Science & Technology/Engineering Education: A Paradigm Shift at CPS/CCHS

March 22, 2016

A Brief Presentation

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Our Foundation

Curricular, Extra Curricular, & Co-curricular

CCHS

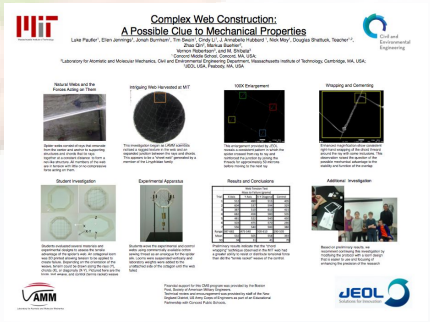
Engineering Certificate Program
Electrical and Mechanical Engineering
Competitive Robotics
Rivers & Revolutions
Fab Lab
5 Computer Courses
12 Math Courses
17 Science Courses

CMS

Earth Science
Life Science
Physical Science
Engineering & Applied Technology
Project Engineering
Lego Robotics
Science Olympiad
Engineers Club

Alcott
Thoreau
Willard

Apple Engineering
Marshmallow Challenge
Musical Instrument Design
Wind turbine Design
Bridge Design
Water Filter Design
Electric Circuit Building

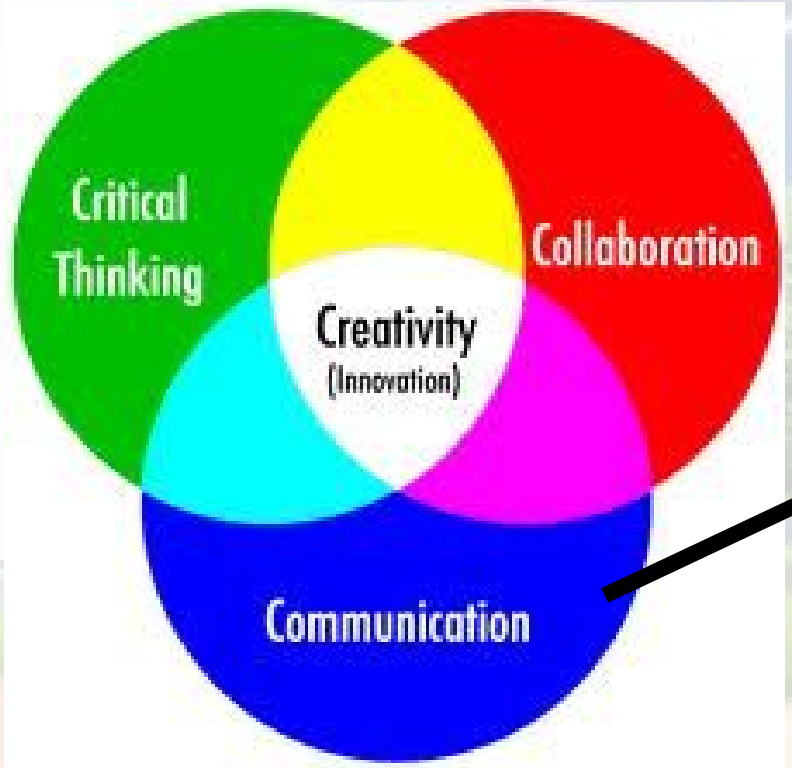


Our Vision

Every Student a Scientist

"**Every** CPS and CCHS **student participates** in STEAM experiences or design challenges **each** school **year**. These experiences reach all learners so that, after years of these experiences, every student feels confident and creative in analyzing and **tackling real world problems** through a STEAM lens."– CPS/CCHS STEAM Vision Statement 2016

From STEM to STEAM



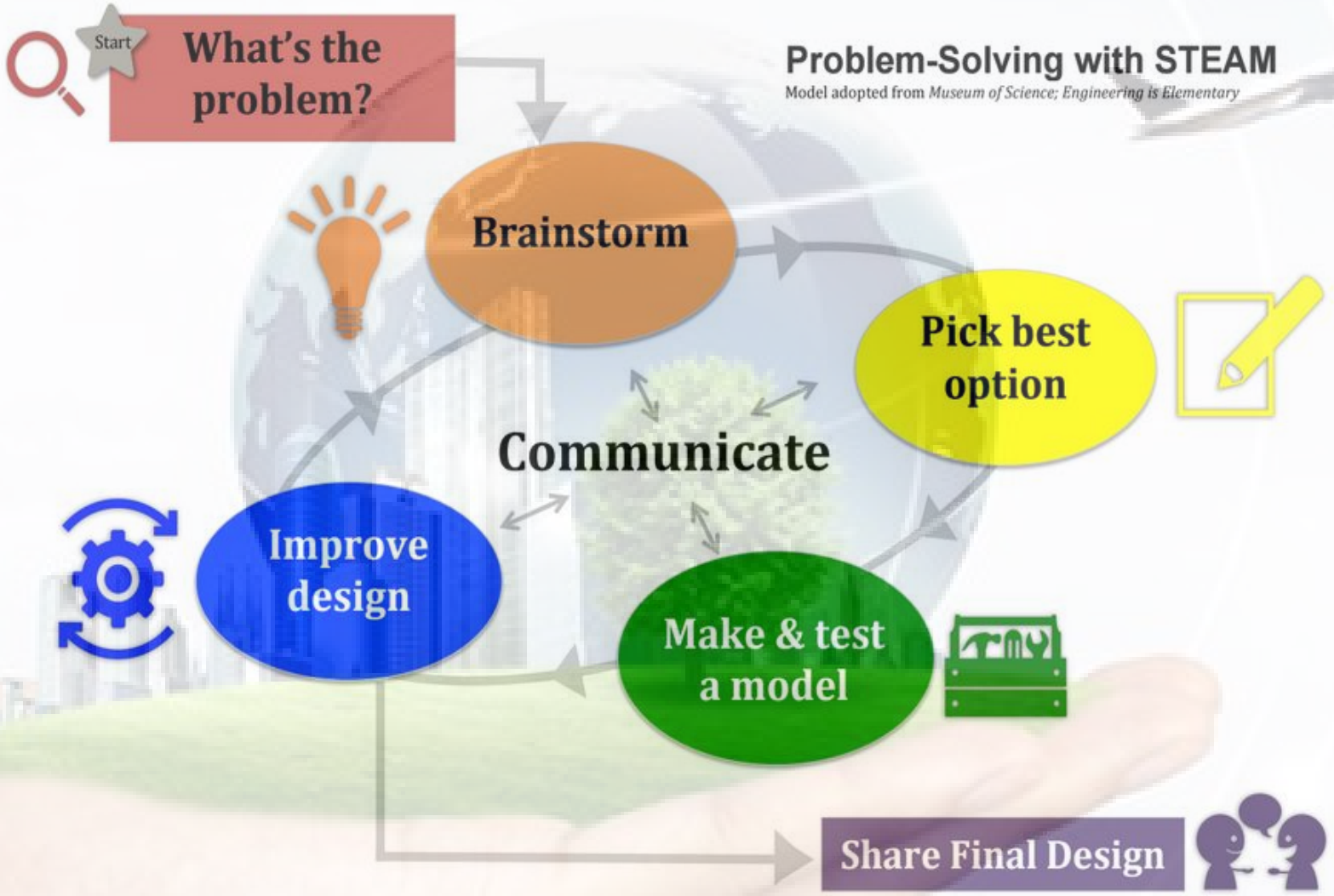
sourcesandsolutions.org/2013/07/31/artifacts-teach-science/

How Scientists and Engineers Communicate

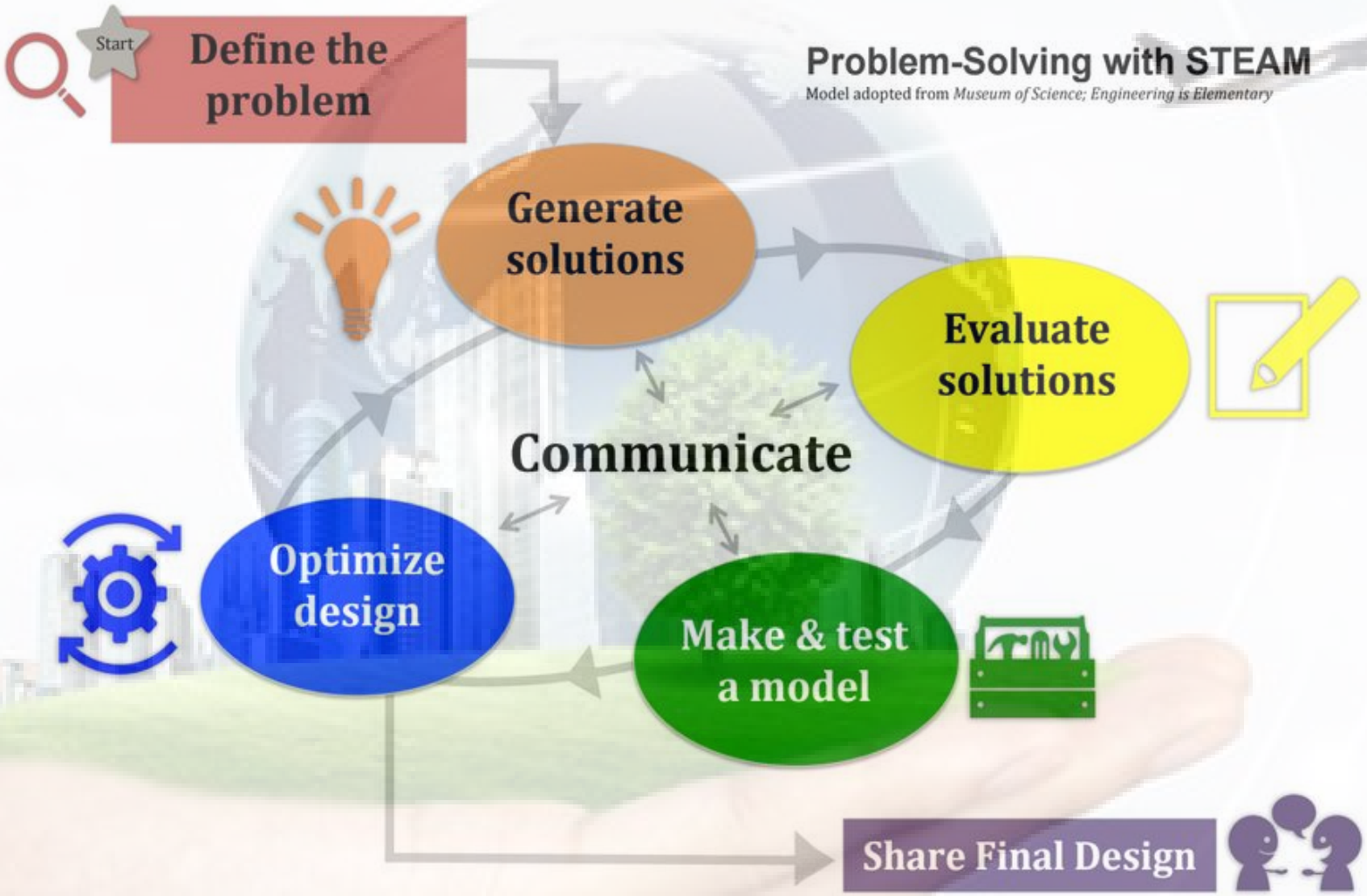
Language
Math
Art
Music
Movement
Code

CPS/CCHS STEAM Programs and Activities teach the
Sciences (Biology, Chemistry, Earth & Space, and Physics and their sub specialties),
Technology and Engineering (as described in the Revised STE Standards, 2016),
The Arts (Visual, Acoustic--music and chorus, and Kinesthetic--drama and dance), and all levels of
Mathematics (including logic and symbolic reasoning such as Code)
--CPC/CCHS Student Steam Activities Catalog

Engineering Design Process (K - 5)



Engineering Design Process (6-8)



Engineering Design Process (9-12)

Engineering Design Process

Our pedagogy focuses on the **Engineering Design Process** which is a systematic, **hands-on** approach to learning whereby students work with teachers to define, describe, or **identify** problems and **challenges**.

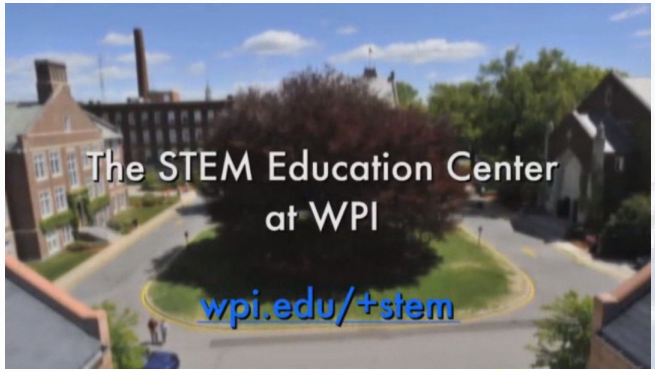
Then they follow an **iterative series of steps** to develop and test alternatives that lead to a final solution or product.

Within the area of STEAM, **special emphasis** is placed on expressing **quantitative relationships**, assessment, and presentation.

That is, using math to **express information accurately and precisely.**

CPC/CCHS Student Steam Activities Catalog

Guidance & Collaboration



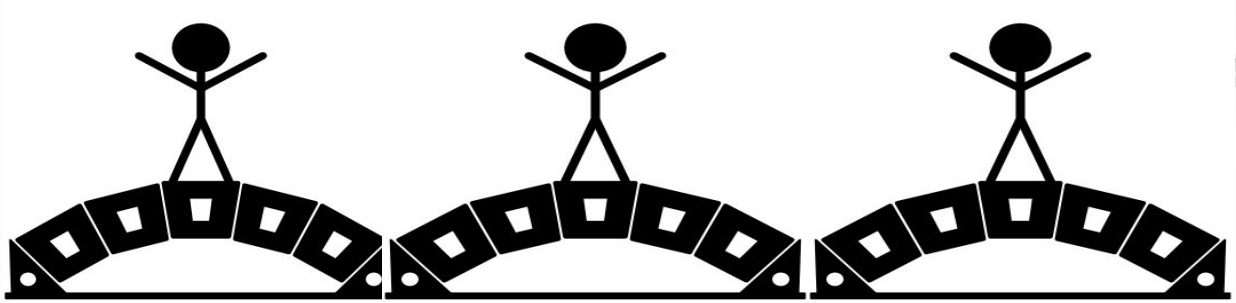
Program Assessment
Goal Setting
Short & Long Range Planning
Performance Evaluation

STEM Integration for District Leaders

<u>Year IV</u> cohort includes teams from **Cambridge Public Schools, Concord Public Schools, Springfield Renaissance School,** and **The Learning Center for the Deaf in Framingham**.

Three Golden Goals

Keystones of our Program



1: **Graduates** leave with the **critical thinking skills and STEAM habits of mind** needed to analyze situations and solve problems that they will face in life. These skills and habits of mind give all students opportunities to pursue STEAM paths in life.

2: K-12 students build **proficiency in the STEAM approach**. Students see the value in STEAM education.

3: **Teachers are supported** and therefore effective STEAM educators. Teachers see the value in STEAM education.

Goal 1 STEAM Thinking - Some Action Steps

- Identify K-12 design challenges;
- Develop common vocabulary;
- Develop/adapt design challenge rubrics to assess students' work;
- Poster of EDP in every STEAM classroom;
- Gather data on students that are admitted to STEAM programs;
- Develop vehicles to expose students to STEAM careers;
- Provide mentors to increase success in STEAM courses.

Goal 2 STEAM Proficiency- Some Action Steps

- Align K - 12 science curriculum with new MA standards;
- Teach STEAM using common vocabulary;
- Continue summer bridge math programs;
- Create school day schedules that allow for more STEAM

Goal 3 Teacher Support- Some Action Steps

- Create STEAM professional development opportunities for teachers;
- Create STEAM introduction and opportunities for teachers new to Concord;
- Each teacher mines their current curricula to identify activities that incorporate STEAM activities;
- Find ways to help all teachers (even those in non-STEAM areas) understand the importance of STEAM opportunities;
- Opening day STEAM speaker to create excitement with teachers.

Signposts to Measure Progress

★ Students begin applying the STEAM approach across the curriculum (assessed on rubrics) ★ Increased number of students choosing STEAM focused and Engineering classes and clubs in HS and Middle School. (2014-2015 baseline data) ★ Increased admission to engineering/ STEAM colleges and universities. (2014-2015 baseline data) ★ Increased percentage of students graduating from college with STEAM majors (tracked by CCHS guidance)

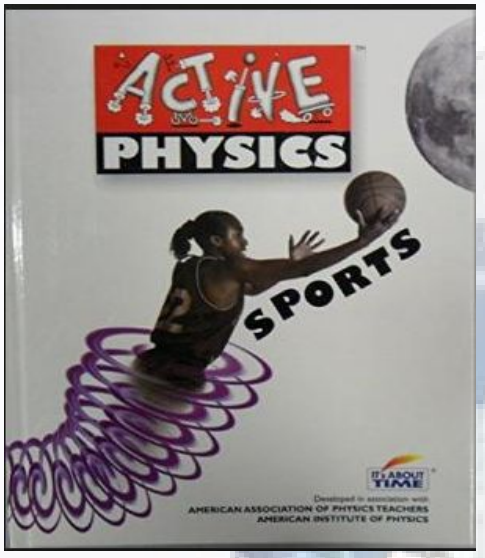
Things to Come

Maker Space at Ripley

Hands-on Workshops for Teachers

District-wide STEAM Field Day

Opening Day Speaker for Faculty: Dr. Arthur Eisenkraft



Learn Physics lessons through cartoons

TIMES NEWS NETWORK

Bangalore: The Commerce student who hated Physics in her high school, and the aeronautical engineer who couldn't make any sense of quantum would have surely loved the subject in this avatar. On the screen were amusing cartoons that explained Physics theories, poems that made Science look beautiful, and quotes that unraveled their intricacies.

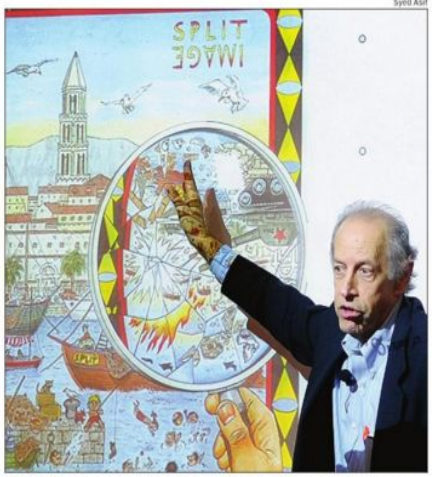
The session was a lecture by Arthur Eisenkraft, professor of Physics and director, Center of Science and Math in Context (COSMIC),

A PROF'S PERSPECTIVE

University of Massachusetts, Boston. Organized by Azim Premji University at the TERI centre in Domlur, the professor talked about engaging students in Science with Art and Literature on Tuesday.

"When we started with a magazine called Quantum, I didn't like the pictures the publisher used with the story. I approached a cartoonist [illegible] He said [illegible]sics. I [illegible]s about [illegible] with a [illegible]n move [illegible]ft said, [illegible]d theo-

Syed Asif



FUN ELEMENT: Professor Eisenkraft elaborates on the art of teaching Science

ries of Physics looked simpler with the cartoons, with the curly-haired Newton and mustachioed Einstein. There were quotes from Dante and the Bhagvad Gita, analogies of potato chips, and rides in Disneyland to explain Science. Ordinary things were juxtaposed with dense Science theories.

"Have we ever given students an opportunity to write a poem or draw a picture about Science? May be they will personalize it," he said. It won't take much time in class, and it's alright even if students notice the red shoes of the superhero instead of the light path, they have got engaged," said Eisenkraft.

"Even the context of a problem in Physics can be valuable. I once asked teachers whether it's alright to say a bomb or a baseball or a food packet is thrown instead of the usual stone that is used in the Physics problems. They said yes. I was disappointed. It's a culture that we are teaching," he said.

"We need stories, we need art, we need literature. They provide meaning to our lives and help us structure the solutions Science finds. It's a combination that is required. Not an either-or approach."

PROBLEM POINT

> There's nothing wrong with the Science curriculum. The problem is with the way it's taught and interpreted. It's the exam that's the driver. If we have to get people passionate about Science, we have to change the exam pattern. That's how it's in the US

Arthur Eisenkraft | PROFESSOR OF PHYSICS AND DIRECTOR, CENTER OF SCIENCE AND MATH IN CONTEXT, UNIVERSITY OF MASSACHUSETTS

Questions? Comments?