



# MSBA Fall 2018 Designer Roundtable

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October 23, 2018

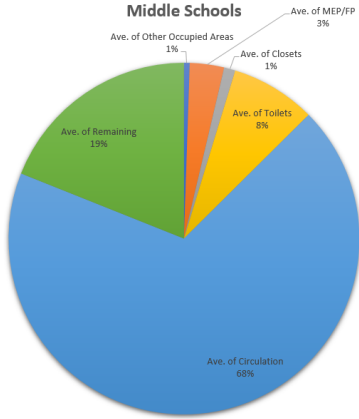
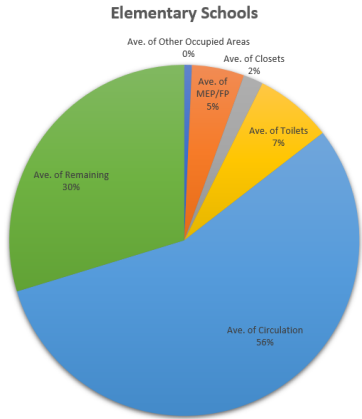


# Non-Programmed Area Collection Update

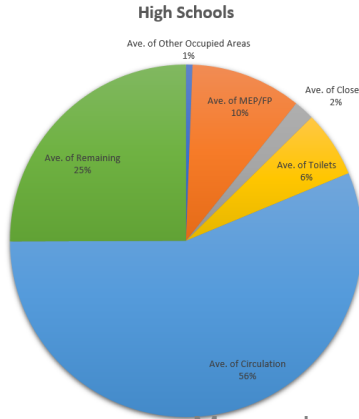
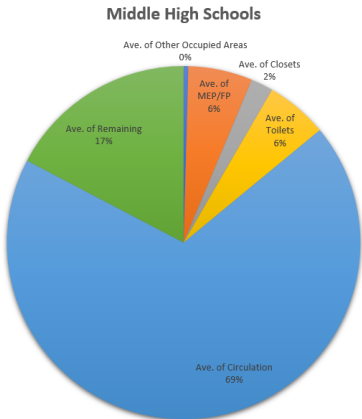
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# Preliminary Results



- Ave. of Other Occupied Areas
- Ave. of MEP/FP
- Ave. of Closets
- Ave. of Toilets
- Ave. of Circulation
- Ave. of Remaining



Room Types	Count	Average of Size
Admin Resource	1	110
Admin/ Single Office	12	130
Conference Room	1	260
Gym/ Athletic Office	1	150
IT Area	5	210
Medical Waiting	2	250
Mother's Room	2	73
School Store	1	150
Staff Lunch	2	229
Support	2	210
Teacher Workroom	2	418
Testing	2	80
Unnamed	1	1595
<b>Grand Total</b>	<b>34</b>	<b>217</b>



# Preliminary Evaluation of Options Update

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# Bid Schedule Update

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### 2018 ESTIMATED BID DATES

Note bid dates are Estimates ONLY. Please contact Districts for exact information.

10/10/18

District	School Type	Enrollment	Project Type	Project Budget	Start	Finish	Constr. Budget	Notes	Timeline												
									Nov '17	Dec '17	Jan '18	Feb '18	Mar '18	Apr '18	May '18	Jun '18	Jul '18	Aug '18	Sep '18	Oct '18	Nov '18
Minuteman Reg. School District	HS	628	New	\$ 144.9	Mon 11/20/17	Mon 6/18/18	\$ 119.2	GMP targeted: June 2018	Minuteman Regional Voc. Tech. HS. 11/20 - 6/18												
Newton	ES	480	Add / Reno	\$ 49.0	Wed 11/29/17	Thu 6/21/18	\$ 36.2	GMP targeted: June 2018	Newton - Cabot Elementary School 11/29 - 6/21												
Millis	ES	515	New	\$ 52.8	Tue 1/9/18	Mon 4/2/18	\$ 42.6	GMP targeted: April 2018	Millis - Clyde Brown Elementary School 1/9 - 4/2												
Triton	ES	415	Reno	\$ 39.0	Thu 2/1/18	Mon 4/9/18	\$ 30.2	GMP targeted: April 2018	Triton Pine Grove Elementary School 2/1 - 4/9												
Blue Hills Regional Voc Tech	HS	900	Reno	\$ 84.9	Fri 3/30/18	Mon 7/30/18	\$ 70.5	GMP targeted: July 2018	Blue Hills RVTHS 3/30 - 7/30												
Somerville	HS	1590	Add / Reno	\$ 256.0	Thu 4/19/18	Mon 10/15/18	\$ 199.0	GMP targeted: October 2018	Somerville High School 4/19 - 10/15												
Braintree	MS	1180	Add / Reno	\$ 83.5	Tue 5/1/18	Wed 6/27/18	\$ 67.7	GMP targeted: June 2018	Braintree East Middle School 5/1 - 6/27												
Saugus	HS	1360	New	\$ 160.7	Wed 6/20/18	Fri 10/12/18	\$ 127.7	GMP targeted: October 2018	Saugus High School 6/20 - 10/12												
Marlborough	ES	610	New	\$ 56.4	Fri 8/31/18	Wed 10/24/18	\$ 47.8	NTP targeted: October 2018	Marlborough - Richer Elementary School 8/31 - 10/24												
Lexington	ES	645	New	\$ 65.3	Wed 9/12/18	Tue 11/20/18	\$ 53.0	GMP targeted: November 2018	Lexington - Maria Hastings Elementary School 9/12 - 11/20												
Cape Cod Regional Tech	HS	650	New	\$ 128.1	Mon 10/1/18	Fri 11/30/18	\$ 104.2	NTP targeted: November 2018	Cape Cod RTHS 10/1 - 11/30												
Taunton	ES	735	New	\$ 65.0	Thu 11/1/18	Wed 12/19/18	\$ 50.1	NTP targeted: December 2018	Taunton - Mulcahey Elementary School 11/1 - 12/19												
<b>Total</b>		<b>9708</b>		<b>\$ 1,186.4</b>			<b>\$ 848.3</b>														

Construction Manager at Risk Project CMR Project Pending Local Approval Filed Sub Bids Design Bid Build Project DBB Project Pending Local Approval GC Bids/GMP Execution

The project start date represents the Filed-Sub bid solicitation date, the gray diamond Filed-Sub bid date, and the black diamond GC Bids / GMP Execution.

Projects represented by a single black diamond have not completed a Schematic Design Submission.

Project Budget denotes total District costs, not the basis of the MSBA Total Facilities Grant. Projects without budget information have not received Project Scope and Budget approval. Note: Budget values are in millions.



### 2019 ESTIMATED BID DATES

Note bid dates are Estimates ONLY. Please contact Districts for exact information.

10/10/18

District	School Type	Enrollment	Project Type	Project Budget	Start	Finish	Construction Budget	Notes	November	December	January	February	March	April	May	June	July	August	September	October	November	December	January	February	
Middleborough	HS	720	New	\$ 103.5	Fri 12/14/18	Thu 1/31/19	\$ 82.8	NTP targeted: January 2019			Middleborough High School 12/14 → 1/31														
Natick	MS	1000	New	\$ 109.6	Thu 1/10/19	Fri 2/15/19	\$ 87.6	NTP targeted: February 2019			Natick - JFK Middle School 1/10 → 2/15														
Westport	MSHS	860	New	\$ 96.9	Wed 1/16/19	Tue 3/12/19	\$ 79.9	NTP targeted: March 2019			Westport MSHS 1/16 → 3/12														
Worcester	HS	1420	New	\$ 210.0	Wed 1/16/19	Fri 3/29/19	\$ 172.9	GMP targeted: March 2019			Worcester South High Community School 1/16 → 3/29														
Harvard	ES	445	New	\$ 53.6	Mon 4/8/19	Wed 6/5/19	\$ 43.0	GMP targeted: June 2019					Harvard - Hildreth Elementary School 4/8 → 6/5												
Fall River	HS	2570	New	\$ 263.5	Wed 5/1/19	Tue 6/18/19	\$ 217.8	GMP targeted: June 2019					Fall River - BMC Durfee High School 5/1 → 6/18												
Boston	HS	500	New	\$ 124.8	Thu 5/2/19	Mon 7/1/19	\$ 96.0	GMP targeted: July 2019					Boston Arts Academy 5/2 → 7/1												
Easthampton	ES	1010	New	\$ 109.2	Wed 5/22/19	Thu 8/1/19	\$ 90.1	NTP targeted: August 2019					Easthampton - Maple Elementary School 5/22 → 8/1												
Springfield	ES	800	New	\$ 82.2	Thu 7/18/19	Thu 10/31/19	\$ 66.9	GMP targeted: October 2019																	
Ludlow	ES	630	New	\$ 57.5	Thu 8/1/19	Thu 9/19/19	\$ 45.8	NTP targeted: September 2019																	
Foxborough	ES	270	Add / Reno	\$ 34.7	Tue 8/6/19	Thu 10/3/19	\$ 27.1	NTP targeted: November 2019																	
Shrewsbury	ES	790	New		Tue 9/3/19	Tue 11/12/19		GMP targeted: November 2019																	

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Manchester - Essex	ES	335	New	\$ 52.2	Mon 9/9/19	Fri 11/22/19	\$ 41.1	GMP targeted: November 2019											Manchester Memorial Elementary School 9/9			11/22			
																				10/25					
Bristol County	HS	640	Add / Reno	\$ 103.8	Wed 10/2/19	Mon 11/25/19	\$ 84.0	NTP targeted: November 2019												Bristol County Agricultural High School 10/2			11/25		
																					10/30				
Northbridge	ES	1030	New	\$ 101.0	Wed 10/9/19	Mon 12/9/19	\$ 79.5	GMP targeted: December 2019													Northbridge - Balmer Elementary School 10/9			12/9	
																						11/8			
Danvers	ES	465	New		Mon 12/23/19	Mon 12/23/19		GMP targeted: December 2019																	
<b>Total</b>		<b>13,485</b>		<b>\$ 1,018.2</b>			<b>\$ 825.6</b>																		

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### 2020 ESTIMATED BID DATES

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10/10/18

District	School Type	Enrollment	Project Type	Project Budget	Start	Finish	Construction Budget	Notes	Sep '19	Oct '19	Nov '19	Dec '19	Jan '20	Feb '20	Mar '20	Apr '20	May '20	Jun '20	Jul '20	Aug '20	Sep '20	Oct '20	Nov '20	Dec '20								
Attleboro	HS	1725	New	\$ 259.9	Wed 10/9/19	Sun 3/1/20	\$ 223.1	GMP targeted: March 2020																								
Framingham	MS	630	New		Tue 10/29/19	Fri 1/3/20		GMP targeted: January 2020																								
Belmont	HS	2215	New	\$ 295.2	Tue 12/17/19	Thu 3/12/20	\$ 236.6	GMP targeted: March 2020																								
Dennis - Yarmouth	MS	940	New		Tue 1/21/20	Tue 1/21/20		NTP targeted: January 2020																								
Wareham	ES	1020	New		Wed 1/29/20	Wed 1/29/20		NTP targeted: January 2020																								
Tewksbury	ES	790	New		Tue 8/11/20	Tue 8/11/20		GMP targeted: August 2020																								
<b>Total</b>		<b>7320</b>		<b>\$ 555.1</b>			<b>\$ 459.7</b>																									

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**2021 ESTIMATED BID DATES**

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10/10/18

District	School Type	Enrollment	Project Type	Project Budget	Start	Finish	Construction Budget	Notes	Jan '21	Feb '21	Mar '21	Apr '21	May '21	Jun '21	Jul '21	Aug '21	Sep '21	Oct '21	Nov '21	Dec '21	
Holyoke	MS	1100	New		Tue 2/9/21	Tue 2/9/21		GMP targeted: February 2021	Holyoke - H.B. Lawrence School ◆ 2/9												
Arlington	HS	1755	New		Wed 3/31/21	Wed 3/31/21		GMP targeted: March 2021			Arlington High School ◆ 3/31										
Lowell	HS	3520	Add / Reno		Fri 7/30/21	Fri 7/30/21		GMP targeted: July 2021							Lowell High School ◆ 7/30						
<b>Total</b>		<b>6375</b>																			

Construction Manager at Risk Project █      CMR Project Pending Local Approval ░░░░░░░░░░░░░░░░      Filed Sub Bids ◆  
 Design Bid Build Project █      DBB Project Pending Local Approval ░░░░░░░░░░░░░░░░      GC Bids/GMP Execution ◆

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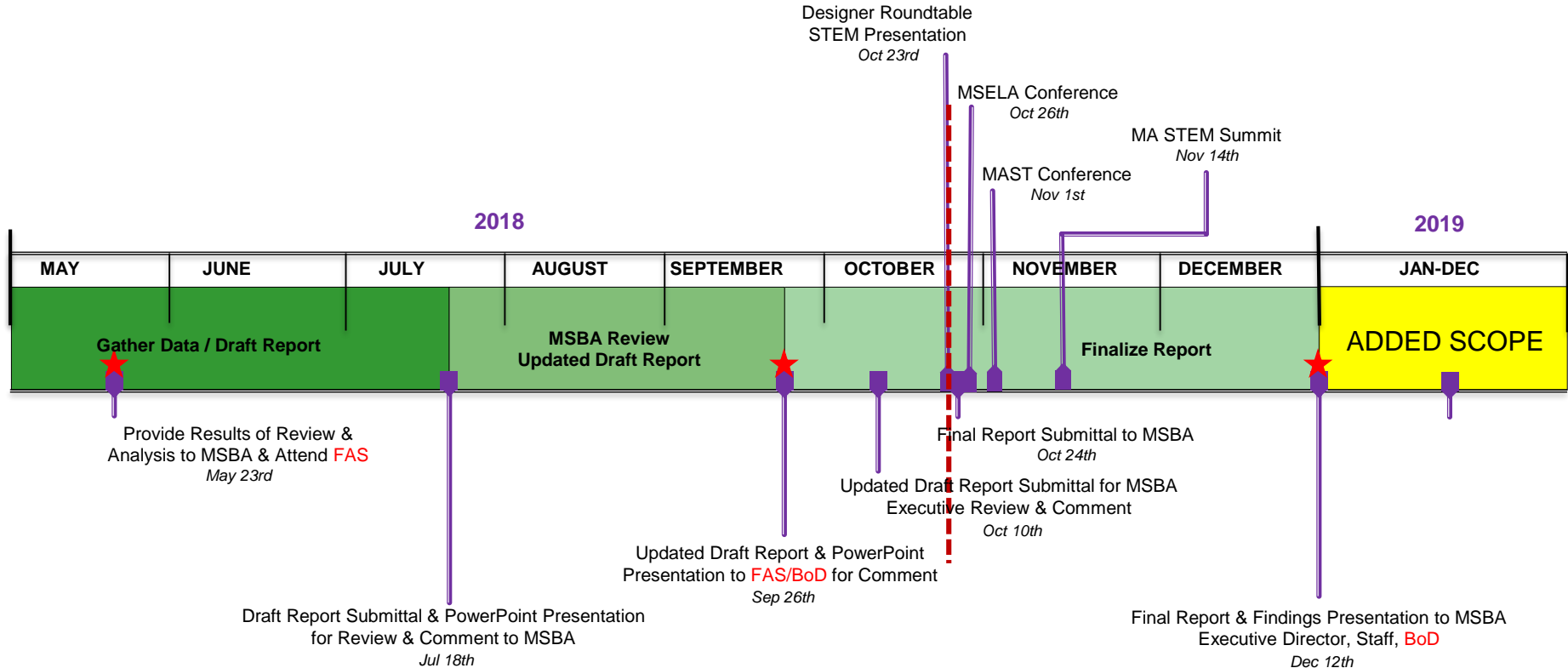


# Draft Recommendations for STE/Science Areas

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# Science Lab Schedule



# STEM Design Roundtable

MSBA, October 23, 2018

Jake Foster, Ph.D., STEM Learning Design LLC

Laura Smith

# Goal of the review

- Complete a review and analysis of K–12 core academic STEM learning spaces, with a focus on K–8, and provide recommendations for “best practices” for the quantifying and sizing, configuration, outfitting, management, maintenance, and use of STEM learning spaces.
- Recommended “best practices” will include a list of suggested teaching and safety equipment, materials, and practices that are optimal and age-appropriate for providing core academic STEM programming for K–12.

# Imperatives for STEM

- A literate society
  - E.g., Ability to understand and analyze the natural and built world to achieve personal well-being and participate in civic government
- Economic viability
  - E.g., Preparation for workforce viability and success in an increasingly technical and innovation-driven economy
- Global sustainability
  - E.g., Grand challenges of our time are global and require engineered solutions

# STEM programming

- To enable:
  - hands-on, minds-on science and engineering
  - relevant and applied mathematics
  - effective integration of technology & use of digital tools
- Application and transfer to literacy, economic, and global contexts
- Development of skills, dispositions, and knowledge
- Critical that a school *clearly articulate program and learning goals for STEM* to inform educational approach and design decisions



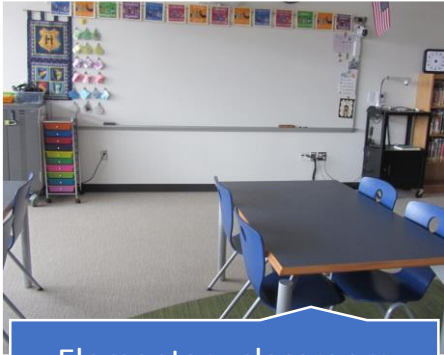
# MA STEM learning standards & frameworks

- **Articulate** desired learning outcomes for all students (knowledge & skills)
  - Science & Technology/Engineering
  - Mathematics
  - Digital Literacy & Computer Science
- **Recommend and encourage** best practices for STEM program design and implementation
- Occasionally suggest **sample** experiences, materials, and tools
- **DO NOT**
  - Require or specify particular materials or equipment
  - Require or specify particular curriculum, pedagogy, or learning activities
  - Require or specify particular space needs or design

# Spectrum of elementary STEM learning spaces



Elementary classroom  
(lower grades)



Elementary classroom  
(upper grades)



Science & tech/eng  
classroom



Makerspace,  
STEM Lab

Generalist teacher

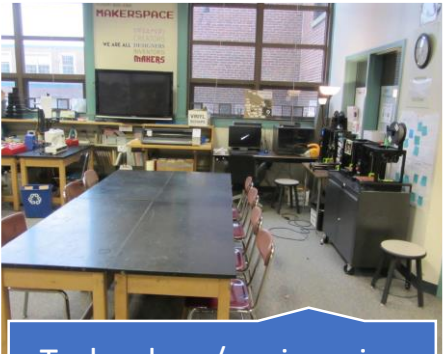


Specialist teacher

# Spectrum of secondary STEM learning spaces



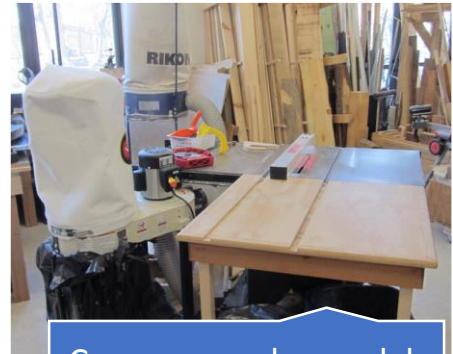
Science lab



Technology/engineering lab



Specialized STEM labs (e.g. forensics, biotech)



Career prep shop or lab (e.g. woodshop)

Core academic/  
General ed



Electives & specials/  
Career preparation

# Elementary generalist classroom K–5

- Much science is currently done in K–5 elementary generalist classrooms
- Typically includes variety of centers around room (1 may be science)
- Several minor tweaks are likely to enhance science & engineering in these spaces
  - E.g., deep sink, project & kit storage, location and light for terrarium or aquarium
  - Note: no eyewash
    - eyewash station should be included in nurse's office/health center, where the nurse is trained on its use

# Science & technology/engineering room K–6

- Typically seen grades 3–5
- Less of a need at grades K–2
- Assumes a dedicated science teacher
- Significant open space
- Additional storage for kits, equipment & projects



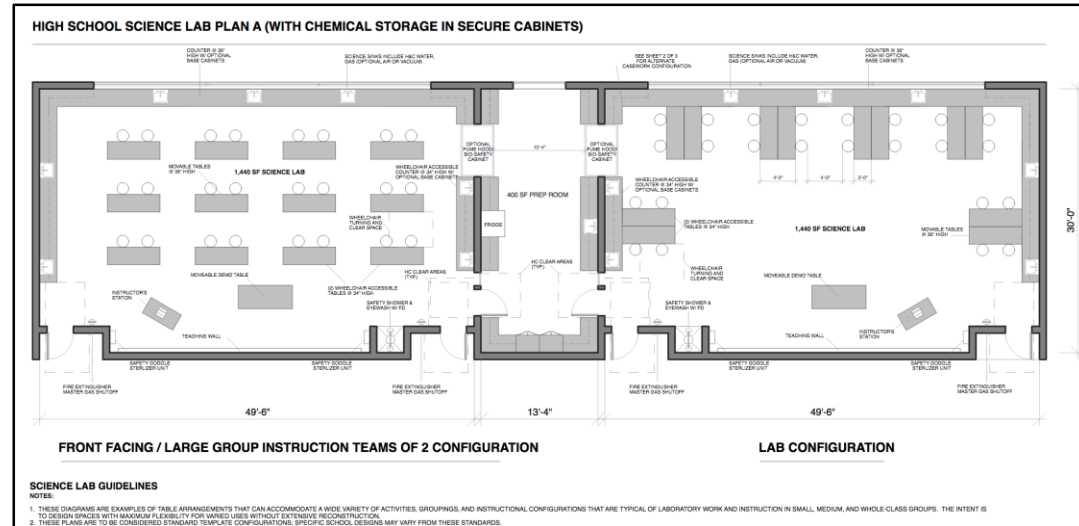
# Science & technology/engineering room K–6

- Similar principles to HS model
  - Flexibility, utilities on edge only
- Standard-height but varied work surfaces
- Multiple sinks
- Electrical ceiling drops
- Special safety equipment:
  - Eye wash station(s) for 6<sup>th</sup> grade when included in MS
  - Goggle sanitizer (option)



# Middle school science labs (gr. 7–8)

- Recommend using the [high school science lab design](#)
  - Nature of the activities, and the size of students, are similar to high school
- No need for gas or compressed air/vacuum
- Some lab tables at lower heights may also be considered



# High school science lab potential tweaks

- Reviewed some schools completed and in use since 2011
- Reviewed safety expectations re: OSHA protections
- Avoid
  - Narrow prep rooms
  - Narrow lab sinks
- Support for engineering
- Chemical safety system refinements in upcoming slides





STEM Learning Design LLC, 10/23/18, STEM Design Roundtable



# High school science lab potential tweaks

- Recognize that some use these spaces for engineering classes as well
  - Consider electrical drops and ceiling bars for all



# “Project rooms”

- Not for STEM per se, but enables STEM design & project activities
- May be achieved through creative hallway adjacencies



# “Project rooms”



# Foundations for making in MA schools

- At the individual level, making enables our ability to use basic tools and address everyday needs (e.g., enable self-sufficiency)
- At the curriculum level, the importance of learning through doing has been recognized for a long time (e.g., Dewey)
- At the program level, making is typically driven by the economy of the time (e.g., industrial arts to support an industrial economy)

# Evolution of making in MA secondary schools

- Industrial arts model
  - Main emphasis is on use of tools for production of quality products
  - Relatively large mechanical shops with major tools & systems representative of target industries
- Technology education model
  - Emphasis on major technological systems and engineering as a design process
  - Shop-like environment with sufficient tools & materials to design products representative of technological systems
- Innovation economy model
  - Emphasis on process for addressing societal and economic needs, to quickly innovate and prototype solutions
  - Collaboration and sharing resources, a variety of materials and small-scale mechanical and digital tools to quickly prototype and test solutions, flexibility





# Makerspaces

- One type of tech ed space
- Use elementary specialist and HS lab principles as foundation (e.g., flexibility, perimeter utilities)
- Centers for different types of prototyping





# Makerspaces

- Expectation of dedicated staff
- May be associated with science, technology, or media programs
- Considerations for
  - Project, tool and material storage
  - Safety equipment
  - Utilities (e.g., dedicated exhaust)
- Expect changes in technology



# Typical usage patterns for MS & HS

- Project rooms available to all classes
- Technology/engineering (tech & career) classes (including dedicated makerspaces) often treated
  - as a *special* in middle school
  - as an *elective* in high school
- Central makerspaces often used to enhance core academics across school, students may not be regularly scheduled into the space

# Safety considerations



<https://www.doh.wa.gov/Portals/1/Documents/4400/SchoolWorkshop-HazmatsJakab.pdf>

# OSHA protections for all public employees

- Updated law M.G.L. ch 149 sec 6½ (March 9, 2018)
  - Takes effect Feb 2019
- Makes explicit OSHA protections apply to all public employees
- Technically OSHA does not apply to students (they are not employees)
- But school should extend protections via policy & practice

# Working assumptions re: chemicals

- A “laboratory” is the room where science experiments and investigations are regularly carried out
- If you can buy it in the store, it is ok to use
  - Potential of K-8 STEM education without “hazardous chemicals”

**Risk = Hazard x Exposure**

# Laboratory Standard [OSHA 29 CFR 1910.1450]

A laboratory is *any place* where:

- Multiple chemicals or multiple procedures are used
- Lab scale; what an individual will do
- Not a production facility
- Presence of standard safety equipment

*Can include CVTE shops, art rooms, others*



# Hazardous Chemicals [OSHA 29 CFR 1910.1200(c)]

*Hazardous chemical* means any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, or hazard not otherwise classified.

# Globally Harmonized System signal words

- *Danger*
  - Used for more severe hazards
  - E.g., HF, Chlorine, 12M HCl,  $\text{Pb}(\text{NO}_3)_2$ , IK
- *Warning*
  - Used for less severe hazards
  - E.g., 6M HCl, 0.1M HCl, 5% acetic acid (vinegar)
- Not classified
  - E.g., NaCl, KCl solution, chlorine water (tho Category 2 acute aquatic toxicity)
- Category 1 chemicals are most dangerous
  - Opposite of NFPA system

# Building implication

- Once a school obtains a chemical with signal word *Danger* or *Warning*, regulatory & professional practice expectations apply
  - OSHA, EPA, DEP, ANSI, NFPA, other building codes ...
- That means having chemical safety systems, best practice procedures, plans *and* training



# Chemical recommendations for schools

- K–6
  - Prohibit use of chemicals with signal words *Danger and Warning*
- 6–12
  - Prohibit from having chemicals with signal word *Danger*
  - Highly recommend avoiding Category 1 chemicals with signal word *Warning*
    - Practice green chemistry and microscale chemistry principles as possible and appropriate
- Always aim for safer, healthier, more sustainable choices
- Require science safety training for all educators

# Building implications

- K–6: no need for typical chemical safety systems
  - Include eyewash in nurses station
- 6–12: most typical chemical safety systems should be provided
  - Eyewash station(s)
  - Safety shower (no drain)
  - Fume hood
    - For MS this likely is only needed in the central chemical storage/prep room (1)
    - For HS the number provided & placement based on STEM program need
  - Negative room pressure & dedicated returns (no room purge system needed)
  - Chemical storage room (with dedicated direct ventilation)
  - Do *not* recommend that acid neutralization systems be installed

# A few physical safety considerations

- Storage
- Sinks









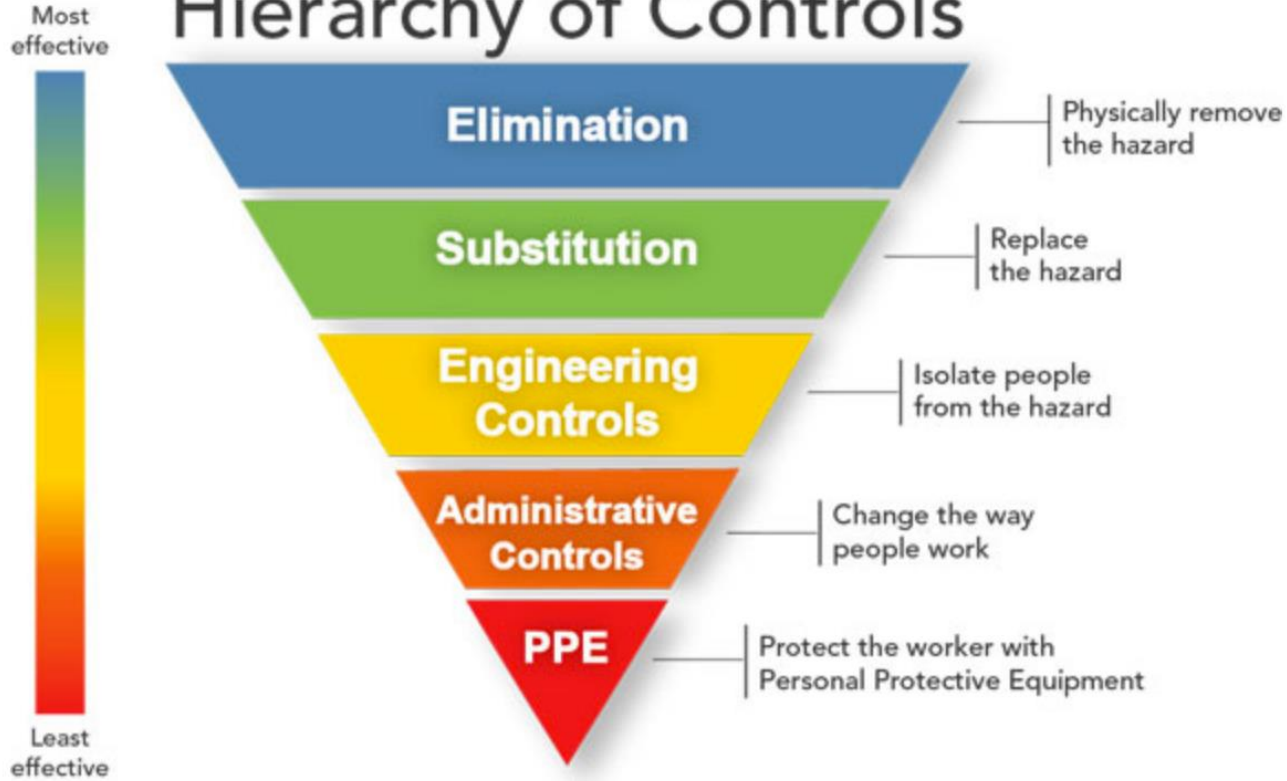
# Planning for safe learning

- Goal is to do no harm to students (mission-focused approach)
- Assess hazards, actively reduce risks, *document*
  - What are the risks and why are they necessary to achieve the learning goal?
  - What has been done to reduce risk (hazard & exposure)?
  - What harm could be incurred, and what do we do if something happens?
- Educator liability
  - Lots of personal liability for educators
  - Share across staff
    - Educator, Chemical Hygiene Officer, Nurse, Administrator, Emergency Response Coordinator, Purchasing Office, etc

# Cost implications

- Cost considerations for safety systems should include
  - Life cycle analysis, such as:
    - Construction/installation
    - Staff training
    - Maintenance and upkeep
    - Replacement
  - Liability analysis, such as:
    - Risk assessment prior to activity/use
    - Ability to appropriately respond in case of harm to student or staff
    - Likely nature of harm caused
    - Clean up

# Hierarchy of Controls



# Applicable code for key safety systems

Control	What triggers the need for it?	Key guidance for its design	Key guidance for testing and maintenance^	Requires plan and/or training (?)
<b>Engineered Controls</b>				
Fume hood	OSHA 1910.1450. This code addresses several aspects of laboratory design and operation. Regarding hoods it is primarily concerned with airflow at the face of the hood, monitoring, maintenance and exhaust.	<b>ANSI/AIHA Z9.5.</b> Titled "The American National Standard for Laboratory Ventilation"	Proper function required as part of OSHA 29 CRF 1910.1450(e)(3)(ii)	Part of 1910.1450 Chemical Hygiene Plan
Chemical storage room (with dedicated direct		<b>NSTA</b>		

Hazard	Comments	Potential Controls*			Building system or feature to support incident response
		Engineered (building features)	Administrative (best practice)	PPE (individual action)	
Exposure to hazardous chemicals	Can be exposure during a lesson, if a student gets in a space they are not supposed to be (e.g., prep room), or from something like cleaning products used across the school  Consider all sources of chemical, including in tech/eng	<ul style="list-style-type: none"> <li>Provide fume hood where appropriate</li> <li>Provide properly designed chemical storage room (with dedicated direct ventilation)</li> <li>Negative pressure in STEM spaces where hazardous chemicals may be used in quantity, to prevent spread of</li> </ul>	<ul style="list-style-type: none"> <li>Maintain and provide SDS sheets</li> <li>Follow appropriate procedures for purchase, storage, preparation, use, and disposal of hazardous chemicals</li> <li>Exposure monitoring</li> <li>Safety contract and training for students on use of tools</li> </ul>	<ul style="list-style-type: none"> <li>Goggles</li> <li>Chemical-resistant apron</li> <li>Chemical-resistant gloves</li> <li>(Respirator if needed)</li> </ul>	<ul style="list-style-type: none"> <li>Safety shower</li> <li>Eyewash station(s)</li> <li>Emergency call button in room</li> <li>Fire extinguisher (visit Nurse/Health Center)</li> <li>(Follow appropriate response and clean up procedures)</li> </ul>

# STEM learning spaces

- To enable:
  - hands-on, minds-on science and engineering
  - relevant and applied mathematics
  - effective integration of technology & use of digital tools
- Application and transfer to literacy, economic, and global contexts
- Development of skills, dispositions, and knowledge
- Critical that a school *clearly articulate program and learning goals for STEM* to inform educational approach and design decisions



# MSBA Policies

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## How the current space summary can accommodate STEM:

### Elementary schools:

- Core Academic in general classrooms
- Art “project rooms”
- Media Center

### Middle & High schools:

- Core Academic science labs
- Art “STEM lab / maker space / project rooms”
- Vocations & Technology
- Media Center



# MSBA Policies

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## Potential Space Summary updates:

- Clarify where STEM spaces can be indicated in the space summary
- Determine the extent that STEM spaces will be eligible for MSBA funding
- Consider a requirement that sinks are provided in all elementary classrooms
- Sub-divide the elementary school enrollment into grades K-2 / 3-6
- Sub-divide the middle school enrollment into grades 5-6 / 7-8
- Increase MS grades 7-8 science lab min. area to align with HS guidelines
- Make any updates to HS science lab guidelines as necessary

# Questions and discussion

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