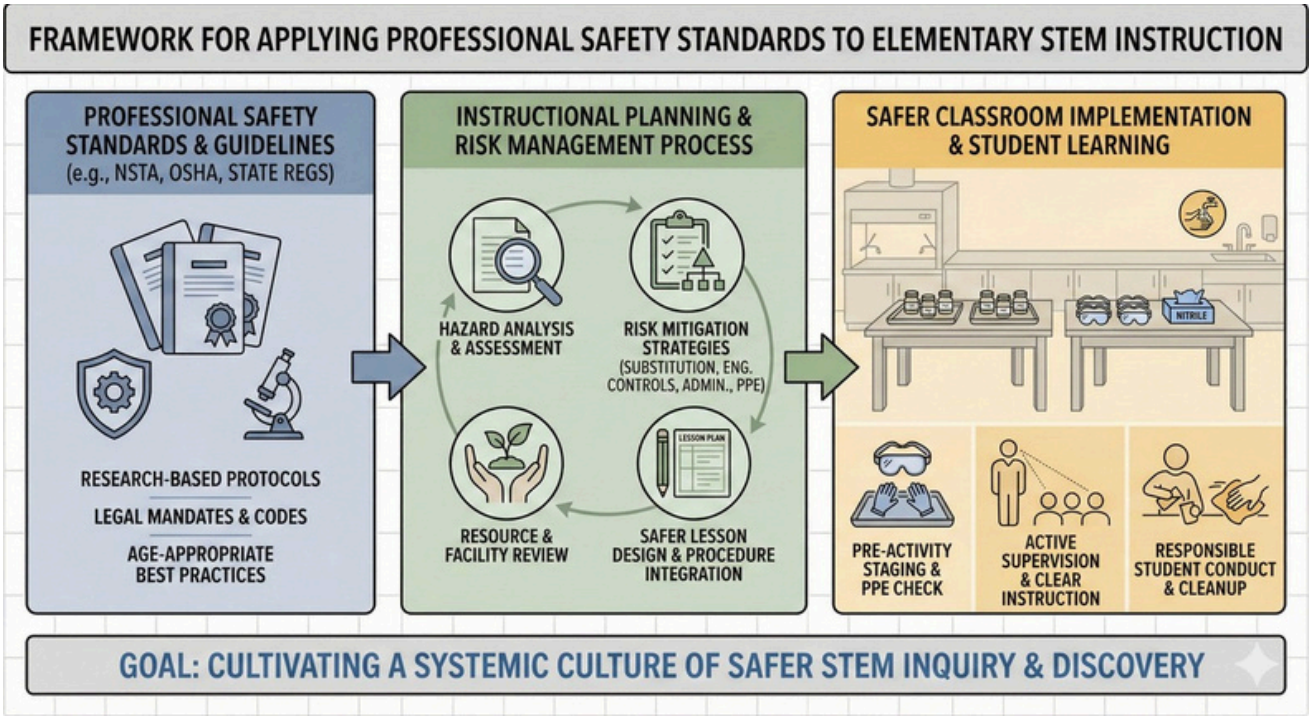
Discipline-Specific Context

- **Science:** Emphasis on observation and guided investigation
- **Engineering:** Emphasis on design thinking without use of hazardous materials
- **Inquiry Learning:** Emphasis on questioning within safer established routines

In elementary STEM, duty and standard of care is not shared equally. Young learners rely entirely on adults to anticipate potential safety hazards and resulting risks and remove them before instruction begins. Ethical practice means choosing prevention over convenience. If an activity cannot be clearly explained and confidently defended to a family, it requires reconsideration. Responsibility at this level is proactive, not reactive.

Figure 5

This figure illustrates how broader safety standards are adapted for elementary classrooms. It helps teachers translate professional expectations into age-appropriate practices.



2.3 District Policies and Ethical Practice

District policies translate professional standards into daily practice.

Ethical STEM instruction requires adherence to local policies, consistent enforcement, and proactive communication with families (CSSS).

Implications for Elementary STEM

Ethical and professional practice includes:

- Following district-approved curricula and safer activity guidelines
- Adhering to material approval and restriction policies
- Communicating expectations clearly to students and families
- Documenting possible incidents, safety concerns, and corrective actions
- Creating an inclusion-based instructional space for students with additional needs

Ethical practice prioritizes student well-being over convenience or tradition.

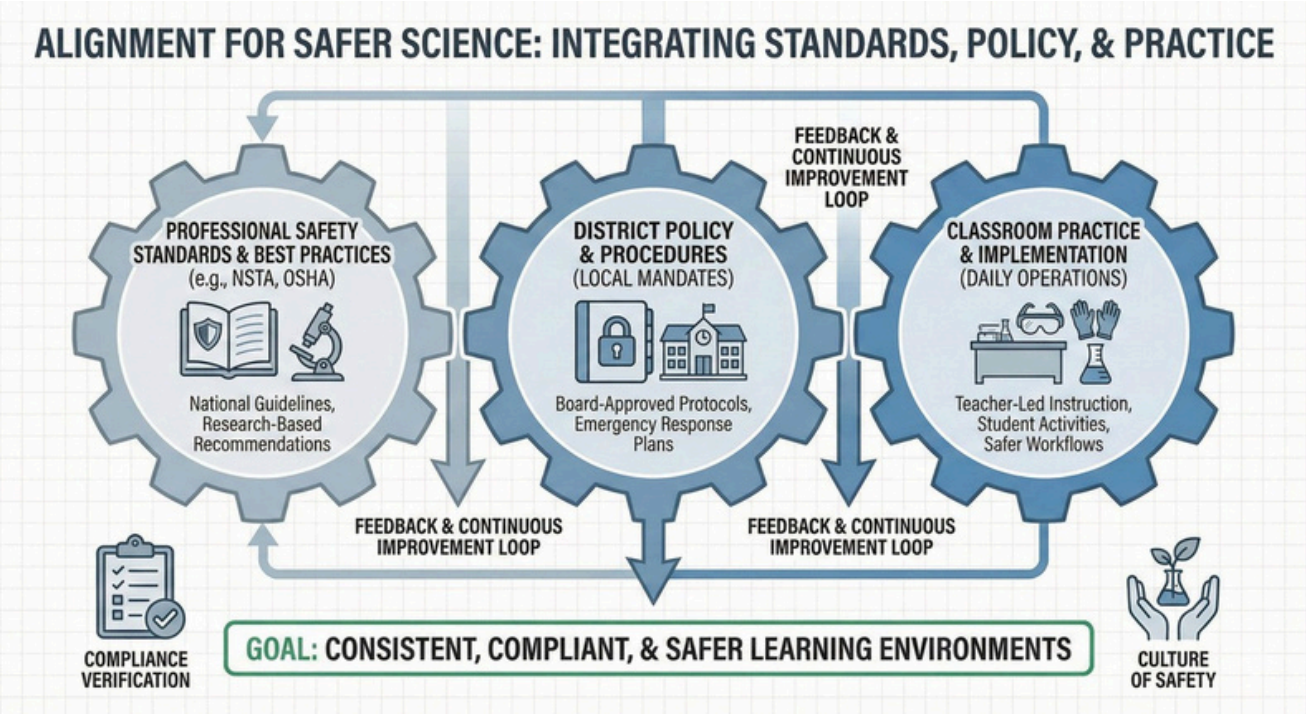
> **If a K-5 STEM activity cannot be defended to a family, it should not be conducted in the school.**

Discipline-Specific Context

- **Science:** Use only district-approved materials and equipment for STEM
- **Engineering:** Ensure activities align with district design guidelines
- **Inquiry Learning:** Maintain transparency about learning goals and routines

Figure 6

This visual shows how instructional space practices connect to school and district expectations. It reinforces the importance of consistency between daily instruction and larger safety systems.



Closing Note from the Safety Desk

Legal and ethical responsibilities in elementary STEM exist to protect learners at their most vulnerable stage. When educators understand and embrace these responsibilities, they create environments where curiosity thrives within safer and supportive boundaries (NSTA).

LEARNING SPACE SAFETY

If you cannot see every student, you cannot supervise every possible safety hazard or risk.

— James Palcik, CHO, Safer STEM

Elementary STEM instructional spaces directly shape student behavior. Young learners explore the world around them through movement, proximity, and imitation; therefore, making room design, layout, and adult positioning critical safety controls that need to be considered and implemented. Safer elementary STEM instruction depends on environments that support visibility, structure, and predictable routines.

As a K–5 teacher, you have the privilege of witnessing students' curiosity, discovery, and the connections they begin to make about the world around them, experiences made possible through the thoughtful and intentional design of the learning environment in which they explore.

Science and STEM instructional spaces are the springboard to future innovation, and safety is the baseline for this journey of exploration into post-secondary and the workforce.

3.1 Classroom-Based STEM Instruction

Most elementary STEM instruction occurs in general education /classroom instructional spaces rather than purpose-built formal academic laboratories.

Activities must be selected and designed based on what the classroom instructional space can safely support, not on secondary laboratory instructional spaces expectations, and the fixtures and furniture typically found in a high school science instructional space (NSTA). All decisions must be age-and stage-appropriate for the elementary learners and the existing STEM instructional space for their learning journey.

Implications for Elementary STEM

Safer instructional space-based STEM instruction includes:

- Limiting activities to low-risk materials and processes (plasticware vs glassware)
- Distributing and collecting materials directly by the teacher rather than students
- Using trays, bins, and defined work areas to control movement of STEM materials
- Always maintaining clear walkways and unobstructed exits
- Positioning the teacher to maintain continuous visual supervision

Activities requiring heat, chemicals, glassware, or complex tools are not appropriate for standard elementary classroom instructional spaces or students at this developmental stage.

These have risks that exceed the educational value for learners and educators at this grade level, and more appropriate products must be used. Choose wisely and select appropriate items and experiments for your students.

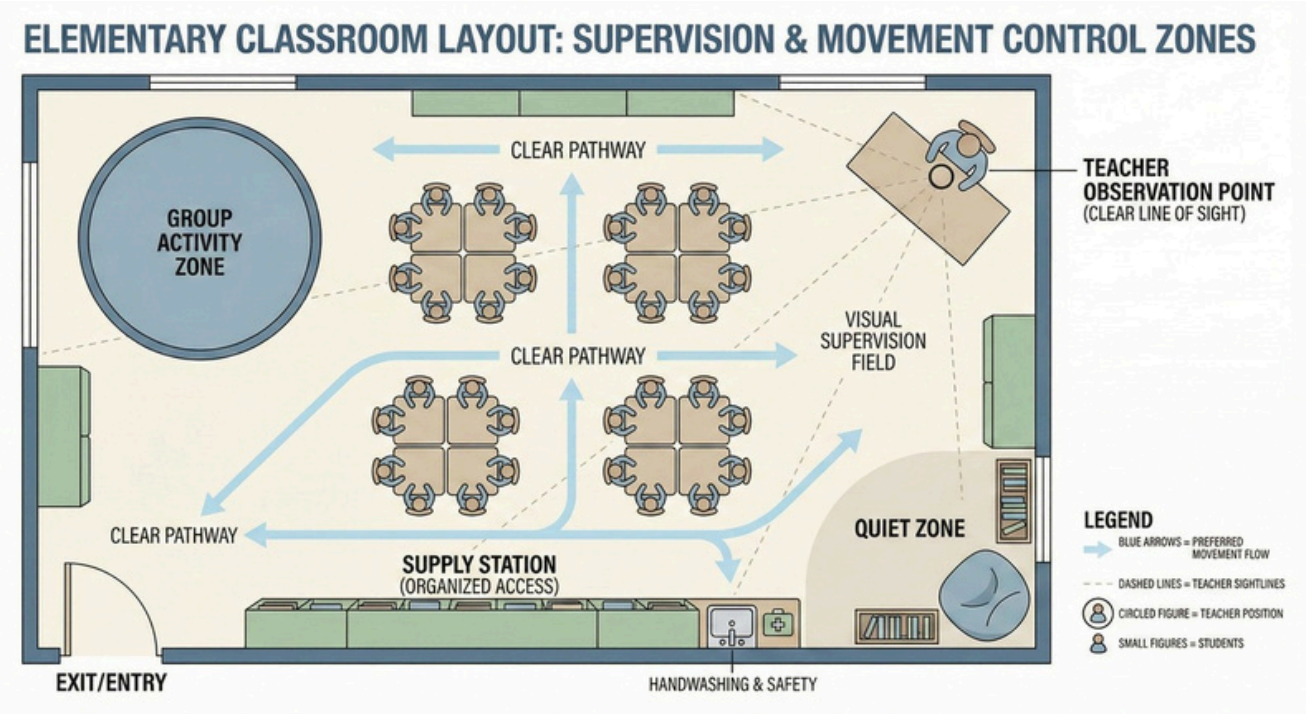
> **If the classroom cannot support the hazard safely, the activity must be modified accordingly.**

Discipline-Specific Context

- **Science:** Observation-based investigations and guided inquiry experiments
- **Engineering:** Building with soft or lightweight materials
- **Inquiry Learning:** Exploration within clearly defined boundaries

Figure 7

This figure demonstrates how room arrangement supports visibility, movement, and safer behavior. It reminds teachers that layout decisions directly impact supervision and student safety.



3.2 Dedicated STEM Instructional Spaces and Shared Spaces

Some elementary schools use shared STEM rooms or innovation spaces. These spaces often serve multiple grade levels and require consistent expectations and controls to remain safer for the students and staff (NSTA; NFPA).

Implications for Elementary STEM

Safer shared instructional space practices include:

- Establishing consistent STEM safety rules across all grade levels
- Limiting access to materials based on age and readiness
- Clearly labeling storage and restricting access to higher-risk items
- Resetting the space after each class to baseline conditions

Shared spaces require tighter supervision and more explicit routines than single-grade classrooms.

> **Shared spaces demand shared expectations.**

Discipline-Specific Context

- **Science:** Materials must be age-appropriate for all users
- **Engineering:** Tools and supplies must be locked or teacher-controlled
- **Inquiry Learning:** Stations must be reset and reviewed before use

Figure 8

This illustration shows how shared spaces can remain safer through clear organization and restricted access to materials. It emphasizes the need for consistent expectations across instructional spaces and grade levels.

3.3 Furniture, Movement, and Visibility

Furniture arrangement and movement patterns influence safety. Elementary students need clear expectations for where to sit, stand, and move during STEM activities (CDC).

Implications for Elementary STEM

Safer room organization includes:

- Defining work zones using tables, mats, or floor markers
- Minimizing student movement during investigations
- Avoiding floor work when materials could be stepped on or spilled
- Ensuring all students remain within the teacher's line of sight
- Removing trip/fall and slip/fall hazards before activities begin

Crowded or cluttered instructional spaces increase the likelihood of falls and collisions.

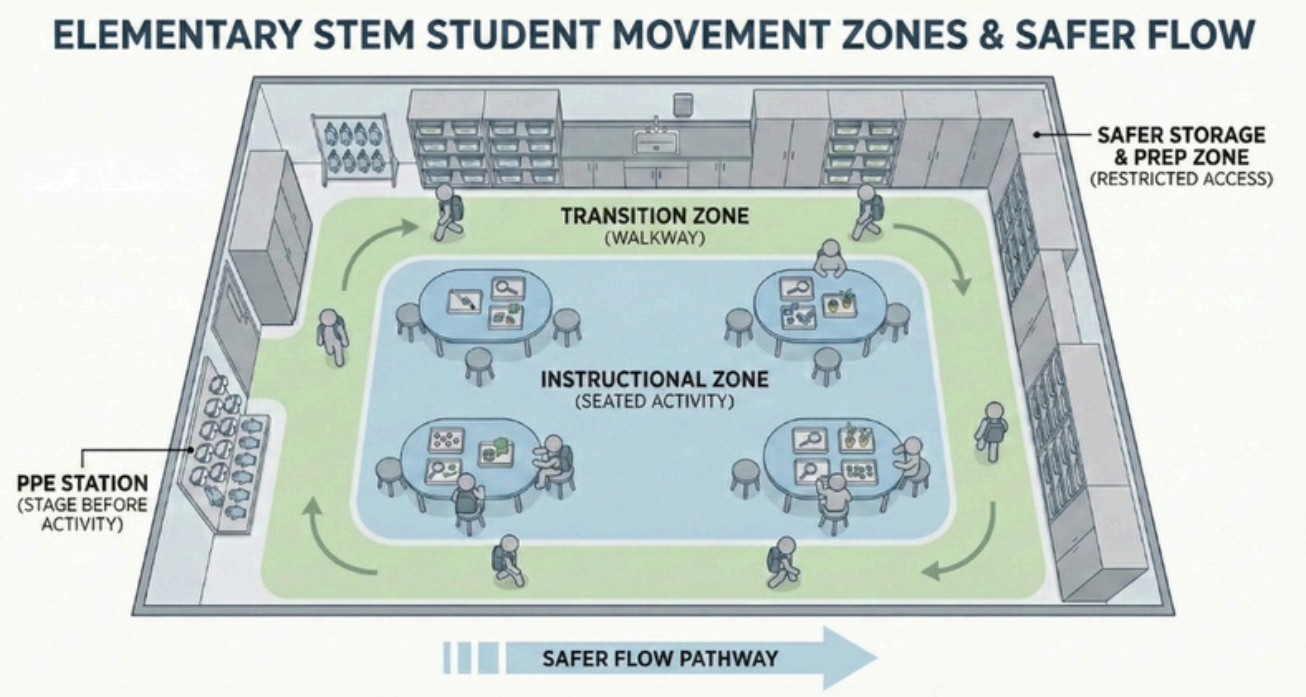
> **If elementary students are moving unnecessarily, the risk increases.**

Discipline-Specific Context

- **Science:** Stations should be properly spaced to prevent crowding
- **Engineering:** Building areas must be clearly defined and stocked
- **Inquiry Learning:** Exploration paths should be planned

Figure 9

This figure highlights defined areas for student movement and activity. It helps teachers guide behavior by making expectations visible and predictable.



3.4 Ventilation, Electrical Safety, and Environmental Conditions

Elementary STEM activities must operate within the limits of existing instructional space building infrastructure. Students must never compensate for inadequate ventilation, electrical capacity, or environmental controls through behavior alone (NFPA; CDC).

Implications for Elementary STEM

Safer environmental practices include:

- Avoiding activities that generate fumes, vapors, particulates or aerosols
- Inspecting cords, outlets, and electrical devices before use
- Using only low-voltage, teacher-approved electrical devices
- Monitoring room temperature and airflow during activities

Improvised electrical setups and extension cords are not appropriate for elementary instruction due to the inherent potential hazards and resulting safety risks, including slips / trips/ falls, that these present to the occupants of the STEM instructional space.

If the room infrastructure systems cannot support the activity, the activity must change.

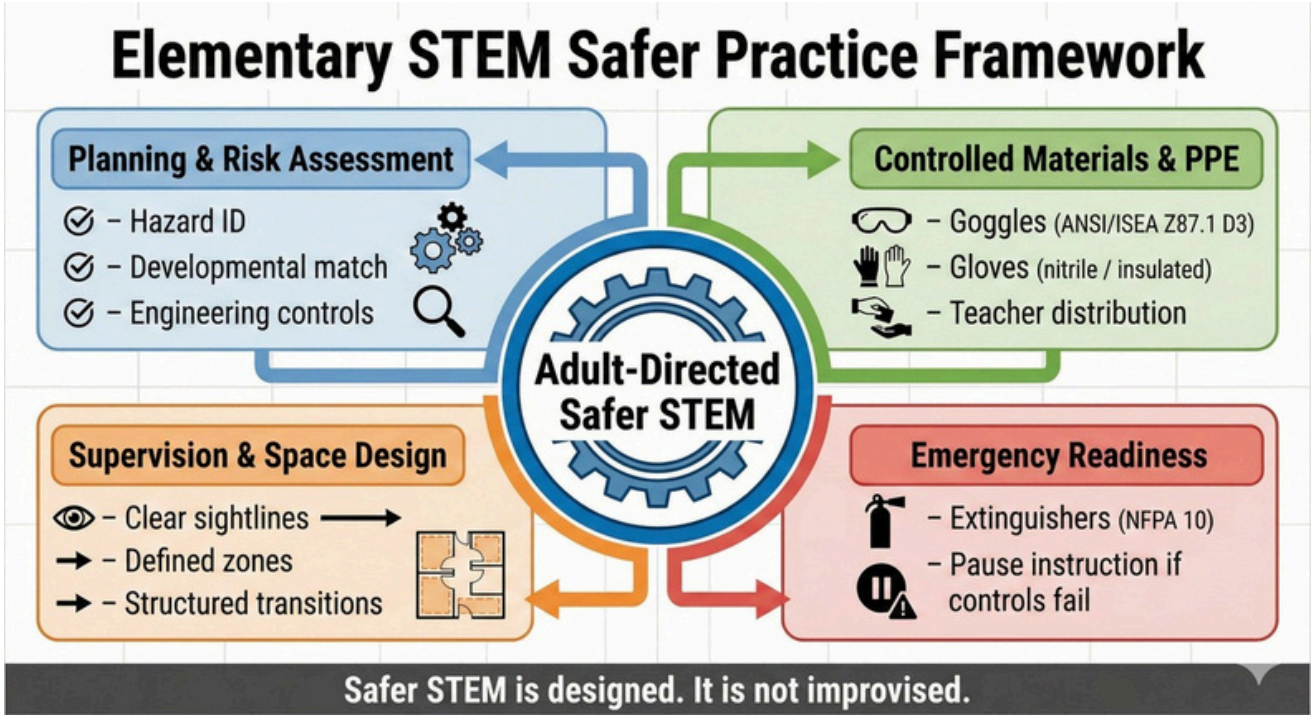
Discipline-Specific Context

- **Science:** Heating and chemical use limited and always under the direct adult supervision
- **Engineering:** Simple circuits use low- voltage components
- **Inquiry Learning:** Environmental conditions are continuously monitored

Space shapes behavior. In elementary STEM instructional spaces, furniture placement, sightlines, and material access function as silent safety systems. A cluttered or crowded space increases risk before a lesson even begins. Expecting orderly behavior in a chaotic environment is like expecting traffic to flow without lanes. Structure supports safety long before instruction starts.

Figure 10

Elementary STEM Safer Practice Framework



Closing Note from the Safety Desk

Elementary instructional spaces / classrooms must support supervision, structure, and predictability. When classrooms and shared spaces are organized intentionally, they reduce behavioral challenges, improve focus, and create safer conditions for hands-on learning for students (NSTA).

IV MATERIALS & EQUIPMENT

> The safest elementary instructional space is not the one with the most equipment. It is the one with the most thoughtfully selected materials.
>
> **— James Palcik, CHO, Safer STEM**

Materials and equipment used in elementary STEM instruction must be selected with extraordinary care. Young learners explore their world by touching, testing, and manipulating objects, often without anticipating consequences. Safer elementary STEM instruction depends on choosing materials that tolerate misuse without causing injury and equipment that supports exploration without introducing unnecessary risks to the STEM instructional space and to your students.

4.1 Developmentally Appropriate Materials

Only materials that are age-appropriate, low hazard/low risk, and instructionally necessary may be used in elementary STEM activities. Materials commonly used in secondary science or adult laboratory instructional spaces are not appropriate for use in elementary instruction (NSELA, NSTA).

Implications for Elementary STEM

Safer material selection includes:

- Using soft, lightweight, non-toxic materials
- Avoiding glass, sharp edges, and breakable components
- Selecting materials that do not produce fumes, heat, particulates, or projectiles
- Limiting quantities to what is immediately needed
- Removing materials from student access when not in use

Materials that require advanced judgment to use safely do not belong in elementary classrooms.

> **If a material would be considered unsafe in a child's hands at home, it is unsafe at school.**

Annex A outlines developmentally appropriate equipment substitutions and control measures designed to reduce foreseeable injury risk in elementary STEM environments.

Discipline-Specific Context

- **Science:** Observation tools, magnifiers, and sealed containers
- **Engineering:** Cardboard, craft sticks, paper, foam, and tape
- **Inquiry Learning:** Manipulatives designed for young learners

Teachers should review student health information before STEM activities, particularly for conditions such as latex allergies, food allergies, or chemical sensitivities that may affect participation in hands-on investigations. Choose appropriate materials for use based on the individual needs of the students in your class. Students with additional needs may require specialized equipment or products to facilitate their access or participation in STEM activities. (ADA; IDEA)

Figure 11

This figure identifies what makes materials appropriate for elementary use. It helps teachers select items that support exploration while minimizing potential safety hazards and resulting safety risks.

Choking Hazard Guidance in Elementary STEM Activities

In elementary STEM instructional spaces, curiosity and hands-on exploration are essential parts of learning. However, younger students, especially those in kindergarten through grade 2, often explore objects with their hands and sometimes their mouths. Because of this, teachers must be mindful of materials that could pose choking hazards. Small parts used in certain STEM activities, such as tiny connectors, beads, magnets, or electronic components, can present choking hazards and related risks if they are not carefully managed. By selecting age-appropriate materials, supervising activities closely, and storing all small components properly, teachers can help ensure that STEM learning remains both engaging and safer for all students.

Key Safety Practices for Teachers

- Be mindful of K–2 choking risks. Young students may place small objects in their mouths. Avoid materials that are small enough to fit entirely inside a child's mouth.
- Avoid loose small parts with early learners. Items such as tiny screws, beads, small connectors, or miniature building pieces should generally not be used with K–2 students.
- Use age-appropriate STEM kits. Choose classroom materials specifically designed and labeled for elementary or primary grades, and evaluate components before providing kits to your students.
- Keep magnets out of early elementary activities. Small high-strength magnets can be very dangerous if swallowed, particularly if more than one is ingested.
- Never allow button batteries in student activities. Button or coin style batteries pose serious internal burn hazards and should only be handled by adults.
- Manage small STEM components carefully. If small parts must be used with older elementary students, distribute them in controlled quantities and collect them immediately after the activity and secure until needed again.
- Provide clear storage and labeling for components. Keep small parts in sealed containers and store them out of reach of younger students until required.
- Maintain active supervision. Closely monitor students during hands-on activities to ensure materials are used appropriately.

Small parts such as magnets, button batteries, and tiny STEM components can present serious choking hazards and resulting health risks, especially for K–2 students. Teachers should only use age-appropriate materials and closely supervise all hands-on activities.

4.2 Household Items Used as STEM Materials

Household items are often perceived as safer because they are familiar. However, many consumer products present choking, ingestion, allergy, or misuse hazards. Household items must be evaluated carefully before use in elementary STEM instruction (CDC; CPSC). Many people seriously underestimate the hazards and risks with consumer commodities leading to preventable accidents and injuries in elementary school STEM instructional spaces. There should be no doubt about the safer use, storage and disposal of all items used in your program at this K-5 level.

Implications for Elementary STEM

Safer use of household items includes:

- Avoiding small objects that pose choking hazards
- Reviewing allergen risks (latex, food products, fragrances)
- Preventing misuse as toys or projectiles
- Providing clear instructions and immediate supervision
- Removing items promptly after use

Familiarity does not equal safety.

> **Just because it is common does not mean it is safer for young learners.**

Program-Specific Context

- **Science:** Avoid hazardous powders, liquids, or substances (e.g., vinegar, alcohol peroxide) that could be ingested and cause harm. Supervision is critical at this age level to prevent accidental exposure to consumer commodities.
- **Engineering:** Avoid elastic materials that could snap or strike
- **Inquiry Learning:** Use teacher-controlled distribution

Figure 12

This illustration shows that common household items are not always classroom-safe. It encourages teachers to carefully review materials before use with students.

4.3 Tools and Simple Devices

Tool use in elementary STEM must be limited, controlled, and explicitly taught. Tools are introduced to support learning, not to replicate adult or secondary practices (NSTA).

Implications for Elementary STEM

Safer tool practices include:

- Using child-safe scissors and tools designed for elementary use
- Demonstrating tool use before distribution
- Limiting one tool per student or group at a time
- Collecting tools immediately after use
- Never allowing free access to tools

Tools remain under teacher control at all times. Teacher provides direct adult supervision when using tools.

> **If a tool is out, the teacher's attention must be fully on its use.**

Program-Specific Context

- **Science:** Measuring tools used under direct guidance
- **Engineering:** Child-safe cutters and connectors
- **Inquiry Learning:** Tools introduced only after routines are established

Figure 13

This figure highlights tools designed specifically for young learners. It reinforces that safer tool selection supports both creativity and protection.

Hot Glue Gun Safety

Hot glue guns are commonly used in elementary STEM programs and maker activities for assembling models and prototypes. While low-temperature glue guns are often recommended for classroom use, teachers should remember that these tools can still cause burns if used improperly. For this reason, hot glue guns should remain under direct teacher supervision and control during instructional space activities. When possible, the teacher should apply the glue for students or closely supervise older elementary students who are using the tool. Clear expectations, proper handling, and careful supervision help ensure that creative building activities remain both productive and safer.

Teacher Safety Guidance

- Teacher control is required. Hot glue guns should only be used under direct teacher supervision in elementary instructional spaces.
- Burn risk is still present. Even low-temperature glue guns can cause skin burns if hot glue contacts the skin.
- Limit student use. Younger students should not operate glue guns independently; the teacher may apply the glue as needed.
- Use low-temperature models only. These are specifically designed for classroom environments and reduce, but do not eliminate, burn hazards and resulting risks.
- Provide clear instructions. Students should understand safer handling before the tool is used.
- Allow glue to cool before touching. Fresh glue and metal tips remain hot for several seconds after application.

Safety Callout – Burn Hazard:
Low-temperature glue guns can still cause burns, so their use in elementary instructional learning spaces should remain under direct teacher supervision.

4.4 Equipment Storage and Access Control

Materials should be distributed directly by the teacher. Students should not independently access storage cabinets, supply closets, or preparation areas used for science / STEM instructional spaces.

Implications for Elementary STEM

Safer storage practices include:

- Storing materials in locked or teacher-only accessible areas
- Using clear labeling for adult organization, not student access
- Keeping potentially hazardous items out of sight and reach of students
- Returning storage areas to baseline after each lesson or activity

Burn Hazard: Low-temperature glue guns can still cause burns, so their use in elementary classrooms should remain under direct teacher supervision.

Unsupervised access increases the likelihood of misuse.

> **What students cannot access, cannot injure them.**

Discipline-Specific Context

- **Science:** Kits stored in closed containers in secure location
- **Engineering:** Building supplies issued per activity
- **Inquiry Learning:** Materials distributed in stages as needed

Young learners explore by touching, testing, and sometimes misusing materials. The safest elementary STEM instructional space is not the one with the most advanced equipment. It is the one where every item has been selected because it tolerates curiosity without causing harm. What we place in students' hands determines the boundaries of safer STEM exploration.

Figure 14

This image shows how storing materials securely reduces misuse and accidents. It reminds teachers that limiting access is one of the most effective safety strategies.

Closing Note from the Safety Desk

Material and equipment choices define the boundaries of safer exploration in elementary STEM. When educators choose wisely, supervise consistently, and store materials securely, students can explore, build, and discover within environments designed for their safety (NSTA). CSSS promotes the hands-on learning of elementary learners and encourages inquiry-based challenges conducted in a safer instructional space that will spark the innate curiosity that these students have about the world around them using a foundation of safer STEM guidelines.

V PERSONAL PROTECTIVE EQUIPMENT (PPE)

Students copy what adults model. If PPE is casual for the teacher, it becomes optional for the student.

— James Palcik, CHO, Safer STEM

In elementary STEM instructional spaces, personal protective equipment (PPE) is introduced as a routine learning tool rather than a response to complex hazards and resulting risks.

Because young learners do not yet assess potential safety hazards and resulting risks independently, PPE expectations must be simple, visible, and enforced consistently by adults. PPE use in elementary STEM focuses on habit formation and preparation for future learning (NSTA). PPE must be considered a rule rather than a random action when conducting demonstrations and hands-on learning experiences for elementary STEM students.

5.1 Eye Protection in Elementary STEM

Eye protection must be worn whenever there is a reasonable risk of impact, splash, or flying debris. Elementary students do not decide when eye protection is required. That decision rests with the teacher (NSTA). As a rule, insist that students wear appropriate and certified ANSI/ISEA Z87.1 D3 protective eye wear, such as indirectly-vented chemical splash safety goggles or approved safety glasses with side shields, based on the STEM activity being conducted.

Implications for Elementary STEM

Safer eye protection practices include:

- Using age-appropriate eye protection designed for elementary students with the ANSI/ISEA Z87.1 D3 certification
- Requiring eye protection during demonstrations and investigations involving any motion, projectiles, or liquids
- Putting eye protection on before materials are distributed in the instructional space
- Keeping certified, sanitary eye protection on until all materials are collected and hazards removed
- Teaching students how to put on, remove, and store eye protection correctly
- Students with additional needs may require specialized equipment, more time, or assistance putting on their PPE for hands-on and demo activities

Eye protection must be worn correctly to be effective.

> **If eyes are at risk, protection stays on from start to finish.**

Discipline-Specific Context

- **Science:** Liquids and simple reactions require eye protection
- **Engineering:** Building and testing structures may require eye protection
- **Inquiry Learning:** Activities involving motion or loose materials require eye protection

Figure 15

This figure demonstrates how eye protection should fit and be worn correctly. It helps teachers build proper PPE habits early and consistently.

5.2 Hand and Body Protection

Hand and body protection in elementary STEM is limited and purposeful. Gloves and protective clothing are used only when they support safer handling of materials and reinforce correct habits (CDC).

Implications for Elementary STEM

Safer hand and body protection practices include:

- Using disposable nitrile gloves only when contact with wet, messy, or irritating materials is expected
- Appropriately removing gloves immediately after the task is complete
- Teaching students not to touch faces, eyes, or mouths while wearing gloves
- Ensuring students wear closed-toe shoes and clothing that covers the body appropriately
- Secure long hair with an elastic and secure loose clothing before activities begin

Gloves are not toys and are not worn continuously.

> **Gloves go on prior to setting up for the activity and come off right after it is complete.**

Discipline-Specific Context

- **Science:** Gloves may be used for wet STEM investigations
- **Engineering:** Gloves are rarely appropriate and should be used cautiously only when instructions identify this as a PPE mechanism
- **Inquiry Learning:** Protective clothing reinforces routines in STEM

Figure 16

This image shows when and how gloves should be used in elementary activities. It supports teachers in introducing PPE in a developmentally appropriate way.

5.3 Teaching PPE Routines

PPE routines must be taught explicitly and practiced repeatedly. In elementary STEM, appropriate use of PPE is learned through modeling and repetition, not explanation alone (NSTA). Elementary students will mimic what they see the teacher doing especially in STEM.

Implications for Elementary STEM

Effective PPE instruction includes:

- Demonstrating correct use before each activity for the whole class
- Practicing putting on and removing PPE as a class
- Using consistent language and expectations across lessons
- Reinforcing correct use immediately and calmly

Consistency across instructional learning spaces / classrooms strengthens habit formation.

> **What students practice repeatedly becomes an automatic safety habit.**

Discipline-Specific Context

- **Science:** PPE routines become part of investigation setup
- **Engineering:** PPE reinforces careful building habits
- **Inquiry Learning:** PPE supports structured exploration

In elementary STEM, PPE is introduced as habit formation, not hazard complexity. When eye protection or gloves are used consistently and calmly, students begin to see them as part of learning rather than as interruptions. Habits built early function like foundations in architecture. They are invisible later, but everything is built on this solid foundation.

Figure 17

This figure emphasizes practicing PPE routines as part of everyday instruction. It reinforces that consistency helps safety behaviors become habits.

Closing Note from the Safety Desk

In elementary STEM, PPE use is about teaching lifelong safer habits. When protective equipment is introduced calmly, modeled consistently, and enforced predictably, students learn that safety is part of how learning happens, not an interruption to it (NSTA). Teachers at this grade level benefit from modeling of PPE and praising students for doing the same.

VI INSTRUCTIONAL RISK & SUPERVISION

Supervision is not proximity. It is awareness.
— James Palcik, CHO, Safer STEM

In elementary STEM instruction, risk is managed almost entirely through adult planning and supervision.

Young learners are still developing impulse control, situational awareness, and the ability to follow multi-step procedures.

Safer STEM instruction depends on limiting safety hazards and resulting safety risks, structuring movement, and maintaining continuous adult oversight (NSTA).

6.1 Anticipating and Limiting Risk

Elementary STEM activities must be designed to minimize foreseeable hazards and resulting risks. Teachers identify risks during planning and remove or control them before instruction begins. Students are not expected to identify or manage potential safety hazards and resulting safety risks independently (NSTA).

Implications for Elementary STEM

Safer instructional planning includes:

- Selecting activities with few and predictable safety hazards and resulting safety risks and resulting risks
- Avoiding simultaneous introduction of multiple new materials or procedures
- Eliminating unnecessary movement during activities
- Using demonstration instead of hands-on participation when potential safety hazards and resulting safety risks exceed student readiness
- Adjusting or discontinuing activities when conditions change
- Make accommodations for students with additional needs to minimize potential safety hazards and resulting safety risks associated with the planned activity

Risk decisions are instructional decisions.

> **If risk cannot be controlled at the elementary level, the planned STEM activity must change.**

Annex B provides elementary educators with a structured, developmentally appropriate checklist for identifying and controlling foreseeable potential safety hazards and resulting safety risks before conducting K–5 STEM activities. Aligned with NSTA and NSELA professional safety guidance, it reinforces that hazard analysis, risk assessment, appropriate supervision, PPE use, and administrative supports are essential components of safer hands-on science / STEM learning.

Discipline-Specific Context

- **Science:** Wet activities are tightly structured
- **Engineering:** Building challenges use low- force materials
- **Inquiry Learning:** Exploration occurs within defined limits

Figure 18

This visual highlights practical ways teachers can reduce risks before and during activities. It supports proactive planning rather than reactive response.

Prohibited Activities in K–5 STEM Classrooms

Elementary STEM programs should focus on safer, age-appropriate investigations that allow students to explore science through observation, building, and simple experimentation. Certain laboratory practices commonly used in secondary science programs are not appropriate for elementary instructional spaces due to increased risks of burns, chemical exposure, breakage, or pressure hazards.

To maintain a safer STEM instructional environment, teachers should avoid activities that involve open flames, hazardous chemicals, pressurized reactions, or fragile laboratory equipment and apparatus. Instead, educators should select safer alternatives that allow students to investigate scientific ideas while minimizing hazards and corresponding risks. Appropriate selection of safer materials is critically important in elementary STEM programs.

Activities Not Appropriate for K–5 STEM Classrooms

- Open flame experiments (e.g., Bunsen burners, alcohol burners, candles used for heating).
- Concentrated acids or bases used in chemical reactions or demonstrations.
- Pressurized reactions that generate gas in sealed containers or devices.
- Glass laboratory apparatus, such as glass beakers, graduated cylinders, flasks, or test tubes that may break and cause cuts.
- Chemical reactions producing strong fumes, smoke, or vapors.
- Heating chemicals or unknown materials.
- Student handling of reactive or corrosive chemicals.

Age-Appropriate Investigations

Elementary STEM investigations should avoid open flames, hazardous chemicals, pressurized reactions, and glass laboratory apparatus in order to keep activities developmentally appropriate and safer for young learners.

6.2 Active Supervision

Elementary STEM instruction requires continuous, active supervision. Teachers must maintain proximity, visibility, and awareness of all students throughout the activity (CDC).

Active supervision in elementary STEM is not stationary or passive. It requires continuous movement, intentional positioning, and ongoing interaction with students during instruction. Teachers must be able to see all students, anticipate potential issues, and intervene immediately when conditions begin to shift. This includes circulating throughout the room, positioning oneself to maintain clear sightlines, monitoring high-risk areas (e.g., water stations, tools, small materials), and adjusting proximity based on student behavior and activity complexity. Remember that students with additional needs often need more support and reinforcement, including supervision. When supervision becomes static or divided, potential safety hazards and resulting risks increase. (ADA;IDEA)

In elementary settings, supervision is the most effective safety control available. When implemented intentionally, it prevents escalation, reinforces expectations, and supports safer learning conditions in real time (NSTA; CDC).

Implications for Elementary STEM

Effective supervision includes:

- Positioning oneself to see all students at all times
- Circulating frequently through the STEM instructional space during activities
- Monitoring student behavior as closely as task completion
- Interrupting instruction immediately when unsafe behavior occurs

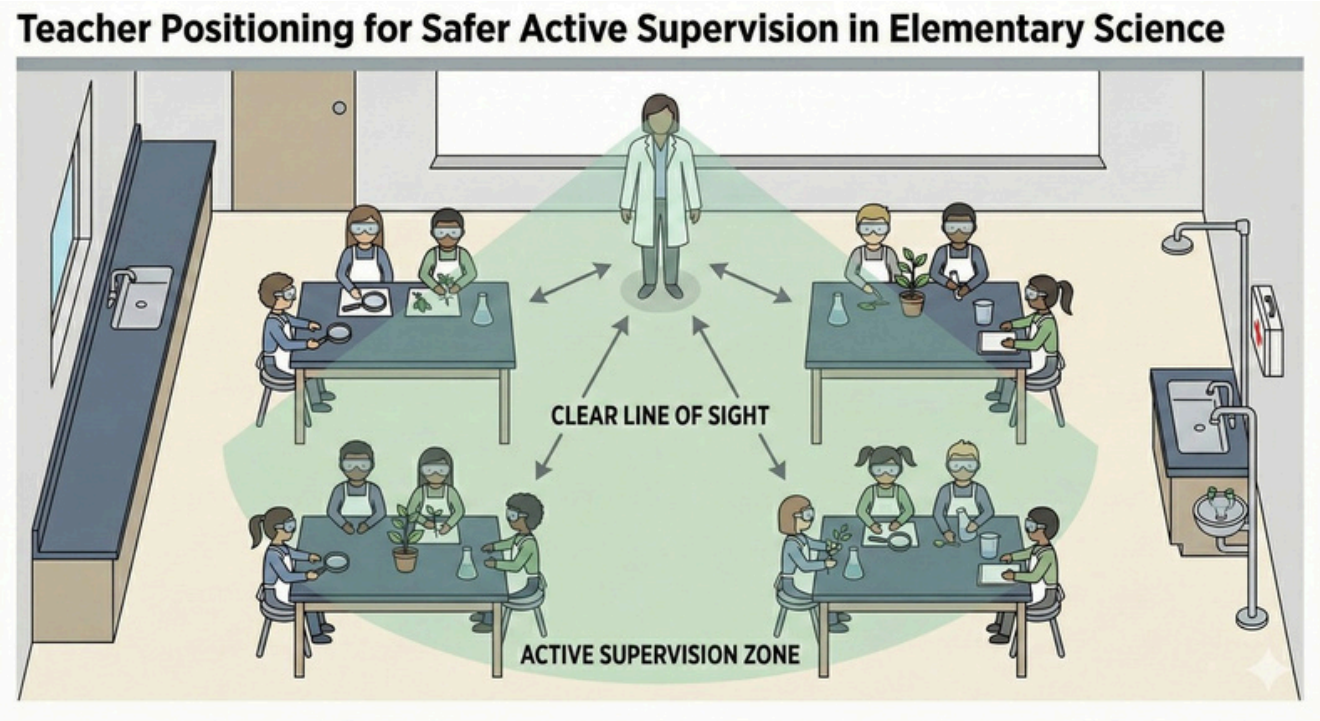
> **When safety is uncertain, evacuation is the only correct response.**

Program-Specific Context

- **Science:** Electrical devices or demonstration equipment
- **Engineering:** Battery-powered projects
- **Inquiry Learning:** Classroom equipment malfunctions

Figure 19

This figure shows where teachers should position themselves to maintain visibility of all students. It reinforces that supervision is active, not passive.



6.3 Transitions, Setup, and Cleanup

Transitions present elevated risk in elementary STEM environments. Materials, movement, and attention must be tightly controlled during setup and cleanup (NSTA).

Implications for Elementary STEM

Safer transition practices include:

- Distributing materials only when students are all seated and attentive
- Providing clear, step-by-step instructions before movement
- Collecting materials systematically rather than allowing free movement
- Assigning cleanup roles or using whole-class end of activity routines

Many injuries occur during transitions, not during the activity itself.

> **The most dangerous moments are often immediately before and after the lesson.**

Program-Specific Context

- **Science:** Spills and breakage often occur during cleanup
- **Engineering:** Loose materials can become projectiles
- **Inquiry Learning:** Movement must be planned

Figure 20

Structured setup and cleanup routines

Rechargeable batteries used in robotics or electronics kits should be charged using manufacturer-approved chargers and monitored during charging to reduce overheating or fire risks. Charging stations should remain visible and accessible to the teacher during STEM instruction. Be mindful of the potential safety hazards and resulting safety risks associated with Lithium-ion batteries in elementary STEM programs.

Lithium-ion batteries are common in elementary STEM classrooms, but they must be handled with clear rules and supervision. Include battery safety in your Chemical Hygiene Plan and post simple expectations like “No unattended charging” and “Report damaged batteries immediately.” Charge batteries only in visible, ventilated areas using approved chargers with automatic shutoff. Keep them away from heat and flammable materials, and store spares in labeled, fire-resistant containers. These practices align with guidance from the National Fire Protection Association, including NFPA 855 recommendations for safer storage and fire risk reduction.

Check batteries before each use for swelling, cracks, leaks, hissing sounds or unusual odors, and remove any damaged units immediately to a fire-resistant container for proper recycling—never the regular school trash. Ensure fire extinguishers are accessible, and teach students to stop, move away, and report if they notice heat, smoke, or odors. Build battery awareness safety into instruction by teaching students that batteries store energy and must be handled carefully, and include safety steps in all STEM activities. Keep a simple log for charging and inspections, review procedures regularly, and treat all incidents as opportunities to improve safety.

6.4 Field-Based and Outdoor Learning

Outdoor and field-based STEM learning introduces additional hazards and requires heightened supervision and planning. The duty and standard of care increases, not decreases, outside the school building instructional space (NSTA; CDC).

Implications for Elementary STEM

Safer outdoor instruction includes:

- Conducting site-specific hazard reviews prior to the involvement of students
- Establishing clear physical boundaries
- Monitoring weather, terrain, and environmental conditions
- Ensuring appropriate adult-to-student ratios
- Preparing emergency response and communication plans
- Ensure that students with additional needs can participate in the field activity

Outdoor learning must be treated as a higher-risk instructional setting.

> **The field is not a less structured classroom; it requires more structure.**

Discipline-Specific Context

- **Science:** Plants, insects, and water features require elevated caution levels
- **Engineering:** Outdoor testing must limit force and movement
- **Inquiry Learning:** Boundaries must be visible and enforced

At the elementary level, supervision is the primary safety control. Planning reduces potential safety hazards and resulting safety risks, but active presence prevents escalation. If a teacher cannot see every student, risk increases. If transitions are rushed, risk increases. Supervision in elementary STEM is not passive observation. It is constant engagement.

Figure 21

This image shows how outdoor learning spaces should be divided and monitored. It reminds teachers that outdoor settings require even more intentional supervision.

Closing Note from the Safety Desk

Instructional risk and supervision in elementary STEM are inseparable. When adults anticipate hazards, supervise actively, and manage transitions intentionally, they create learning environments where curiosity thrives safely and predictably (NSTA).

VII EMERGENCY RESPONSE

Unreported incidents repeat themselves.
— James Palcik, CHO, Safer STEM

Emergency situations in elementary STEM environments are rare, but they are foreseeable. Young students rely entirely on adults to recognize emergencies, take immediate action, and provide reassurance.

Effective emergency response in elementary STEM prioritizes calm, clarity, and protection of students above all else (NSTA).

7.1 Responding to Minor Injuries

Minor injuries must be addressed immediately, calmly, and according to established school policies and accepted procedures. Even small incidents require attention, documentation, and communication with appropriate school personnel (NSTA).

Elementary students must never administer first aid to themselves or others without direct adult assistance.

Implications for Elementary STEM

Safer response practices include:

- Stopping the activity immediately
- Providing basic first aid within the scope of training
- Referring the student to the school nurse or health office when needed
- Monitoring the student following treatment
- Documenting the incident according to district procedures

Prompt response reduces anxiety and prevents escalation.

> **If a student is hurt, all STEM instruction pauses until the student is cared for.**

Discipline-Specific Context

- **Science:** Minor cuts, splashes, or skin irritation
- **Engineering:** Pinches or scrapes from building materials
- **Inquiry Learning:** Trips or falls during movement

Figure 22

This visual provides an action for responding to minor injuries. It supports calm, consistent responses that prioritize student care.

7.2 Fire, Electrical, and Heat-Related Emergencies

Fire, electrical, and heat-related incidents require immediate adult control and adherence to school emergency response procedures. Elementary students are never responders; they are evacuees under direct adult instruction (OSHA).

Implications for Elementary STEM

Safer emergency response procedures typically include:

- Removing students from the immediate hazard
- Shutting down equipment only if it can be done safely
- Activating the school fire alarm when required
- Evacuating the instructional space promptly and calmly
- Following school and district emergency plans
- Recognize that students with additional needs may require more help in an emergency

Fire extinguishers are emergency tools for trained adult use only.

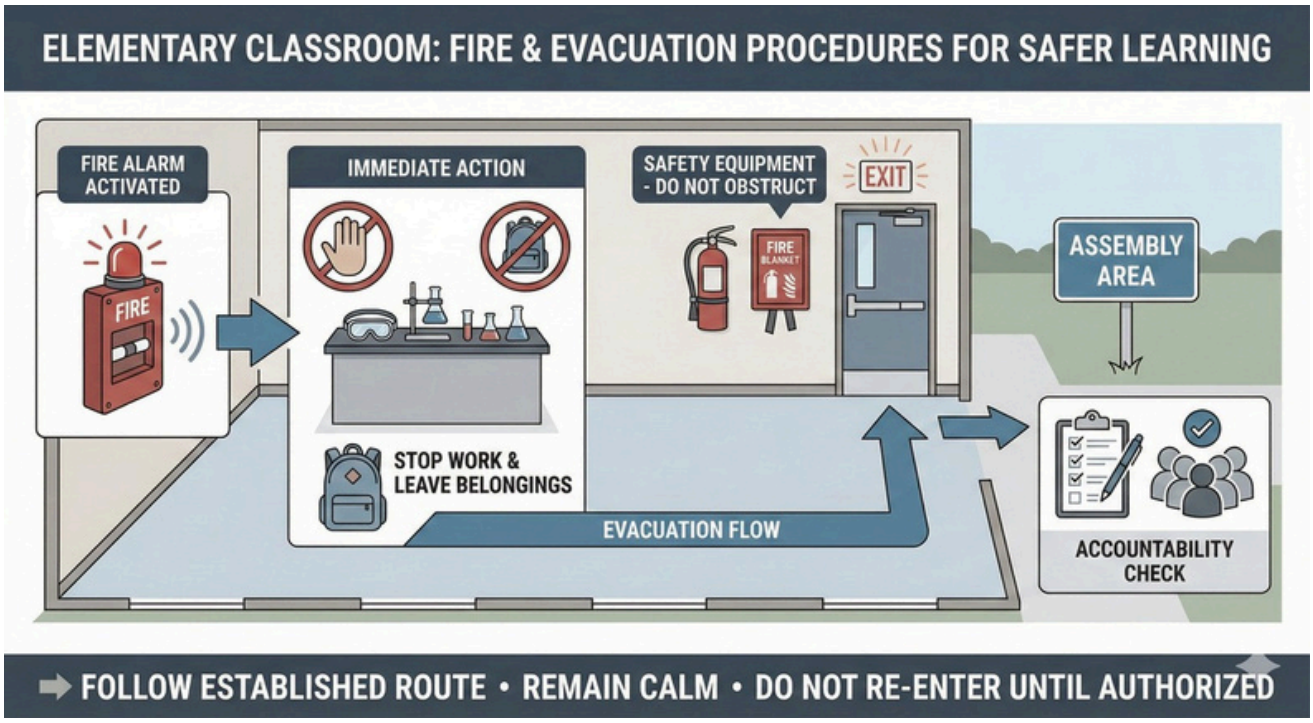
> **When safety is uncertain, evacuation is the only correct response.**

Discipline-Specific Context

- **Science:** Electrical devices or demonstration equipment
- **Engineering:** Battery-powered projects
- **Inquiry Learning:** Classroom equipment malfunctions

Figure 23

This figure outlines essential steps for safer evacuation during emergencies. It helps teachers reinforce routines that students can follow confidently.



7.3 Spills and Exposure Concerns

Spills involving liquids or materials must be managed promptly to prevent slips, skin contact, or ingestion. Teachers must not improvise responses beyond their training or school procedures (CDC). Elementary students must never clean spills involving unknown or irritating substances.

Implications for Elementary STEM

Safer spill response includes:

- Isolating the area immediately
- Directing students away from the spill
- Using approved cleanup procedures and materials
- Seeking assistance from custodial or administrative staff when needed
- Documenting incidents involving exposure or concern

> **If a spill raises concern, stop and get help.**

Discipline-Specific Context

- **Science:** Water or simple solution spills
- **Engineering:** Adhesives or paints
- **Inquiry Learning:** Sensory materials

Spills are safety events, not cleanup tasks for students.

Figure 24

This image shows how to respond safely and efficiently to spills. It emphasizes teacher control and clear procedures to prevent escalation.

7.4 Communication, Reporting, and Follow-Up

All incidents, injuries, and near-misses must be reported and reviewed. Documentation supports communication, accountability, and improvement of safety practices (OSHA).

Implications for Elementary STEM

Effective follow-up includes:

- Completing required incident reports
- Notifying administrators and support staff as required
- Communicating with families through established school channels
- Reviewing incidents to identify prevention strategies

> **If it is not reported, it cannot be prevented next time.**

Discipline-Specific Context

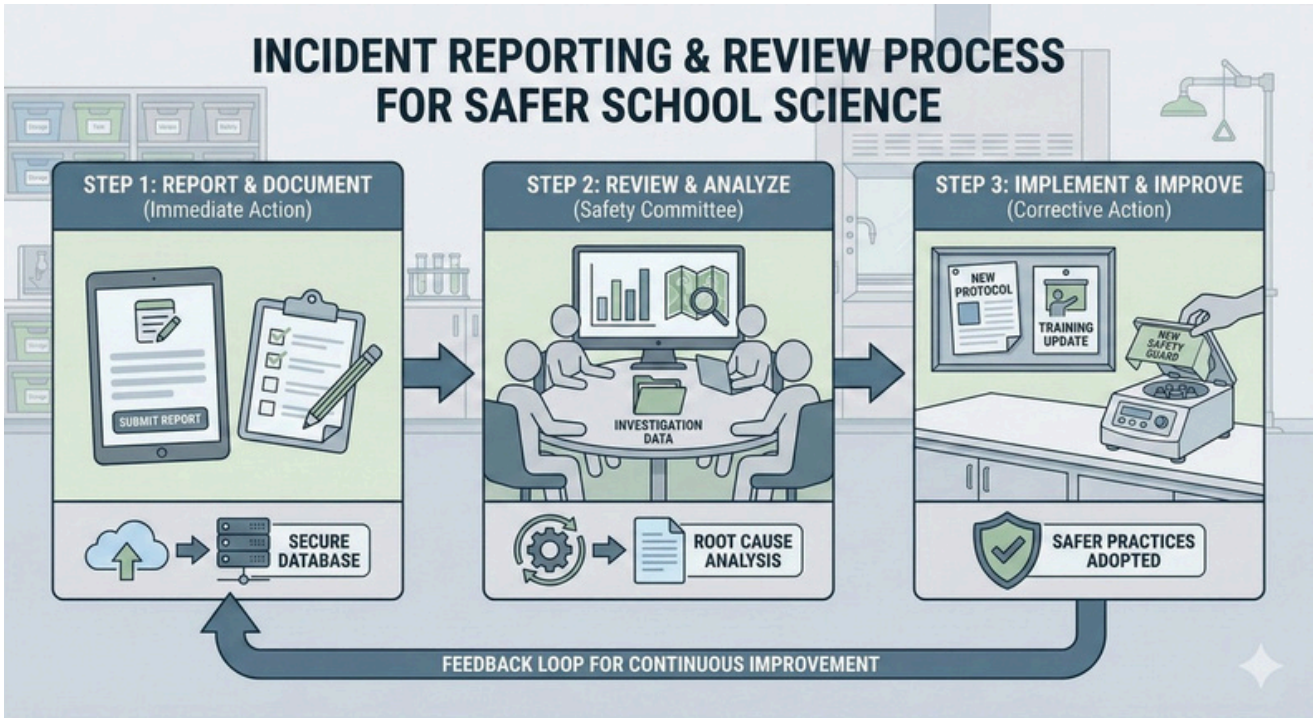
- **All elementary STEM areas:** Patterns may indicate instructional or environmental issues or lack of proper controls.

Near-misses provide valuable information and should be treated seriously.

In emergencies, children look to adults for cues. Calm, decisive action communicates safety more powerfully than words. Clear procedures and practiced routines transform uncertainty into structure. When adults respond predictably, students feel secure, even in unexpected moments.

Figure 25

This figure explains how incidents should be documented and reviewed. It supports teachers in using data to improve future safety practices.



Closing Note from the Safety Desk

Emergency response in elementary STEM is about preparation, calm action, and clear communication. When adults respond quickly and consistently, students feel secure and learning can continue safely (NSTA; CDC).

VIII TRAINING, COMMUNICATION, AND CONTINUOUS IMPROVEMENT

Safety systems improve the same way learning improves through reflection, revision, and repetition.
— James Palcik, CHO, Safer STEM

Safer elementary STEM programs are sustained through intentional training, clear communication, and continuous review. Facilities, materials, and routines alone do not create safer learning spaces. Adults do. When training is inconsistent or communication is unclear, potential safety hazards and resulting safety risks increase even in low-hazard STEM instructional spaces/classrooms (OSHA).

8.1 Educator Safety Training

All educators responsible for elementary STEM instruction must receive regular, documented safety training aligned to the activities and materials used with students.

Training is a professional obligation and an institutional responsibility, not a one-time requirement (NSTA; OSHA). Appropriate safety training annually is a legal requirement and not a recommendation for STEM educators even at the elementary level.

Implications for Elementary STEM

Effective training systems include:

- Initial safety orientation for new teachers, specialists, and support staff
- Annual refresher training focused on elementary-specific risks and routines
- Targeted training before introducing new materials, tools, or instructional formats
- Documentation of training dates, topics, and participants
- Alignment between training content and actual classroom practice
- Accommodations and modifications to activities for students with additional needs

Training must reflect what happens in STEM instructional space, not idealized conditions.

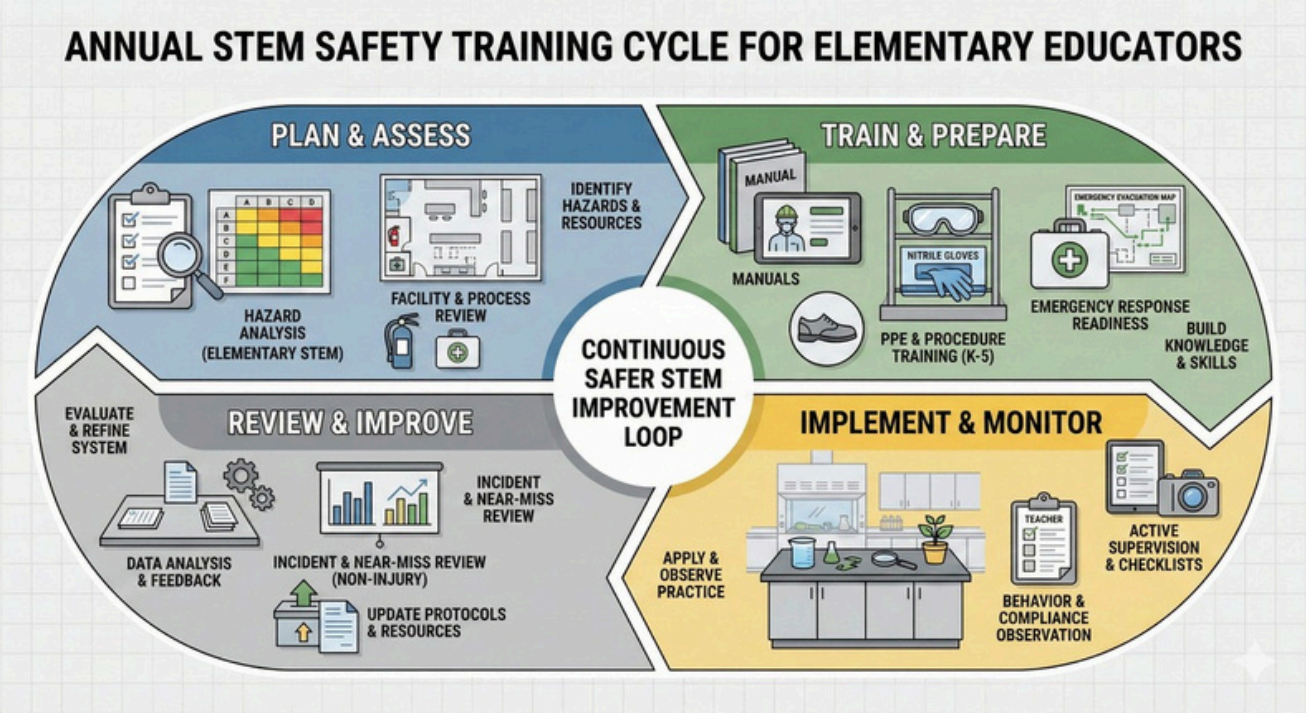
> **Training that is not documented is assumed NOT to have occurred.**

Discipline-Specific Considerations

- **Science:** Investigation routines and material handling
- **Engineering:** Building activities and supervision strategies
- **Inquiry Learning:** Movement, transitions, and behavior management

Figure 26

This visual shows how ongoing training supports consistent safety practices. It reinforces that safety is maintained through continuous learning.



8.2 Student Instruction and Family Communication

Elementary students and families must understand safety expectations and routines. Clear communication builds trust and reinforces consistent behavior across school and home environments (NSTA).

Implications for Elementary STEM

Effective communication includes:

- Age-appropriate safety instruction embedded in lessons
- Repetition of routines across the school year
- Family communication explaining STEM activities and expectations
- Transparency when incidents occur, following district procedures

> **Clear expectations reduce confusion and increase compliance.**

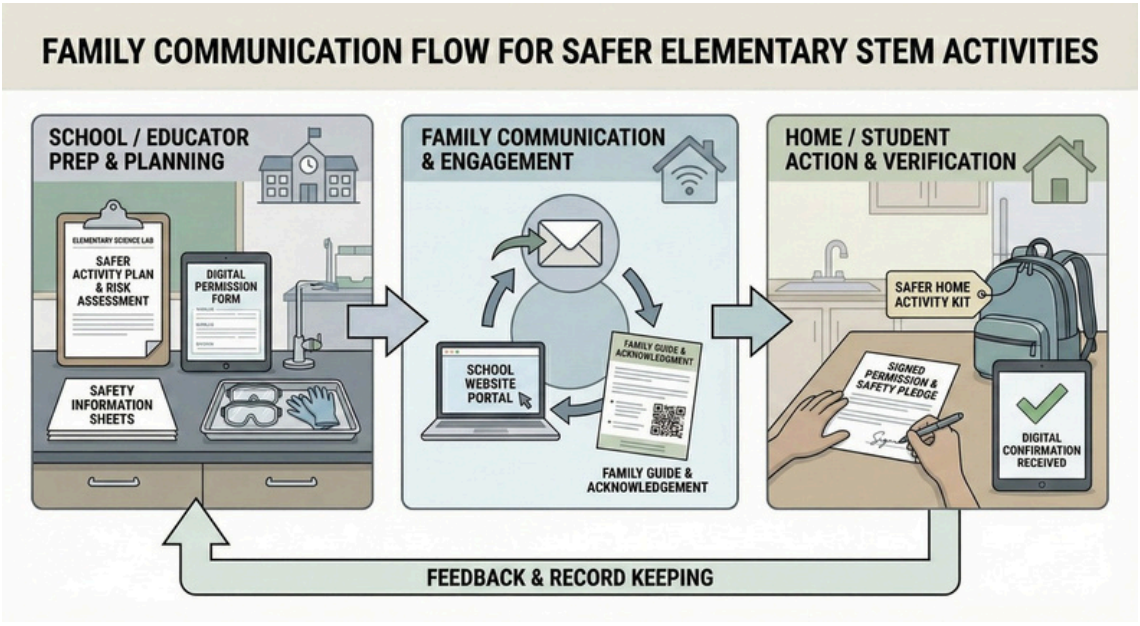
Discipline-Specific Context

- **Science:** Families informed of hands-on investigations
- **Engineering:** Communication about building challenges
- **Inquiry Learning:** Explanation of materials and routines

Students learn safety best when expectations are consistent and reinforced.

Figure 27

This figure highlights how safety information is shared with families. It reminds teachers that communication builds trust and reinforces expectations beyond the classroom.



8.3 Documentation, Review, and Improvement

Documentation and review are essential for improving elementary STEM safety over time. Incidents, near-misses, and concerns provide data for refinement and prevention (OSHA; CSSS).

Implications for Elementary STEM

Continuous improvement practices include:

- Reviewing incident and near-miss reports for trends
- Updating procedures and routines as needed
- Adjusting instruction or materials based on experience
- Sharing lessons learned with staff

> **Every incident is information. Use it to improve.**

Program-Specific Context

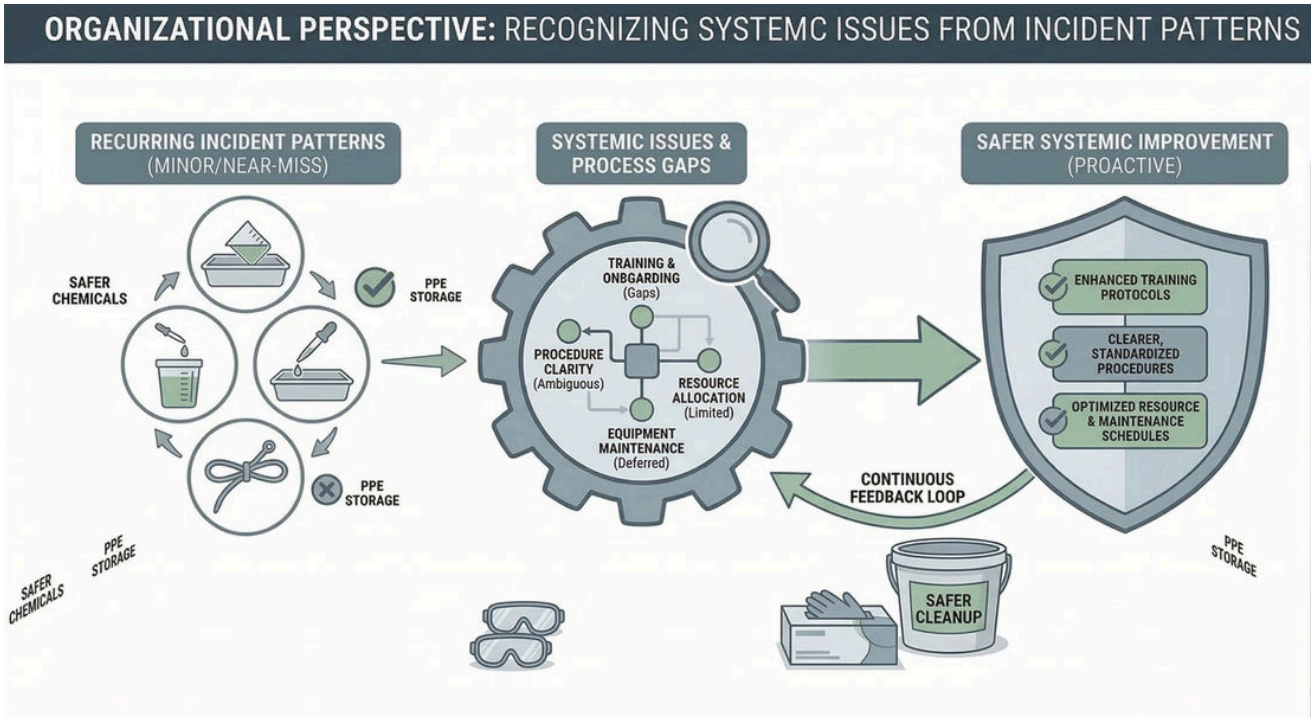
- **All elementary STEM areas:** Patterns may indicate systemic issues

Near-miss events are situations where potential hazards and resulting safety risks were present, but injury did not occur. These events should also be documented and reviewed, since they often provide early warning indicators of emerging safety risks and help improve future instructional decisions.

Safer elementary STEM programs do not remain safer by accident. They improve because adults reflect, communicate, and adjust. Documentation and review are not administrative burdens. They are feedback systems. Just as students learn through iteration, safety systems strengthen through continuous refinement which is planned and purposeful.

Figure 28

This illustration shows how reflection, feedback, and adjustment strengthen safety over time. It encourages teachers to view safety as an ongoing, evolving practice.



Closing Note from the Safety Desk

Elementary STEM safety is built through shared responsibility and ongoing learning. When educators train regularly, communicate clearly, and reflect on practice, they create environments where curiosity, exploration, and safety coexist successfully (NSTA).

ANNEX A

K–5 SAFER STEM EQUIPMENT TABLE

In elementary STEM instruction, safer equipment choices reduce hazards while preserving hands-on learning. The following substitutions reflect developmentally appropriate practices aligned with consensus safety standards.

Measuring and Transferring Materials

- Use digital thermometers instead of glass thermometers to prevent breakage and exposure to hazardous contents.
- Use labeled plastic droppers or pipettes rather than uncontrolled transfer methods to prevent over-pouring and splashes; never allow mouth pipetting.

Handling and Manipulating Materials

- Use blunt-tip plastic tweezers in place of sharp metal tweezers to reduce puncture risk while maintaining fine motor control.
- Use plastic stirring rods or craft sticks instead of glass rods to eliminate breakage hazards during mixing.

Cutting and Preparation Tools

- Use safety scissors and pre-cut materials rather than razor blades or craft knives to prevent lacerations. Blades should remain teacher-only if absolutely necessary.

Energy and Electricity

- Use low-voltage battery packs with insulated leads instead of loose batteries and exposed wires to reduce shock and overheating risks. Always power off before adjusting circuits.
- Use LED bulbs (low heat) rather than incandescent bulbs to eliminate burn hazards and reduce fire risk.

Heating Practices

- Use warm water baths (teacher-controlled) instead of open flames or candles. This removes fire hazards while maintaining safe, controlled heating conditions.

Optics and Observation Tools

- Use durable magnifiers and stable-base microscopes rather than fragile glass optics to reduce breakage and support safe handling routines such as two-hand carrying and proper storage.

Containers and Pouring

- Use plastic beakers and graduated cylinders (polypropylene) instead of glass containers to reduce laceration risk if dropped. These are appropriate for room-temperature, water-based investigations.
- Use wide-base plastic funnels with spill trays rather than freehand pouring to minimize spills and slip hazards. Always teach “two hands on containers.”

Storage and Specimens

- Use unbreakable specimen jars with screw lids instead of glass jars to prevent shattering and improve transport safety.
- Use pre-portioned materials in lab caddies rather than open bins at tables to reduce clutter, cross-contamination, and unsupervised access.

Personal Protective Equipment (PPE)

- Use ANSI/ISEA Z87.1 D3-rated indirectly vented splash goggles (child size) instead of no protection or toy goggles to guard against splash and impact hazards. Goggles should be cleaned and sanitized after each use.
- Use disposable nitrile gloves (when justified) instead of bare-hand contact to reduce exposure to irritants or unknown substances; reinforce proper handwashing.
- Use child-size lab aprons or smocks instead of regular clothing to protect skin and clothing during messy or wet investigations.

Key Takeaway

Safer equipment choices are not about limiting learning; they are about removing unnecessary hazards while preserving meaningful, hands-on STEM experiences appropriate for elementary students.

ANNEX B:

ELEMENTARY STEM (K–5) HAZARD ANALYSIS & RISK ASSESSMENT REVIEW CHECKLIST

Hands-On Learning. Thoughtfully Managed Risk.

Purpose: This checklist supports teachers in identifying hazards before conducting any STEM activity. Aligned to professional safety guidance from the National Science Teaching Association (NSTA) and the National Science Education Leadership Association (NSELA).

01. Materials & Chemical Safety Review

- [ ] All substances reviewed prior to lesson
- [ ] Only teacher distributes materials
- [ ] Containers clearly labeled
- [ ] No unknown mixtures allowed
- [ ] Safety Data Sheet reviewed if applicable
- [ ] Sanitized indirectly vented chemical goggles available if liquid handling involved

Common Risks Identified:

- Eye irritation
- Skin irritation
- Accidental ingestion
- Allergic reaction

02. Tools & Construction Materials

- [ ] Scissors age-appropriate and in good condition
- [ ] Low-temperature glue guns only
- [ ] No sharp wires, splinters, or exposed edges
- [ ] Small parts monitored (especially K–2 choking risk)
- [ ] Materials stored safely between classes
- [ ] No use of rods

Common Risks Identified:

- Cuts and punctures
- Burns
- Choking hazards
- Trip hazards
- Impalement hazards

03. Electrical & Technology Safety

- [ ] Cords secured and taped down
- [ ] No overloaded power strips
- [ ] Devices inspected for damaged wiring
- [ ] Students do not plug/unplug without supervision
- [ ] Liquids kept away from electronics
- [ ] Extension cords unplugged daily at the end of an activity

Common Risks Identified:

- Trip and fall injuries
- Electrical shock
- Fire risk

04. Biological & Environmental Safety

- [ ] No mold-growing experiments conducted
- [ ] Organisms handled safely and ethically
- [ ] Handwashing with soap and water required at the end of the activity
- [ ] Outdoor hazards assessed (weather, insects, terrain)
- [ ] Students with allergies identified

Common Risks Identified:

- Allergic reactions
- Respiratory irritation
- Cross-contamination
- Environmental exposure

05. Behavioral & Supervision Controls

- [ ] Safety expectations reviewed before activity
- [ ] Clear stop signal established
- [ ] Student-to-teacher ratio appropriate
- [ ] PPE worn when required
- [ ] Emergency procedures reviewed and accessible

Common Risks Identified:

- Horseplay
- Impulsivity
- Improper material handling
- Delayed emergency response

5-Minute Pre-Lesson Risk Reflection

Before beginning the activity, ask:

01. What could reasonably go wrong?

02. Who could be harmed?

03. How serious could the injury be?

04. What controls reduce the risk?

05. Is PPE or administrative approval required?

STOP the Activity If:

- Students are not following safety expectations
- Electrical hazards are present
- Mold or unknown biological growth is observed
- PPE is required but not available
- Supervision is compromised

Implementation Follow-Ups

(For Principals, STEM Coordinators, & District Leaders)

- [ ] Provide annual elementary STEM safety training
- [ ] Maintain written safety expectations for all K–5 teachers
- [ ] Conduct classroom safety walkthroughs
- [ ] Document safety discussions during staff meetings
- [ ] Provide access to age-appropriate PPE for all occupants

This hazard analysis and risk assessment review process is not intended to be a compliance exercise; it is a core element of professional decision-making in elementary STEM instruction. Effective educators internalize these questions and apply them consistently during lesson planning and implementation.

Over time, this reflective practice strengthens a STEM educator's ability to recognize patterns of potential safety hazards and resulting safety risks, anticipate student behavior, and select appropriate controls before instruction begins. It also provides a pause for reflection and evaluation of additional student needs to ensure access for all learners.

When used consistently, this process supports defensible instructional decisions and reduces the likelihood of preventable incidents. In elementary STEM instructional spaces, safer outcomes are the result of **intentional planning, not reactive response.**

ANNEX C:

SUPPORTING STUDENTS WITH ADDITIONAL NEEDS IN ELEMENTARY STEM (K–5) INSTRUCTIONAL SPACES

Science and STEM instructional spaces are designed to be hands-on, inquiry-driven, and engaging. These same qualities introduce potential safety hazards and resulting safety risks that must be carefully anticipated and controlled. When working with students who have additional needs, the responsibility for creating safer and equitable learning conditions becomes even more critical.

In today's classrooms and laboratory instructional spaces, many students have identified needs through an Individualized Education Program (IEP), 504 Plan, or medical condition. Providing these students with meaningful access to STEM learning is not optional; it is a legal and ethical responsibility under the Individuals with Disabilities Education Act (IDEA) and the Americans with Disabilities Act (ADA).

Beyond compliance, this work is about opportunity. Students must never be viewed as "unsafe." Instead, they must be supported through thoughtful planning, appropriate accommodations, and intentional instructional design so they can safely participate and succeed.

Understanding the Learner: A Safety Imperative
Students with additional needs may include those with learning, sensory, physical, behavioral, or health-related conditions. These needs vary widely and may impact how students interact with materials, follow procedures, or respond during instruction and emergencies.

Key Principle:
Each student presents a unique safety profile. A one-size-fits-all approach does not work in elementary STEM instructional spaces.
Educators must ask:
"How does this activity look from the student's point of view?"

Examples:

- Materials at table height may be at face level for a student using a wheelchair
- Small tools may be difficult for students with fine motor challenges
- Verbal-only instructions may not be accessible to all learners

Design First: Universal Design for Learning (UDL)
The most effective approach is proactive—not reactive. Universal Design for Learning (UDL) supports safer, inclusive environments by:

- Presenting information in multiple formats (visual, verbal, modeled)
- Structuring clear, step-by-step routines
- Allowing multiple ways for students to engage and demonstrate learning

Well-designed instructional spaces reduce barriers before they become safety risks.
Accommodations in Elementary STEM Settings
Accommodations adjust how students access learning, not the learning expectations.

Examples include:

- Visual + verbal + modeled instructions
- Extended time or adjusted pacing
- Strategic seating for visibility and access
- Use of assistive tools or peer support

All accommodations must be paired with a potential safety hazard and resulting safety risk analysis and risk assessment prior to the activity.

Practical Safer Strategies
Visual Needs

- Use high-contrast materials and clear labeling
- Provide verbal descriptions and guided observation

Hearing Needs

- Provide written directions and visual cues
- Ensure clear sightlines for demonstrations

Mobility Needs

- Maintain clear, wide pathways
- Ensure access to exits and safety equipment

Learning and Attention Needs

- Break tasks into simple steps
- Use checklists, repetition, and visual supports

Health Needs (e.g., allergies, asthma)

- Avoid known triggers
- Substitute safer materials when possible

Student-Centered Risk Assessment
Standard hazard analysis is not enough. Educators must consider student-specific risk assessments, including:

- Review of IEP/504 requirements
- Anticipation of how materials may be used or misused
- Adjustments to procedures, tools, or timing
- Documentation of safety decisions

Safer instruction is achieved when potential safety hazards and resulting risks are addressed before the activity begins.
Emergency Planning for All Learners
Emergency procedures must be accessible to every student.

Consider:

- Can the student reach safety equipment quickly?
- Can they follow evacuation routes independently?
- Will assistance be required?

Best practices:

- Practice procedures with students
- Assign support roles when needed
- Keep all pathways clear and accessible

Equity Through Safety
Students with additional needs may face barriers to participation in STEM learning. The role of the educator is to remove those barriers without increasing risk.
This may require:

- Adjustments to materials or setup
- Changes in instructional approach
- Collaboration with support staff

These are not obstacles; they are essential elements of professional practice.

Safety Enables Access
Inclusive STEM education is not about lowering expectations. It is about strengthening support systems so all students can participate safely.
When safety is intentionally designed:

- All students can engage
- All students can learn
- All students can thrive

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Almost every school in the United States must follow the OSHA 29 CFR 1910.1450 Laboratory Standard (or state equivalent safety program) for their science department safety requirements. OSHA safety standards serve as both legal safety standards and/or better professional safety practices required by all schools.

Always follow your approved Chemical Hygiene Plan (CHP) or equivalent safety plan in your local school district jurisdiction and consult with your Chemical Hygiene Officer or safety compliance officer for more details.

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