West Virginia DEPARTMENT OF EDUCATION

Integrating STEM Into Classroom Instruction

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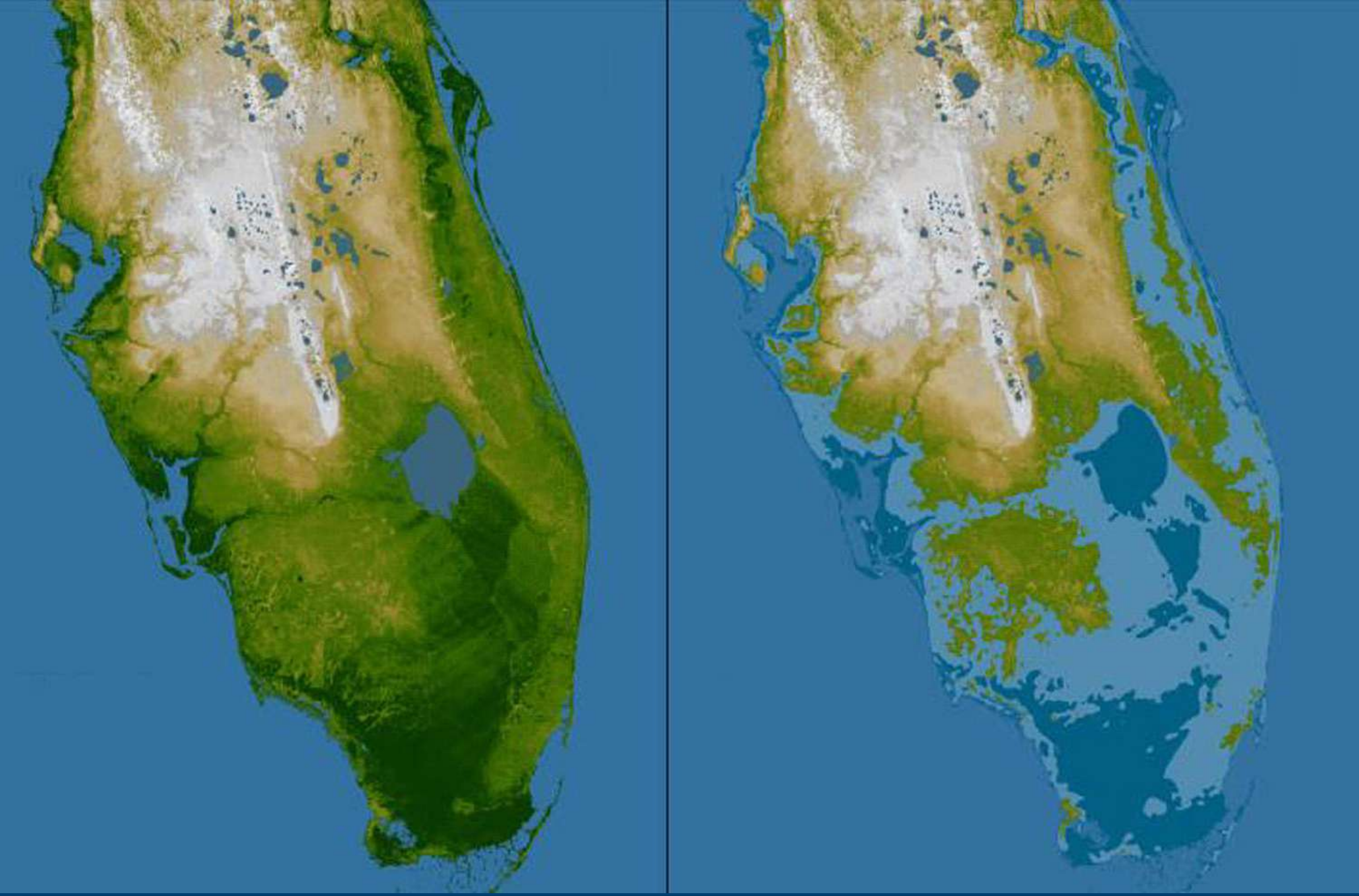
STEM Stories

Please indulge me as I tell you a stem story...



https://wusfnews.wusf.usf.edu/post/rising-seas-may-mean-tampa-bay-floods-even-during-sunny-days

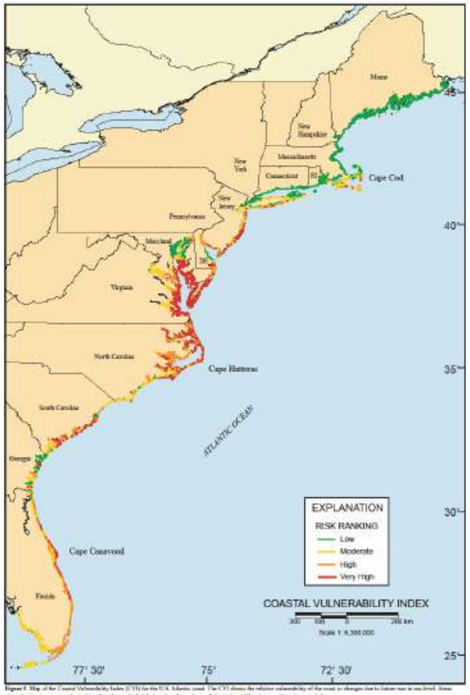


Figure 1. Map of the Coastal Vulnerability Index (CVI) for the U.S. Atlantic coast. The CVI shows the relative vulnerability of the coast to changes due to future rise in sea-level. Areas along the coast are assigned a ranking from low to high risk, based on the analysis of physical variables that contribute to coastal change.

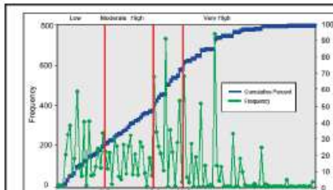


Figure 2.

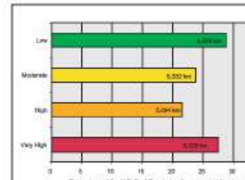


Figure 3.

Table 1. Ranking of coastal vulnerability index variables.

	Ranking of coastal vulnerability index				
	Very low	Low	Moderate	High	Very high
VARIABLE	1	2	3	4	5
Geomorphology	Rocky, cliffed coasts Fiords Fiards	Medium cliffs Indented coasts	Low cliffs Glacial drift Alluvial plains	Cobble beaches Estuary Lagoon	Barrier beaches Sand beaches Salt marsh Mud flats Deltas Mangrove Coral reefs
Coastal Slope (%)	>0.115	0.115 – 0.055	0.055 – 0.035	0.035 – 0.022	< 0.022
Relative sea-level change (mm/yr)	< 1.8	1.8 – 2.5	2.5 – 3.0	3.0 – 3.4	> 3.4
Shoreline erosion/accretion (m/yr)	>2.0 Accretion	1.0 – 2.0	-1.0 – +1.0 Stable	-1.1 – -2.0	< - 2.0 Erosion
Mean tide range (m)	> 6.0	4.1 – 6.0	2.0 – 4.0	1.0 – 1.9	< 1.0
Mean wave height (m)	<0.55	0.55 – 0.85	0.85 – 1.05	1.05 – 1.25	>1.25

New York to New Jersey example

Figure 4. Map of the Coastal Vulnerability Index for the New York to New Jersey region.

Figure 5. Map of the geomorphology variable for the New York to New Jersey region.

Figure 6. Map of the coastal slope variable for the New York to New Jersey region.

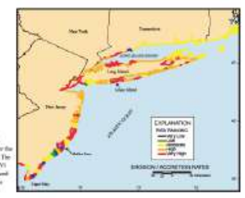


Figure 7. Map of the shoreline erosion/accretion rate variable for the New York to New Jersey region.

North Carolina to Georgia example

Figure 8. Map of the Coastal Vulnerability Index for the North Carolina to Georgia region.

Figure 9. Map of the geomorphology variable for the North Carolina to Georgia region.

Figure 10. Map of the sea-level rise variable for the North Carolina to Georgia region.

Figure 11. Map of the mean wave height variable for the North Carolina to Georgia region.

INTRODUCTION

RISK VARIABLES

DATA RANKING

COASTAL VULNERABILITY INDEX

RESULTS

DISCUSSION

SUMMARY

REFERENCES

National Assessment of Coastal Vulnerability to Sea-Level Rise: Preliminary Results for the U.S. Atlantic Coast

By

E. Robert Thieler and Erika S. Hammar-Klose

U.S. Geological Survey
Woods Hole, Massachusetts

1999

USGS

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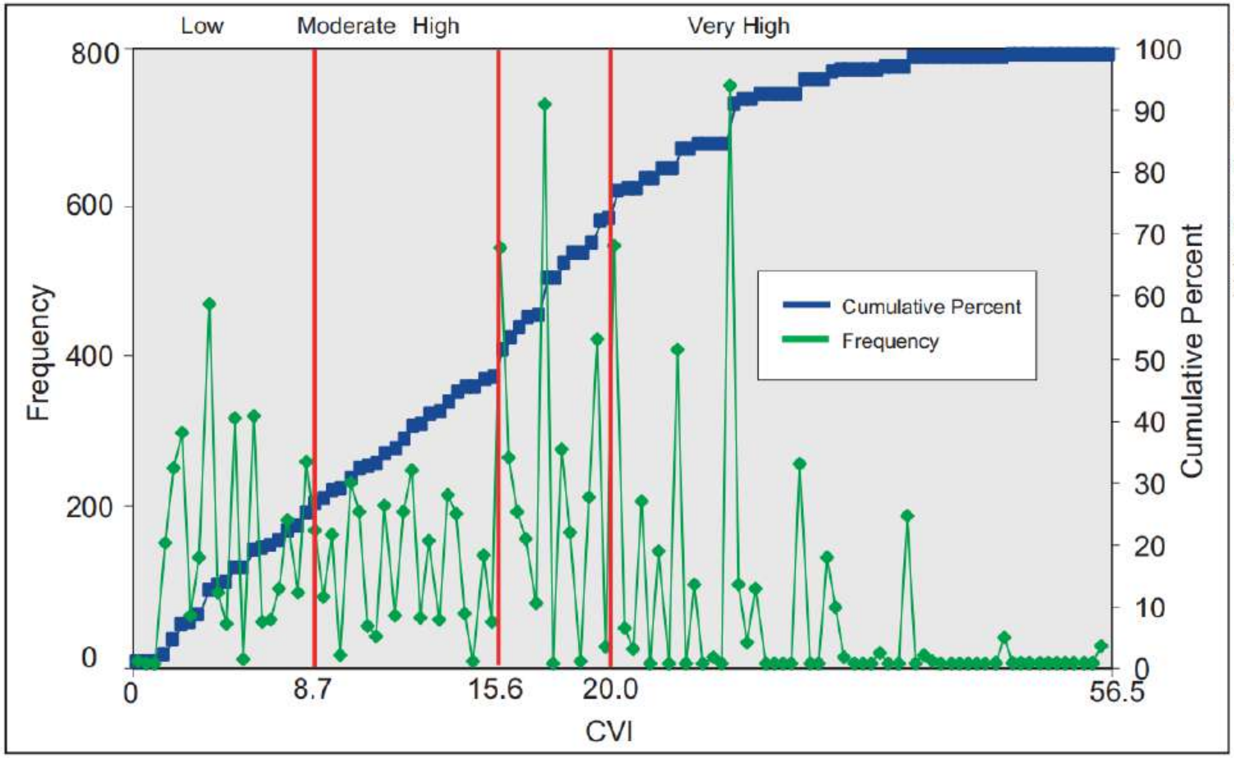

Figure 2. Histograms showing the frequency of occurrence and cumulative frequency of CVI values for the U.S. Atlantic coast. The vertical red lines delineate the chosen ranges for low, moderate, high, and very high risk areas.

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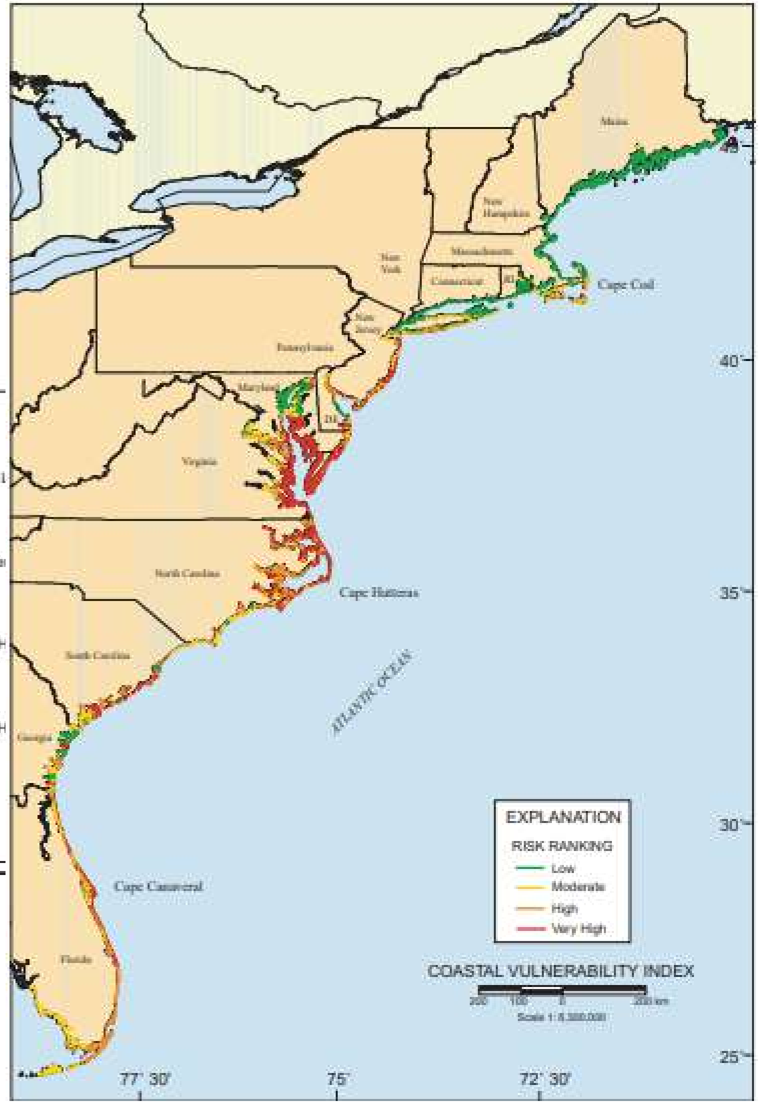

Maine
New Hampshire
Massachusetts
Connecticut
RI
New York
New Jersey
Pennsylvania
Maryland
DE
Virginia
North Carolina
South Carolina
Georgia
Florida
Cape Cod
Cape Hatteras
Cape Canaveral
ATLANTIC OCEAN
EXPLANATION
RISK RANKING
Low
Moderate
High
Very High
COASTAL VULNERABILITY INDEX
40°
35°
30°
25°
77° 30'
75'
72° 30'

North Carolina to Georgia example

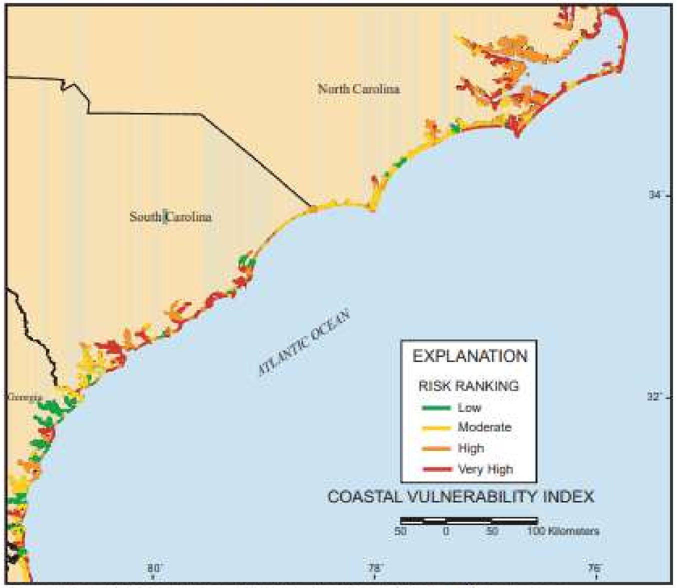


Figure 8. Map of the Coastal Vulnerability Index for the North Carolina to Georgia region.

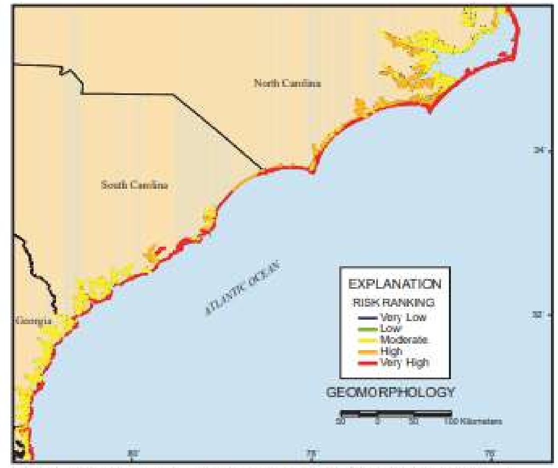


Figure 9. Map of the geomorphology variable for the North Carolina to Georgia region. Like the New York to New Jersey region, geomorphology is still the dominant variable influencing the CVI values (see Figure 8).

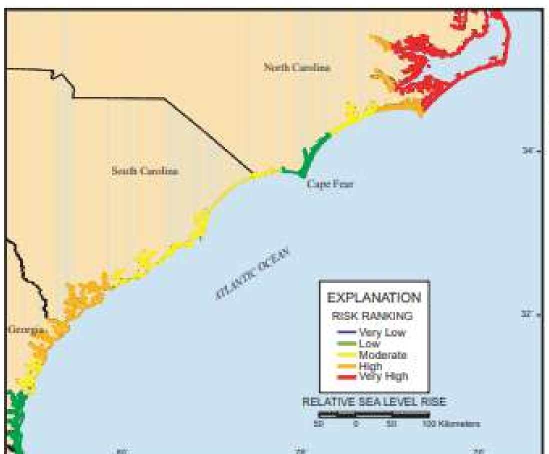


Figure 10. Map of the relative sea-level rise variable for the North Carolina to Georgia region. The rate of sea-level change is lowest at Cape Fear, North Carolina, due to long-term tectonic uplift of the mid-Carolina Platform High.

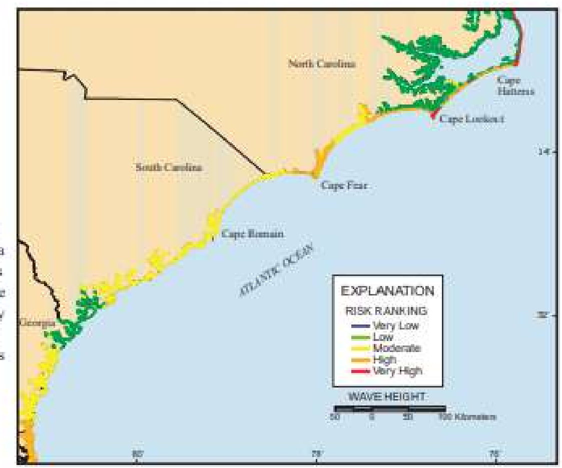


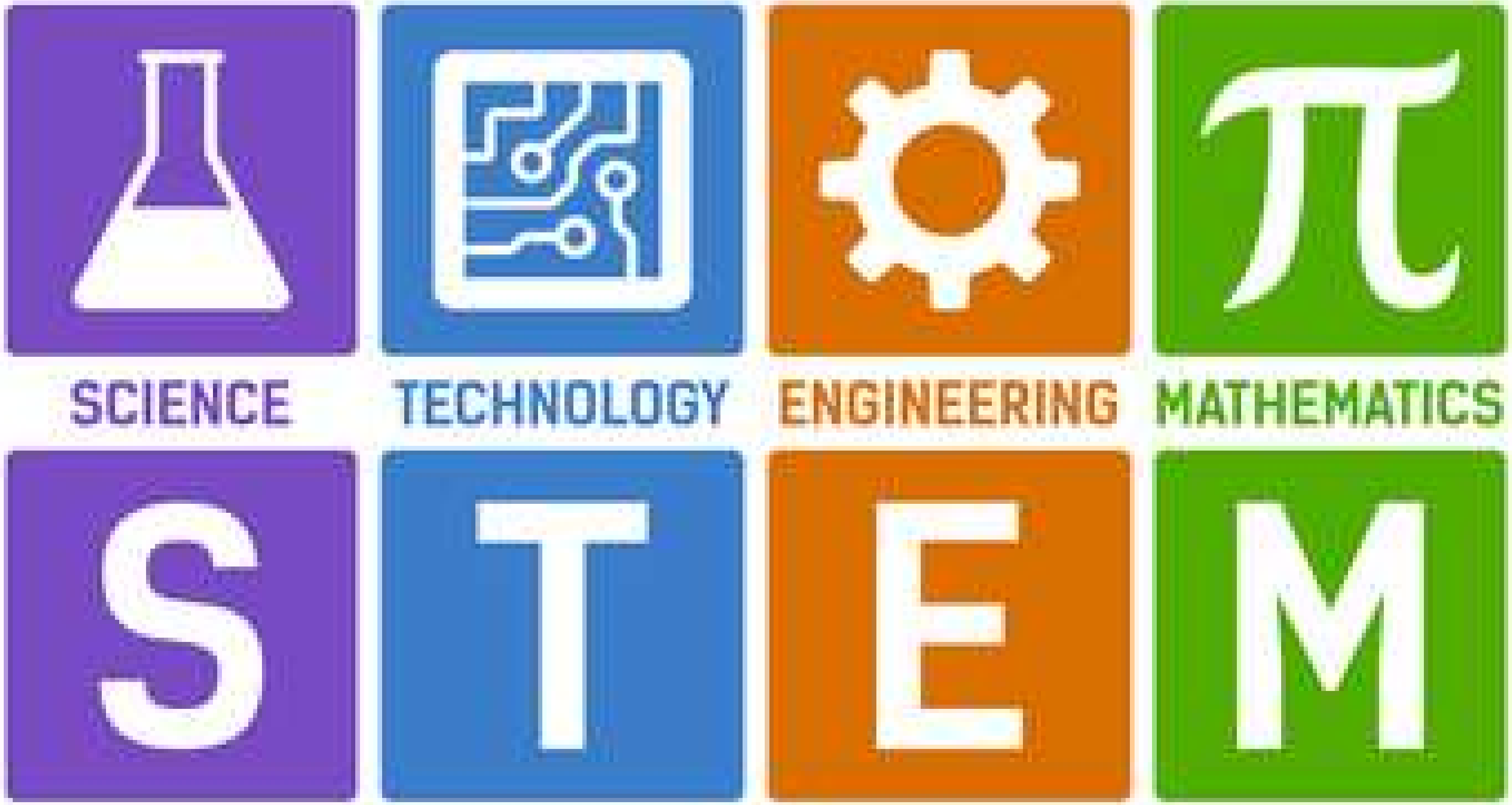
Figure 11. Map of the mean wave height variable for the North Carolina to Georgia region. The risk due to wave height varies between the north and south sides of Cape Hatteras and Cape Lookout, and generally decreases from Cape Hatteras southward into the Georgia embayment. This reflects differences in wave exposure due to shoreline orientation, as well as the increasing continental shelf width from North Carolina to Georgia.

- Asking questions like “what factors influences whether or not a shoreline will be physically changed as sea-level rises?”
- Mapping software & data collection tools.
- Developing models to show the relationships among variables that are not observable but predict observable phenomena.
- Engineering is problem solving.
- How can I convey this information attractively? What design principles must I follow?
- $$CVI = \sqrt{((a*b*c*d*e*f)/6)}$$

Goals:

- We want students to have their own STEM stories.
- We want students to understand the components of STEM.
- We want students to see themselves as a participant in STEM.
- We want students to see a future in STEM.

Let's have an acronym chat...


SCIENCE
TECHNOLOGY
ENGINEERING
MATHEMATICS
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E
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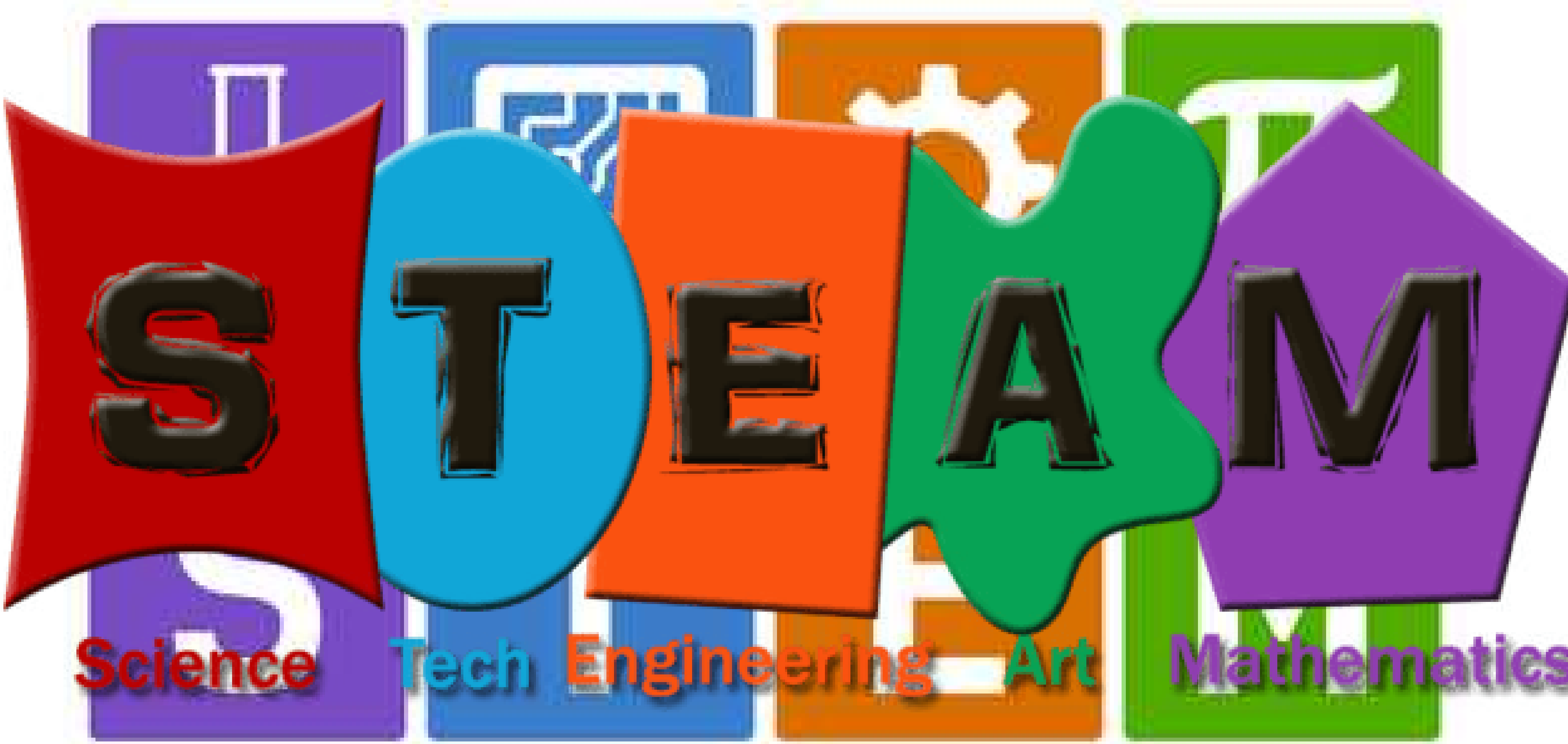
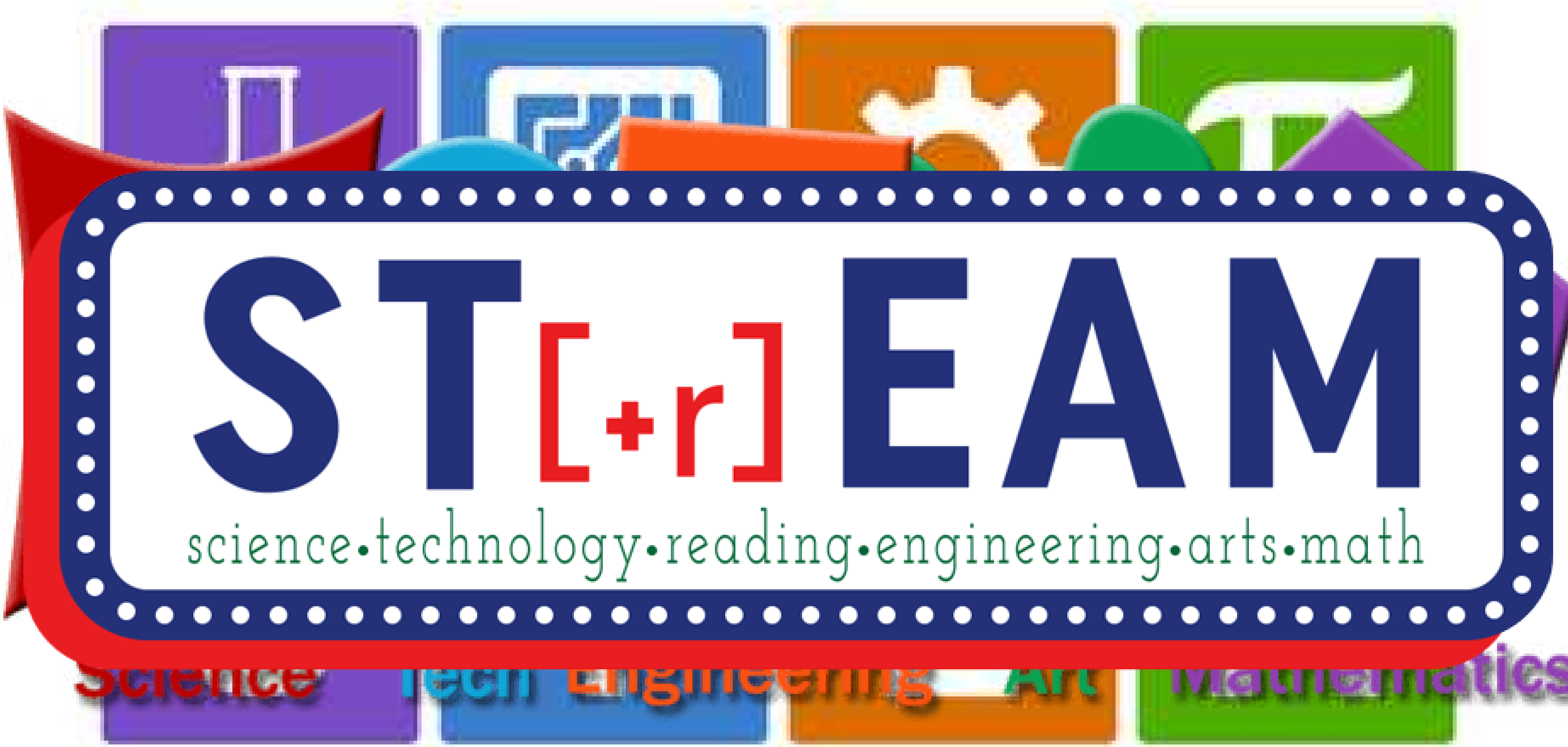
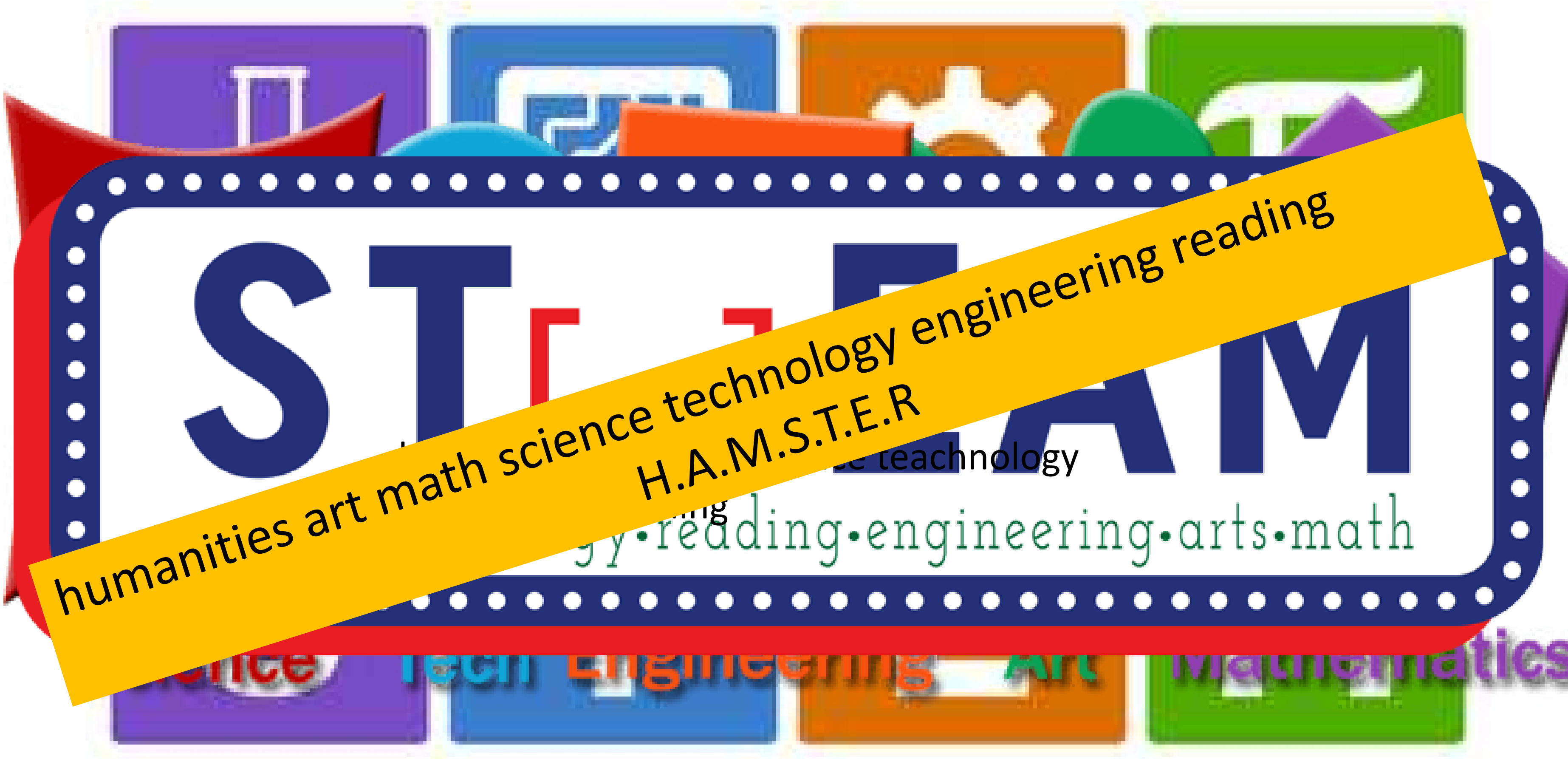

STEAM
Science Tech Engineering Art Mathematics


ST[+r]EAM
science•technology•reading•engineering•arts•math



humanities art math science technology engineering reading
H.A.M.S.T.E.R

teachnology

Which acronym is yours?

- Share your choice by using the QR code, or a web browser to access https://b.socrative.com/login/student/
- Enter KLOSE for the room.
- Answer the question.

STEM-MINDED WV

Developing the habits of mind for student success in a WV STEM society.

WVDE defines STEM-mindedness as an awareness that the future for which we are preparing students will require them to operate in arenas that require a synthesis of the content we teach every day. Primarily, this is a belief that our instructional thinking is not to be governed by an acronym, such as STEM, STEAM, STREAM, HAMSTER, or STREAM-E, but by the desire to create an optimal teaching condition that recognizes the interconnectedness and value of math, the sciences, reading, writing, history, the social sciences, and the arts. Secondly, this is a belief that what we call softs skills are necessary to effectively weave our content disciplines together. These personal effectiveness competencies improve performance, facilitate relationships, and complement the technical competencies students will need to find and maintain employment in a STEM-driven world, whether or not they enter a STEM-focused career. STEM-MINDED WV will reach students, parents, families, educators and school administrators with tools for the development of STEM-minded students.

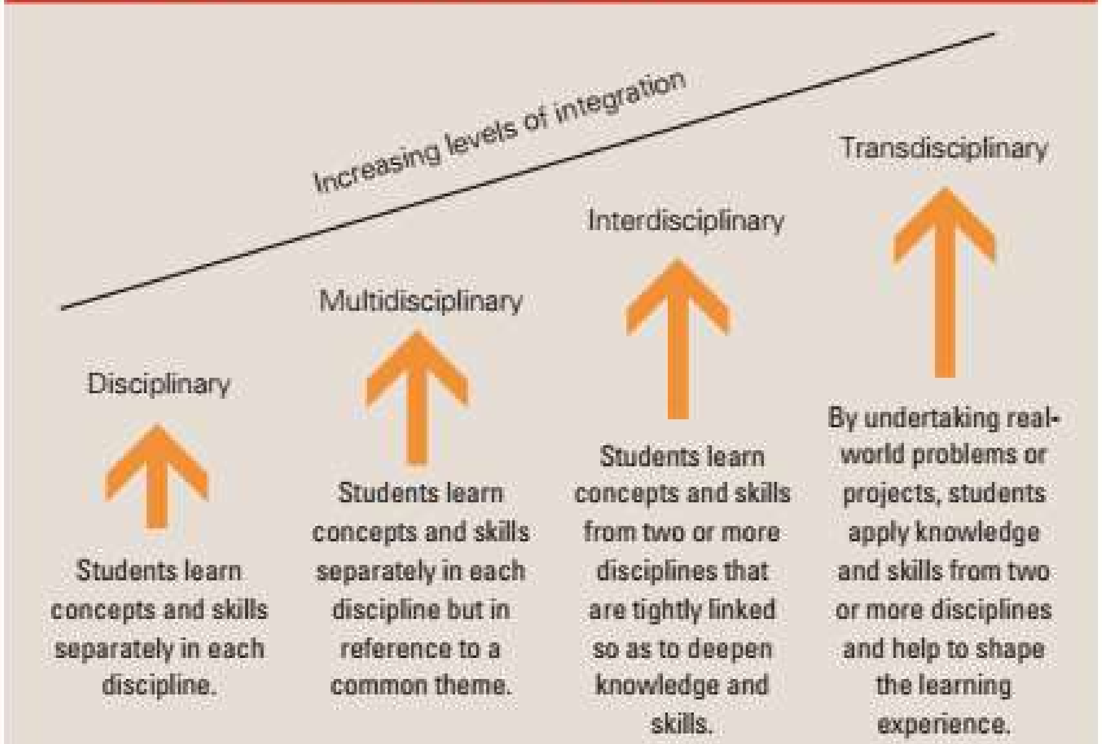
STEM integration

Form of integration	Features
1. Disciplinary	Concepts and skills are learned separately in each discipline.
2. Multidisciplinary	Concepts and skills are learned separately in each discipline but within a common theme.
3. Interdisciplinary	Closely linked concepts and skills are learned from two or more disciplines with the aim of deepening knowledge and skills.
4. Transdisciplinary	Knowledge and skills learned from two or more disciplines are applied to real-world problems and projects, thus helping to shape the learning experience.

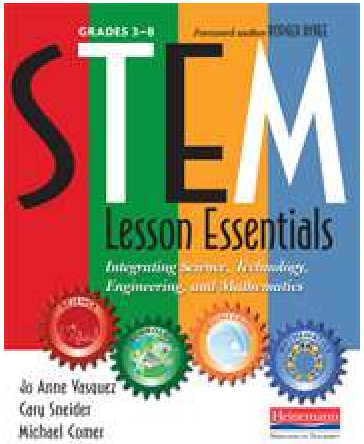
From: STEM education K-12: perspectives on integration

STEM integration

FIGURE 1. The Inclined Plane of STEM Integration



Source: From STEM Lesson Essentials, Grades 3–8: Integrating Science, Technology, Engineering, and Mathematics (p. 73), by Jo Anne Vasquez, Cary Sneider, and Michael Comer, 2013. New York: Heinemann. Copyright 2013 by authors. Reprinted with permission.



STEM Mindsets and Skillsets

- Mindsets are established sets of attitudes held by an individual that play a major role in motivation and achievement. Mindsets determine how individuals make decisions, approach opportunities, and handle adversity. Skillsets are specific abilities that allow individuals to accomplish tasks.
- What STEM mindsets and skillsets are necessary for student success in a STEM-rich future?
- Share your ideas:

Go to **www.menti.com** and use the code **44 98 3**

List some mindsets and skillsets that you think are important for STEM student success.

Mentimeter

100

CURIOSITY & IMAGINATION

Students value originality, generate new ideas, investigate life with curiosity, and ask questions.

GROWTH MINDSET

Students think about their thinking and reflect upon their actions and ideas.

COURAGE & RISK-TAKING

Students work outside their comfort zones, embrace adventure, stay open to new ideas, and strive to achieve their goals.

PERSISTENCE & GRIT

Students see a task through to completion, push through obstacles, and work to create solutions to problems. Students see challenges as a learning opportunity.

OPPORTUNITY-SEEKING

Students identify community issues and act to find solutions.

PROBLEM-SOLVING

Students generate alternative solutions to problems, think critically, recognize solutions, and proactively develop creative solutions.

OPTIMISM

Students feel confident and hopeful in their ability to innovate solutions.

RESOURCEFULNESS & ADAPTABILITY

Students explore quick and clever ways to overcome challenges, with the understanding that they can always make adjustments.

EMPATHY & ALTRUISM

Students think about other people's needs and feelings and keep these in mind when solving problems.

CREATIVITY

Students are bold and imaginative.

TEAMWORK

Students learn from new people and work with people with diverse perspectives, skills, and talents.

DESIGN THINKING

Students learn processes for problem solving that originate with empathy and compassion.

PROTOTYPING

Students create simple models to explain their ideas, get feedback, and learn how their solutions can be improved.

PUBLIC SPEAKING

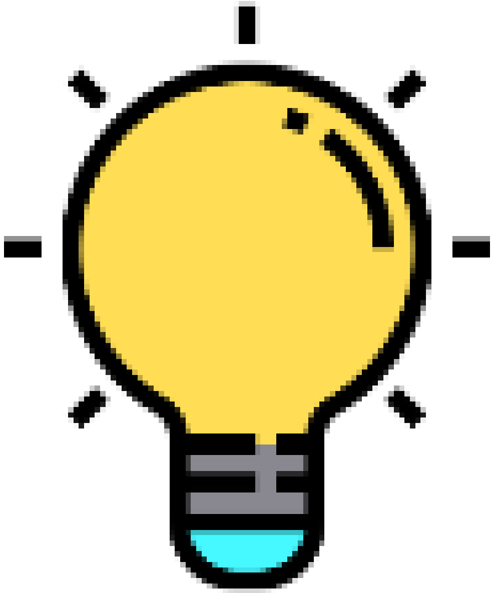
Students create and deliver short, clean, persuasive arguments to rally people around their ideas.

Response

- **Choose a mindset or skillset from the list and drop a quick note in the Teams chat to describe how you could teach that mindset or skillset in your class.**

- Curiosity and Imagination
- Growth Mindset
- Courage and Risk-taking
- Persistence and Grit
- Opportunity-Seeking
- Problem-Solving
- Optimism
- Resourcefulness and Adaptability
- Empathy and Altruism
- Creativity
- Teamwork
- Design Thinking
- Prototyping
- Public Speaking

STEM Planning Tool



Selected STEM Resources

- The Daily STEM – http://dailystem.com/news/
- PBS Kids Design Squad – https://pbskids.org/designsquad/build/
- STEM Teaching Tools – http://stemteachingtools.org/
  - **Failing Forward: Managing Student Frustration During Engineering Design Projects -** http://stemteachingtools.org/brief/36
- Edutopia STEM Resources – https://www.edutopia.org/stem-to-steam-resources
- PBS – Engineering Design – https://wv.pbslearningmedia.org/subjects/engineering--technology/engineering-design-and-practices/
- Green Bank Observatory – https://greenbankobservatory.org/try-it-at-home
- PBL for Remote Learning – https://www.pblworks.org/pbl-remote-learning
- Teach Engineering – https://www.teachengineering.org/curriculum/browse?collection=Activities
- UN Sustainable Development Goals – https://www.un.org/sustainabledevelopment/sustainable-development-goals/

STEM Listserv

- To subscribe to the WV STEM in K12 Education listserv, send an e-mail to: LISTSERV@LISTSERV.WVNET.EDU with no subject and the following in the body (not subject) of the message (Make sure you put your first and last name as specified):
- subscribe K12-STEM-L FirstName LastName
- Or, email Erika Klose (eklose@k12.wv.us) to be added

Brainstorming – Choose a goal, how could your class complete a STEM project to investigate and develop a solution?

Resources: https://linktr.ee/EKstem

Survey link:

Instructional Support Professional Learning Forum
Session Survey/Evaluation

https://bit.ly/survPL83720

IMPORTANT:

You must complete the survey and hit "submit" to be counted as present for this session.