

## STEM...ESTEM...STEAM Bringing Learning Alive!

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### Status of STEM according to ACT

- In state & national scores students who expressed interests in STEM fields outperform their peers in college readiness scores.
- Almost 50% of all Minnesota students expressed interests in STEM fields and careers.
- Of the over 61,000 students who took the ACT in Minnesota only:
  - 135** expressed interest in Math Education
  - 65** expressed interest in Science Education

### ACT STEM research con't

- Significant differences occur in college readiness scores specifically in Math & Science:

**Minnesota College Readiness  
Benchmark Percentages by  
Race/Ethnicity**

Race	Math	Science	STEM
2 or More Races	40%	36%	18%
White	57%	50%	29%
Pacific Islander	31%	24%	13%
Hispanic	24%	21%	9%
Asian	44%	34%	23%
Native American	15%	12%	2%
Black	16%	12%	5%



### ACT Recommendations for STEM

Increase opportunities for all students to engage in STEM lessons grades K-12 to increase interest in STEM fields and careers.

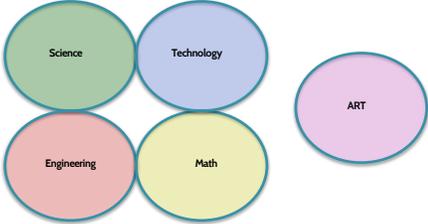
Increase opportunities for coursework in STEM fields during middle & high school.

Build partnerships & after school opportunities for students to engage in STEM learning.

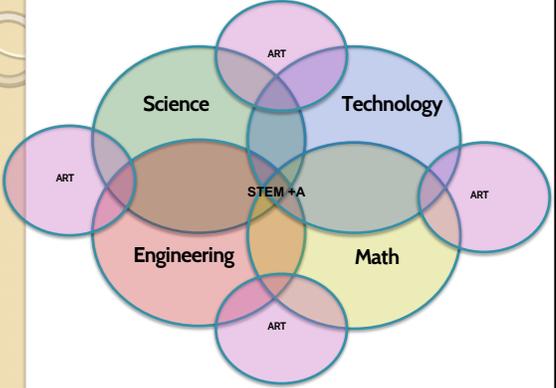


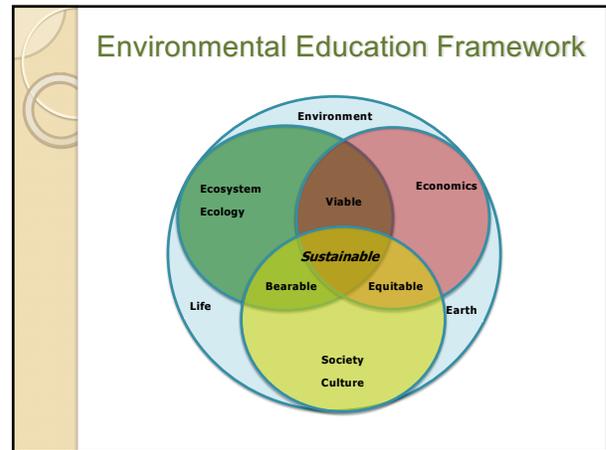
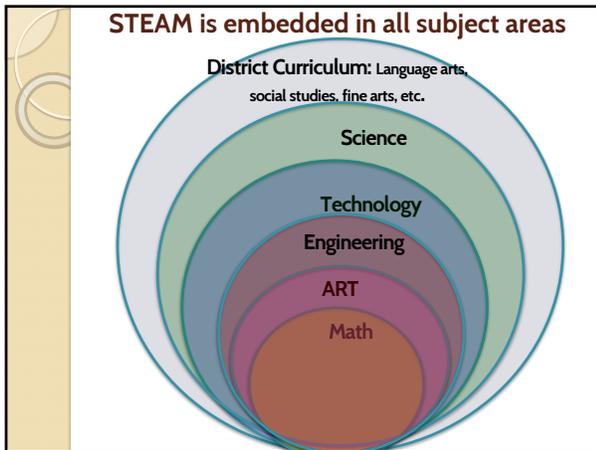
### Models of STEAM Teaching & Learning

- Science, technology, engineering and math are taught, but are separate subjects, with art as extra.



### STEAM subjects are integrated.



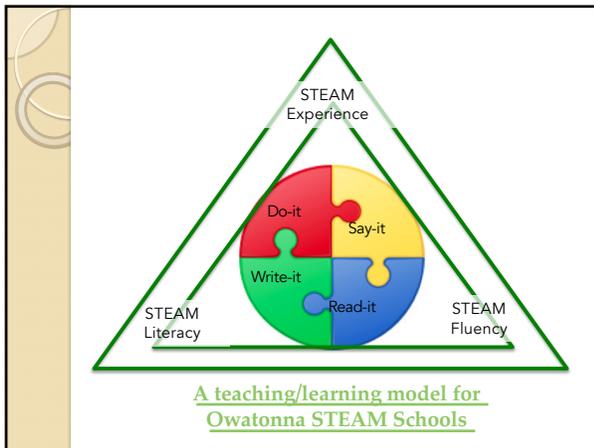


- ### 8 Elements of a STEM School
- (University of Chicago STEM School Study, 2015)
- **Problem-based Learning** – Interdisciplinary instruction, student reflection, student autonomy
  - **Rigorous Learning** – Real-world content, staff-created curricula, cognitively demanding work
  - **Career, Technology, and Life Skills** – Early college activities, technology use by students, practice of communication/life skills
  - **Personalization of Learning** – Differentiation, follow student interests, use of formative assessments
  - **School Community and Belonging** – Atmosphere of respect, Induction of new students, extracurricular activities
  - **External Community** – Community presence, service learning, teachers sharing practices
  - **Staff Foundations** – Collaboration, reflection, leadership
  - **Essential Factors** – Flexible/open to change, representative student population, Professional Development

- ### The STEAM Acronym
- Reexamining STEAM in the light of how effective teaching and learning occurs.
- Scientific thinking, questioning and investigating
  - Technology use and creation
  - Engineering design and problem solving
  - Art is the application of human creativity and imagination.
  - Mathematical computation, data analysis and interpretation
- STEAM is not what we teach, it's HOW we teach.**
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- ### STEAM program in ISD761
- Classes focus on students developing **growth-mindsets** and making mistakes is real learning.
  - Teaching STEAM emphasizes integrated lessons students asking questions, investigate solutions to problems and engineering challenges.
  - STEAM is embedded among all subject areas where all students can learn rigorous academic subject matter.
  - Students recognize that lessons relate to real world learning.
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- ### Developing a STEM teaching and learning model
- Lessons are designed for using STEM notebooks/journaling to promote: **STEM literacy & STEM fluency**
  - However, shared **STEM experience** is essential.
  - We want students to show-off their work and publish their learning.
  - When all these ideas are combined a STEM teaching & learning model emerges:
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## How to *STEMify* your teaching

- STEM means learning by inquiry-based, interdisciplinary problem-solving, including:
- Having a shared common experiences,
- Student raising/recording questions,
- Searching/researching answers,
- Working in teams,
- Arguing from evidence,
- Creating solutions,
- Making connections & applications of what they learned.



## Questions?



## Practice in a STEM lesson

- The Power of Objects (Lee Schmitt, Hamline University)
  - Objects can be used to develop student curiosity about a time period, event, a person or a natural phenomenon.
  - This is done preferably before students start the unit of study.
  - Pictures are OK, but 3-D objects are better to extend student fascination, interest and speculation.



## “The Liars Club” (Using the power of objects)

- List three adjectives that describe your object.
  - Close your eyes and come up with three more adjectives.
- Describe the sound the object makes.
- Draw the object: Details, scale (measure), & accurate.
- Label your drawing, make up names for the parts of the object if you need to.
- Speculate what it is made of, what materials?
- Record three questions about your object.

## “The Liars Club”

- Who do you think would (have) use(d) this object? Why do you think that?
- What do you think is it used for? Why do you think that?
- What environment (or region of the world) do you think it is from? Why do you think that?
- What’s your object’s story?
- Share this story with others in your group.



## The Common Experience

- Set Learning **Goals**
- Determine **Grouping**
- Make **Observations** of focused activity—objects, pictures, primary documents, selected text, or applications,
- Record **Questions** developed from the shared experience.
- **Share Observations & Questions**
- Research to find the answers



## Reflection Prompts

- Today I learned ...
- I used to think ... Now I think ...
- I was curious about ...
- I was surprised by ...
- Today I rediscovered ...
- The important thing about \_\_\_\_ is ...
- I can claim ... because ...
- I can predict that ... because ...
- My findings today show ...
- Now I understand ...
- I want to remember ...
- I'm still not sure about ...
- Now I know ...
- My next steps are ...
- Today we accomplished ...
- The big idea(s) from today is ...
- The most challenging part of today was ...

## Practice in a STEAM lesson

- Wonder wander with National Geographic magazines
- Look through a NG without reading and record 30 observations of the photos.
- Write a question for each observation you record.
- Choose 3 questions that could be researched using the text in the magazine.

## NG Wonder wander con't

Share out questions with a partner and decide which question to answer.

- Find data within the text, the photo or in other sources in the magazine to answer your question.
- Organize and interpret your findings to see how accurately you answered your question.
- What did you learn?

## Practice STEMifying lesson planning

- Start with content standards, these may be math, science, social studies or language arts.
- Identify the enduring understandings and learning targets within each content field that can be integrated with your anchor standards.
- What is the essential question that guides your content teaching?

## Building a STEM unit

- Identify key STEM practices that engage students with inquiry experiences and exploration to support learning targets.
- Embed these practices within instruction.
- Map out the sequence of lessons, create a time frame and determine how students learning will be assessed.
- Identify the shared-common experien

