Science, Technology, Engineering and Mathematics (STEM) Update

Education Development Committee Meeting

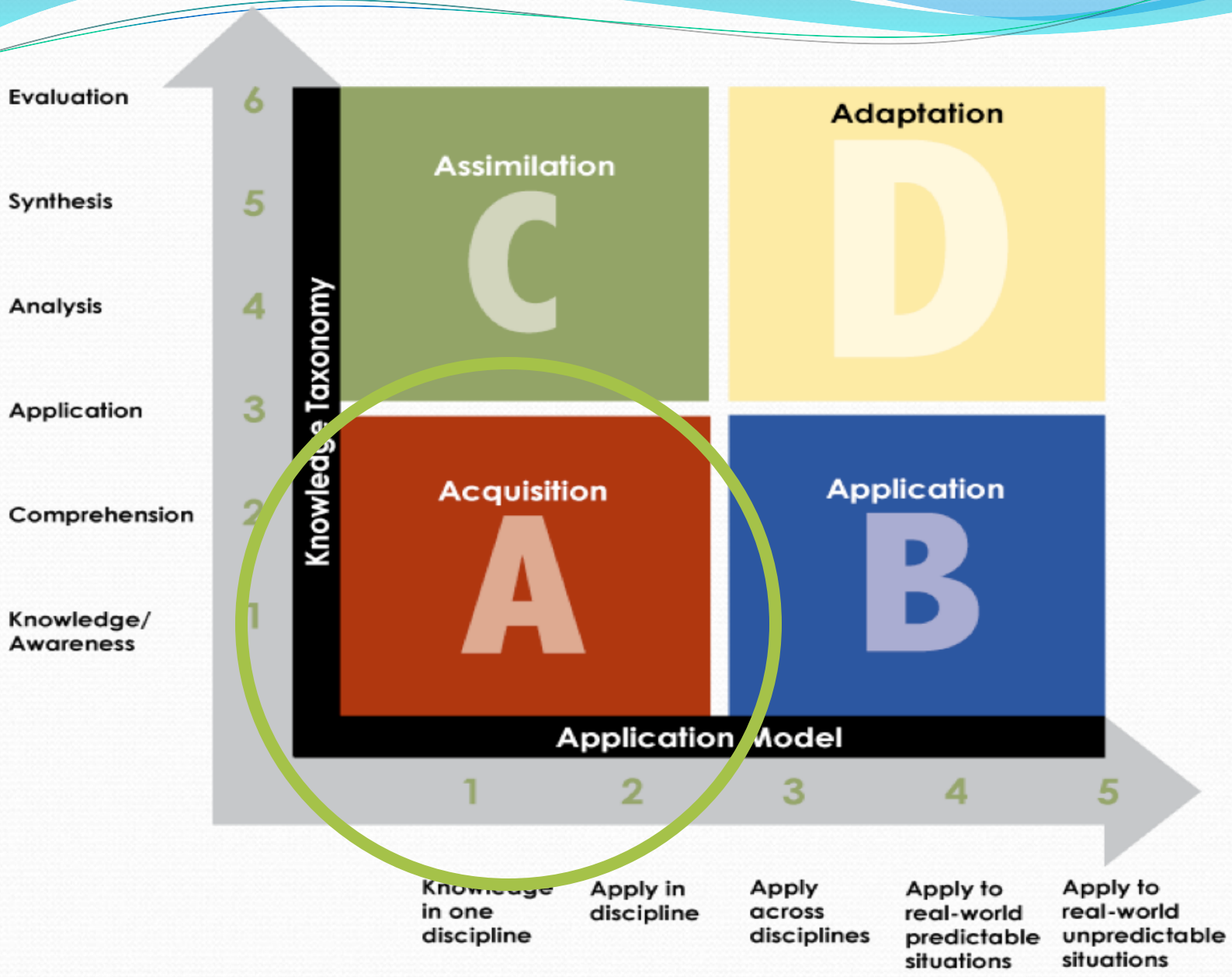
March 10, 2015

STEM

Science • Technology • Engineering • Math

What is STEM?

- PA Definition of STEM: "STEM education is an intentional, integrative approach to teaching and learning in science, technology, engineering, and mathematics…


Evaluation
Synthesis
Analysis
Application
Comprehension
Knowledge/ Awareness
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Knowledge Taxonomy
Assimilation
C
Adaptation
D
Acquisition
A
Application
B
Application Model
1
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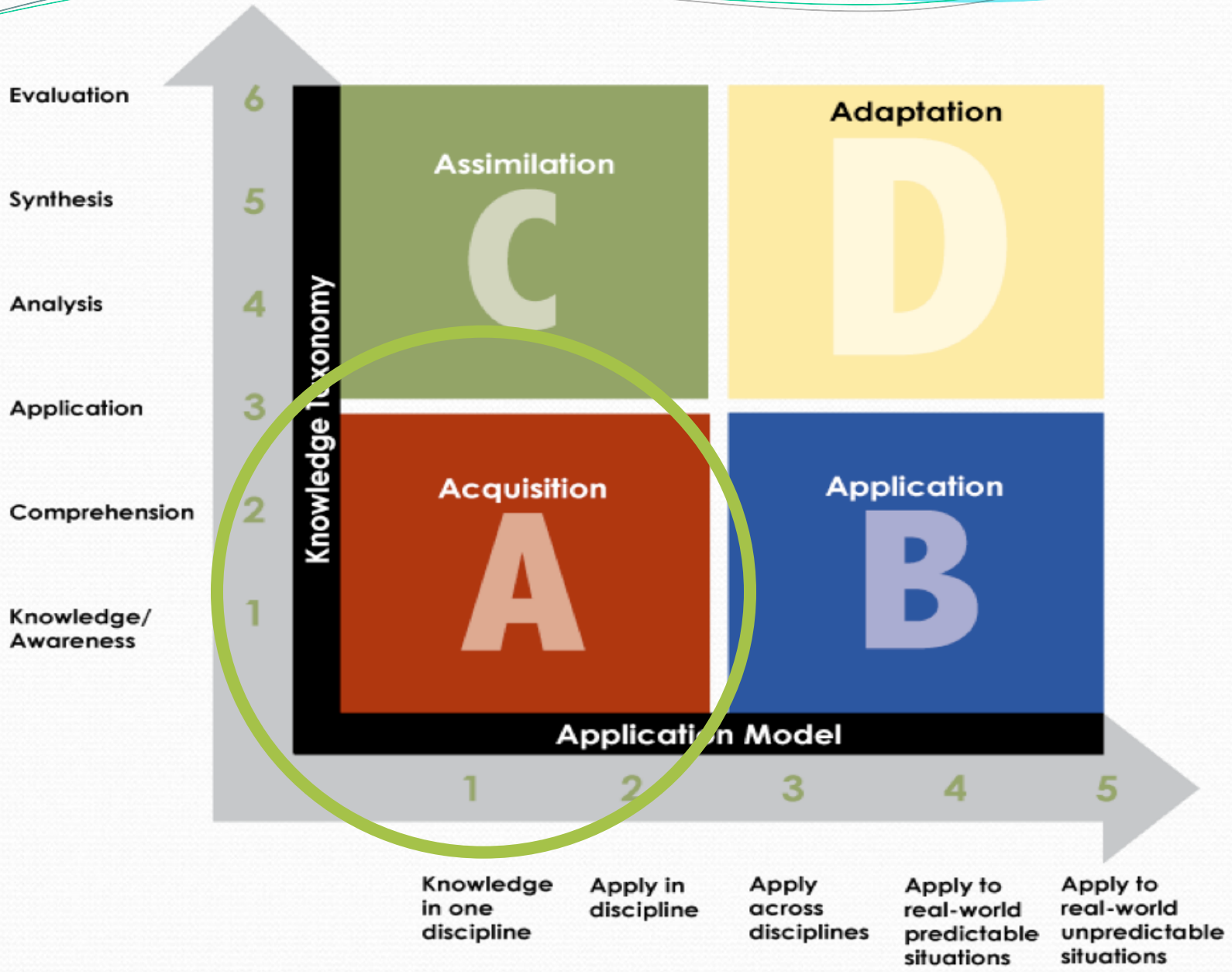
Apply in discipline
Apply across disciplines
Apply to real-world predictable situations
Apply to real-world unpredictable situations

What is STEM?

- "…Students become adept problem solvers, innovators, and inventors who are self-reliant by asking questions, investigating, making informed decisions about how they live their daily lives and engage in their vocations and communities."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Knowledge in one discipline
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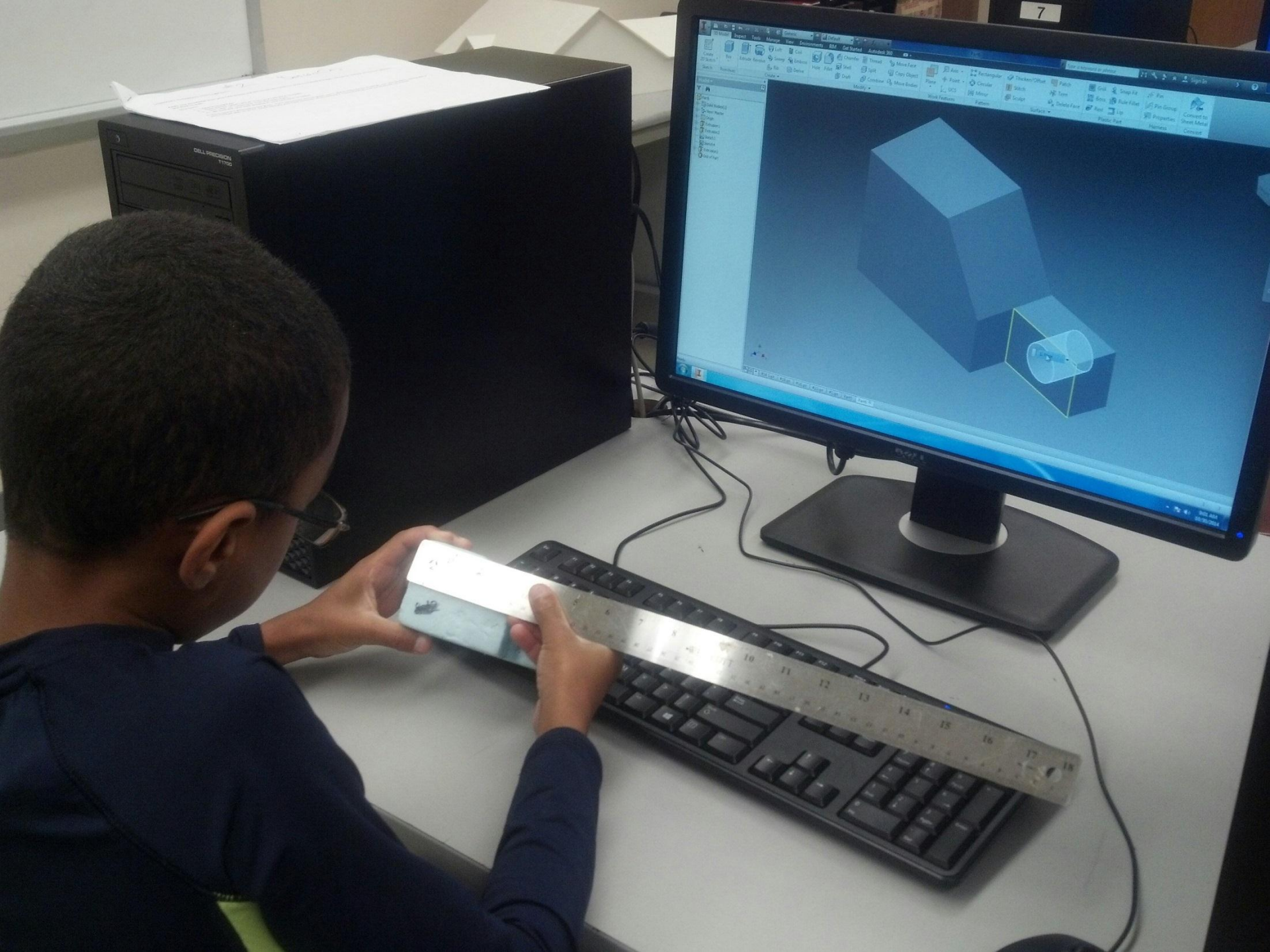
Technology and Engineering Education: MS Update

- Restructured 6-8 curriculum to align all 3 MS's and to integrate PLTW content
- Met with MS science teachers to identify areas of overlap
- Restructuring 5-8 to better align with science concepts

5th Grade	6th Grade	7th Grade	8th Grade
• PLTW Introductory Units on STEM definitions and applications	• PLTW Measuring, Sketching, Dimensioning Units	• PLTW 3D modelling units using AutoDesk Inventor	• PLTW Advanced 3D modelling units using AutoDesk Inventor
• Technology Education content on the "Fields of Technology"	• Technology Education content on Construction and Manufacturing	• Technology Education content on Transportation	• Technology Education content on Communication and Biotech
• Engineering activity to reinforce simple machine content from science curriculum	• Engineering activity to reinforce forces and materials content from science curriculum	• Engineering activity to reinforce transfer of energy content from science curriculum	• Engineering activity to reinforce waves and information transfer content from science curriculum
• Engineering Design Process and application	• Engineering Design Process and application	• Engineering Design Process and application	• Engineering Design Process and application

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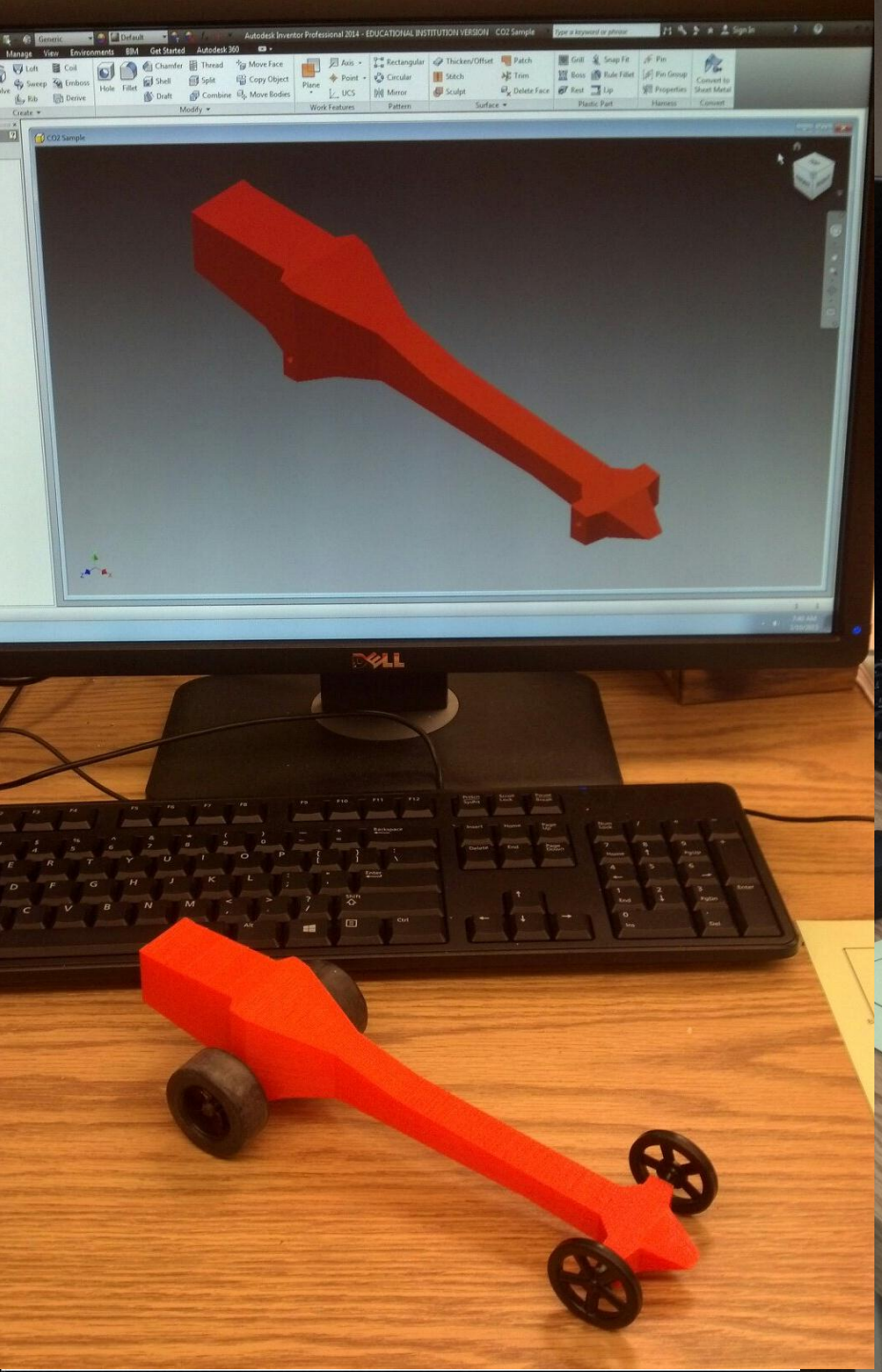
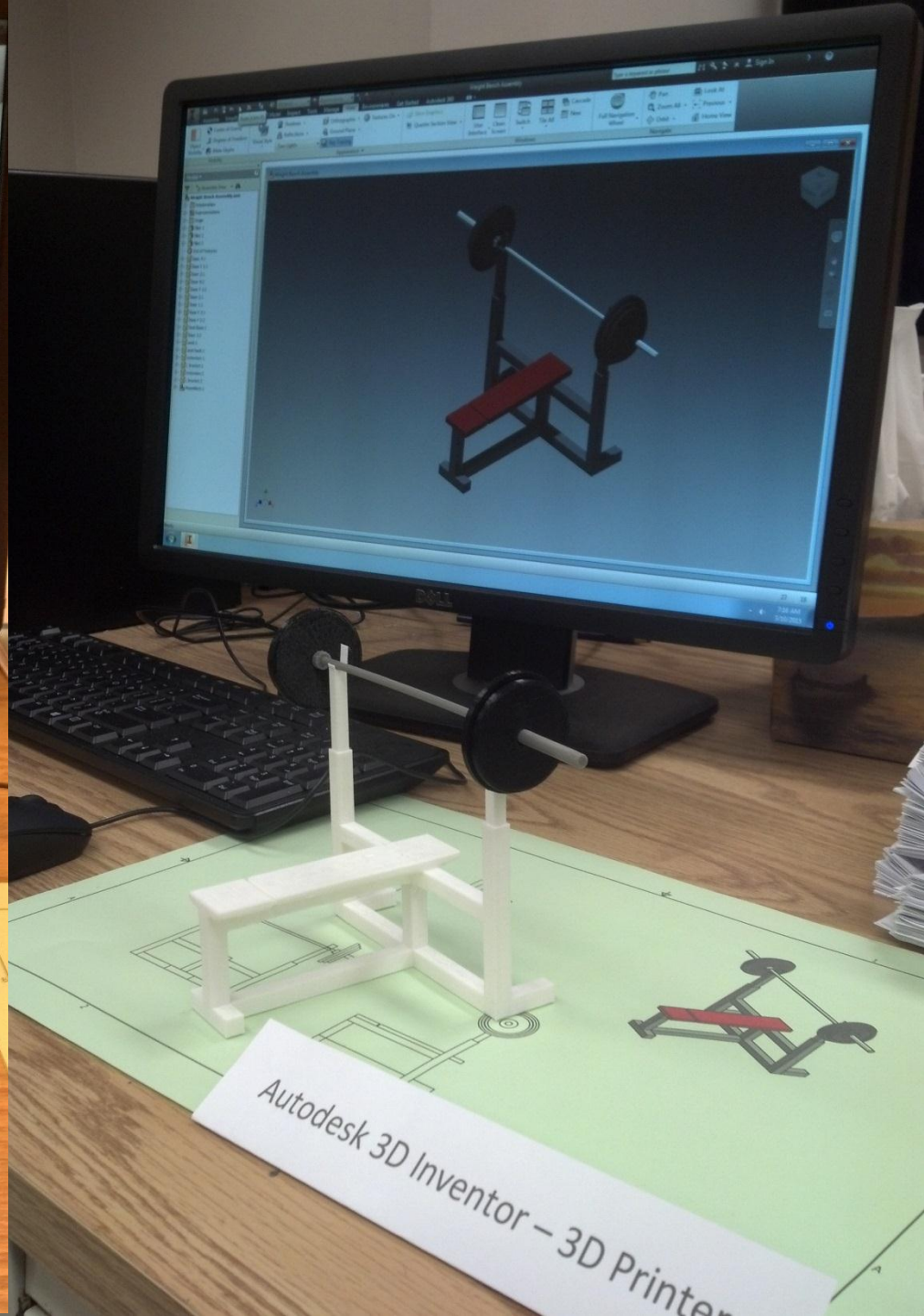
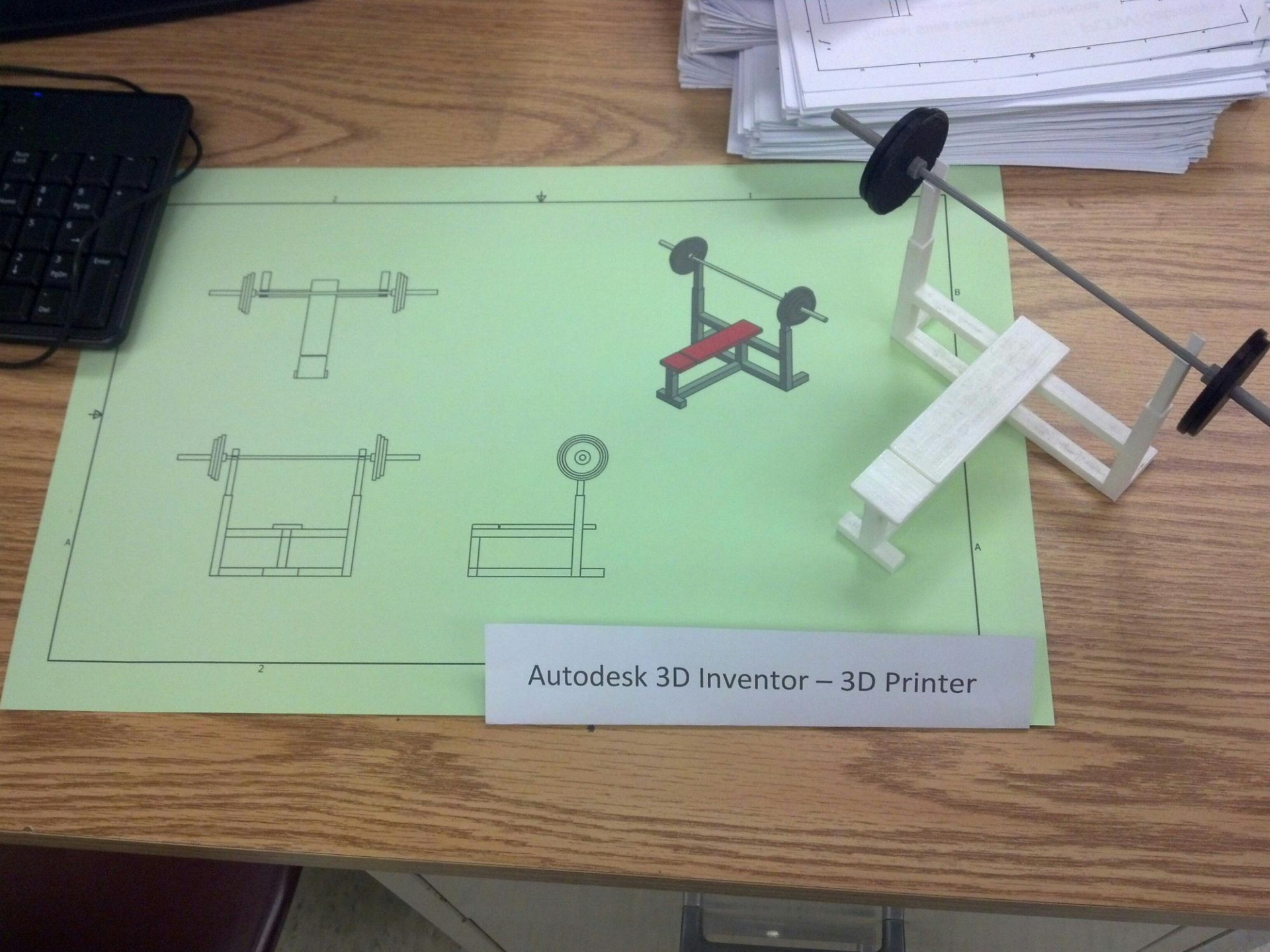

Autodesk Inventor Professional 2014 - EDUCATIONAL INSTITUTION VERSION CO2 Sample
CO2 Sample


Autodesk 3D Inventor – 3D Printer


Autodesk 3D Inventor – 3D Printer


Pavilion 3670


Mallet Handle


- HATCH
P - PLANE (SHAPES)
FLORIDASTATE

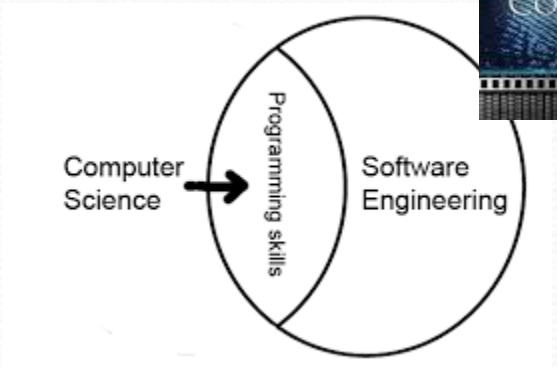
Technology and Engineering Education: HS Update

PA PLTW Conference

- November 19th at Wilson Area High School
- 3 Teachers and 1 Administrator attended
- Goal was to get more information on CSE
- Surprising presentation on CEA
- In the future, possible AP testing in two PLTW courses

Computer Science and Software Engineering (CSE)

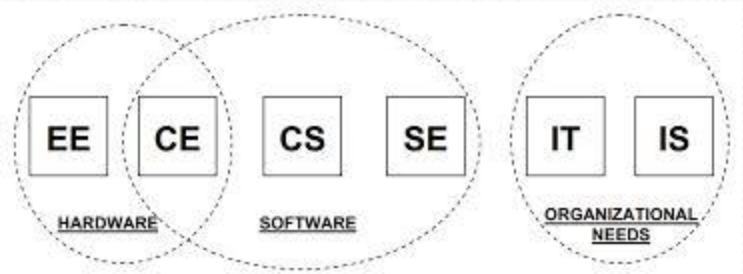
- This course will develop computational thinking skills used to solve practical problems in the real world.
- Focus will be placed on object oriented programming environments, specifically the Python language.



PROJECT LEAD THE WAY
PLTW

Computer Science and Software Engineering (CSE)

- Students will code their own applications for use on provided Android tablets.
- Students will also create interactive web 2.0 software working with HTML5, CSS and JavaScript.
- Students will apply C++ coding on Arduino robots.



PROJECT LEAD THE WAY
PLTW

Civil Engineering and Architecture (CEA)

- This course is a hands-on course where the students will solve problems using real life scenarios that civil engineers and architects face daily.
- The students will use AutoDesk Revit 3-D design software to solve problems.

PROJECT LEAD THE WAY
PLTW

Civil Engineering and Architecture (CEA)

- Areas of focus include
  - land surveying
  - water resources & management
  - environmental issues
  - soil testing
  - architectural building design
  - landscape design
  - structural strength of materials

PROJECT LEAD THE WAY
PLTW

2015-2016 HS Program

Technology Education

- Graphic Design 1 & 2
- Manufacturing and Construction 1 & 2
- Power, Energy, and Transportation 1 & 2
- TV / Video Production 1 & 2
- Robotics
- Architecture and Interior Design 2

Engineering Education

- Introduction to Engineering Design
- Principles of Engineering
- Digital Electronics
- Civil Engineering and Architecture
- Computer Science and Software Engineering

Integration Update

- Started filming club targeting freshmen, robotics club, community involvement MS program,
- Expand Robotics Camp—add a 3rd year advanced week (total of 4 weeks with 2 beginners and one advanced)
- Addition of a new, Camp Invention STEM camp (created by National Inventors Hall of Fame) for 4th/5th grade students—for 2 weeks; hands-on, creative, critical thinking activities http://campinvention.org/about-us/
- Assist AE teachers with STEM activities for gifted students

Camp Invention®

National Inventors Hall of Fame®

HS/MS Science

- AP Chemistry, Biology, Environmental Science, Physics
- 9th grade science--JASON Mission Center website; digital labs(PHET); Edmodo for assignments
- MS Science: Each grade focuses on a single subject area (earth, life, or physical science)
- MS will become integrated/spiraled one year at a time, beginning with 6th grade in the 2015-2016 school year.
- Alignment to NGSS

MS Science per Subject/Grade

	6th	7th	8th
FIRST MKG PD	METRICS: • UNIVERSAL SYSTEM USED BY SCIENTISTS TO MAKE QUANTITATIVE OBSERVATIONS • ALL METRIC UNITS USE THE SAME PREFIXED • LENGTH • MASS • VOLUME CYLINDER/BEAKER • MENISCUS-WATER PROPERTIES	Cells	The Universe-Solar System (Observations of the sky) The Universe-Solar System (phases of the Moon) The Universe-Solar System (The Planets)
SECOND MKG PD	Variables	HEREDITY	The Universe-Gravity (Forces and Motion) The Universe-Gravity (Observations of the Sky and on Earth) The Universe-Stars (Celestial Bodies)
THIRD MKG PD	Chemical Interactions	Diversity of Life Interdependence of Life FLOW OF MATTER	Processes That Shape the Earth - Plate Tectonics - Changes in the Earth's Surface
FOURTH MKG PD		Natural Selection	Weather and Climate

MS Science—spiraled/integrated

	6th	7th	8th
FIRST MKG PD	**PS3. A and B —ENERGY:** *How is energy transferred and conserved?*	**LS1—FROM MOLECULES TO ORGANISMS: STRUCTURES AND PROCESSES:** *How do organisms live, grow, respond to their environment, and reproduce?*	**LS4—BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY:** *How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms? How does biodiversity affect humans?*
SECOND MKG PD	**PS1—MATTER AND ITS INTERACTIONS:** *How can one explain the structure, properties, and interactions of matter?*	**LS3—HEREDITY: INHERITANCE AND VARIATION OF TRAITS:** *How are characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?*	**PS2—MOTION AND STABILITY: FORCES AND INTERACTIONS:** *How can one explain and predict interactions between objects and within systems of objects?* **PS3.C—ENERGY:** *How is energy transferred and conserved?* **PS4.B—WAVES: (ER)** *How are waves used to transfer energy and information?*
THIRD MKG PD	**ESS1 A and B— EARTH'S PLACE IN THE UNIVERSE:** *What is the universe, and what is Earth's place in it?*	**ESS2—EARTH'S SYSTEMS:** *How and why is Earth constantly changing?*	**ESS3—EARTH AND HUMAN ACTIVITY:** *How do Earth's surface processes and human activities affect each other?*
FOURTH MKG PD	**LS2—ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS:** *How and why do organisms interact with their environment and what are the effects of these interactions?*	**PS4.A—WAVES AND THEIR APPLICATIONS IN TECHNOLOGIES FOR INFORMATION TRANSFER:** *How are waves used to transfer energy and information?*	**ESS1.C— EARTH'S PLACE IN THE UNIVERSE:** *What is the universe, and what is Earth's place in it?*

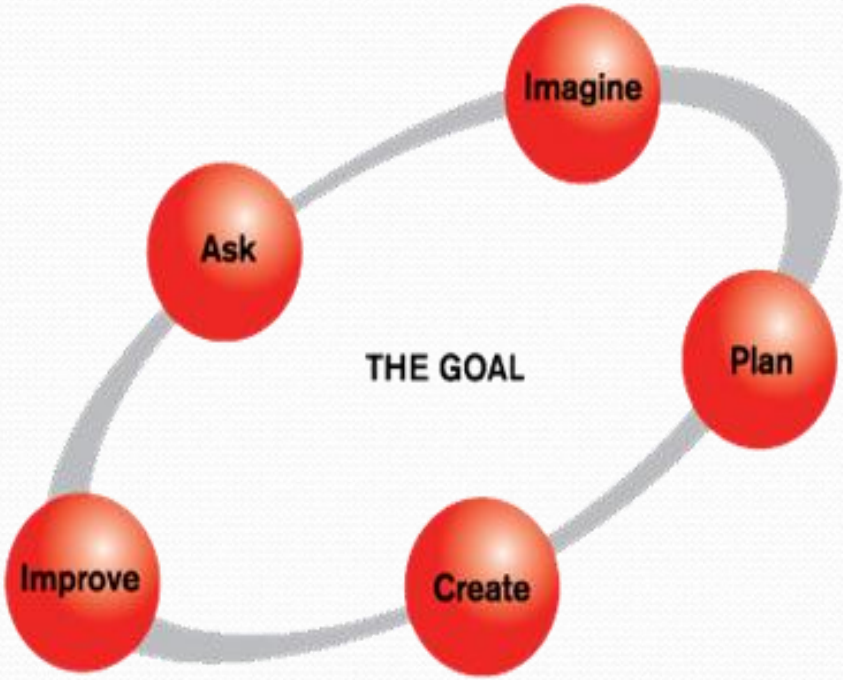
ES Science

- FOSS kits—Consider upgrades to meet NGSS as done with Materials of the World in kindergarten
- Review Science and Technology for Children (STC) kits and Science Companion Prime (digital science)
- Engineering is Elementary (EiE) and PLTW Launch elementary programs for more design process—potential supplements
- Integrated science/T&EE learning with kits

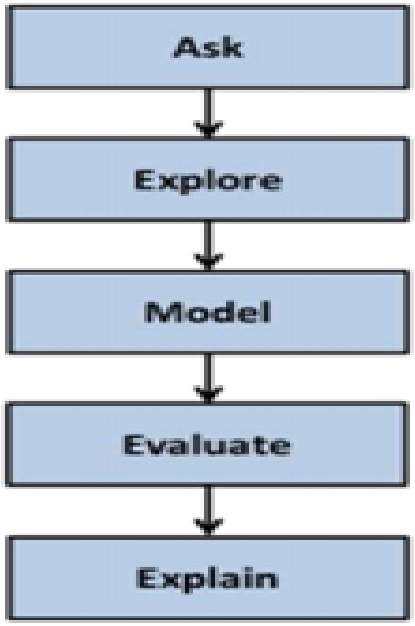
Science Companion

EiE and PLTW Launch

- Engineering is Elementary



- Project Lead the Way Launch



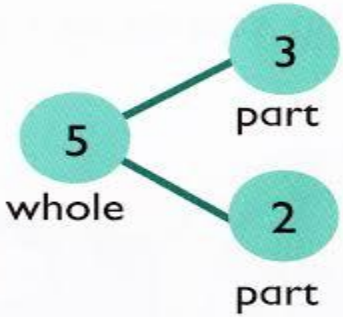
Launch

HS/MS Math

- AP Statistics, Calculus and Computer Math Java (computer science AP exam)
- 2nd year for pre-algebra in 6th grade; 1st year for algebra in 7th; Students can take two years of calculus
- Integration of math into physics and engineering—robotics, physics labs
- Math is at the core of STEM

ES Math

- More professional development and collaboration for teachers in the Math in Focus, Singapore teaching/learning approach
- With 5th grade at the MS level, the 6th grade math teachers will have opportunities to learn some of the Singapore math approaches. This will help with the transition of students to their more abstract/algorithmic MS math courses.

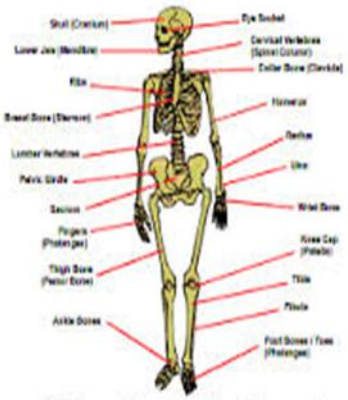


BCIT, FCS, P.E./Health

- Many elective Business, Computer and Information Technology courses at the HS and STEM oriented BCIT units in the MS curriculum.
- Specifically, Micro and Macroeconomics plus technology driven courses focusing on programming, Google applications, Microsoft certifications, web design tools, cyber forensics, and social media marketing platforms

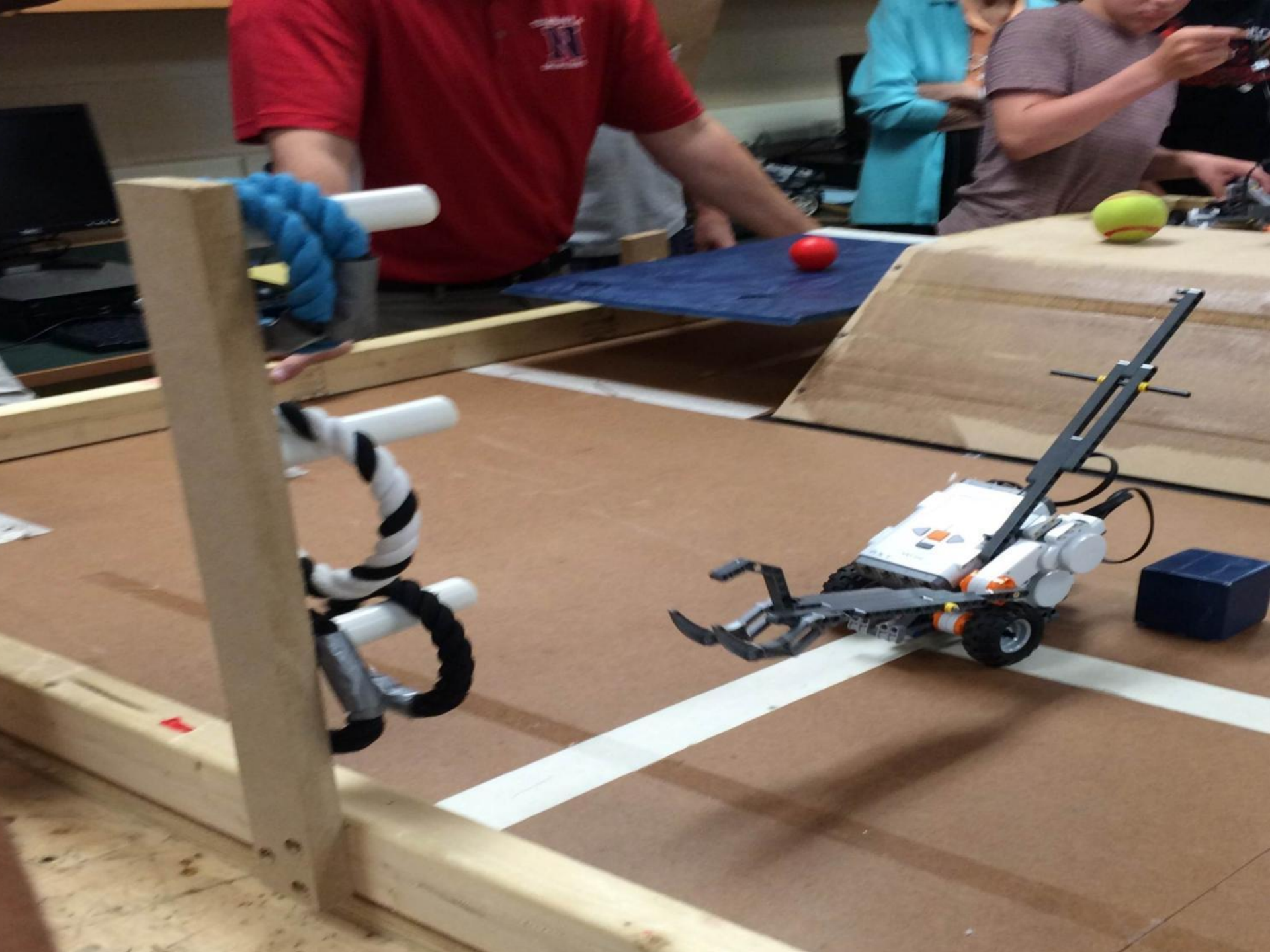
- Family Consumer Science elective courses at the HS support STEM—Honors Nutrition and Dietetics, Textile Design, Engineering and Construction course next year that includes a fashion show
- Health units support the science standards in MS

FAMILY & CONSUMER SCIENCES



Activities

- Robotics team will continue to develop into 2015-16 as more students choose to take robotics classes and as the younger summer STEM academy students make their way to the high school.
- Computer Science clubs at our middle schools becoming popular
- Participate in STEM contests and activities



#GirlSTEM Conference 2014

#GirlSTEM Conference 2014

STEM Advisory Council

- *To assist in implementation and monitoring of the STEM program, a STEM Advisory Council is being created to develop a plan for K-12 STEM education that is aligned to the district's strategic plan.*

- The council will be comprised of:
  - 1 administrator from the high school
  - 1 administrator from the middle school level
  - 1 administrator from the elementary level
  - 2-3 STEM teachers (including AE) from each of the levels
  - 1 cabinet/board level representative
  - 1 community member with interest/expertise in STEM subjects or STEM education
  - 1 parent
  - 2 students: high school and middle school

Keeping the Community Informed

- Sharing and marketing of our overall STEM program can be supported through:
  - collaborative efforts with our community relations specialist;
  - various individuals updating/maintaining STEM content area web pages on the district and building level websites;
  - use of the district's Facebook page, Twitter, district newsletters; and
  - creation of informative and STEM highlight videos for local media use and publicity.

Financial Support for Programs

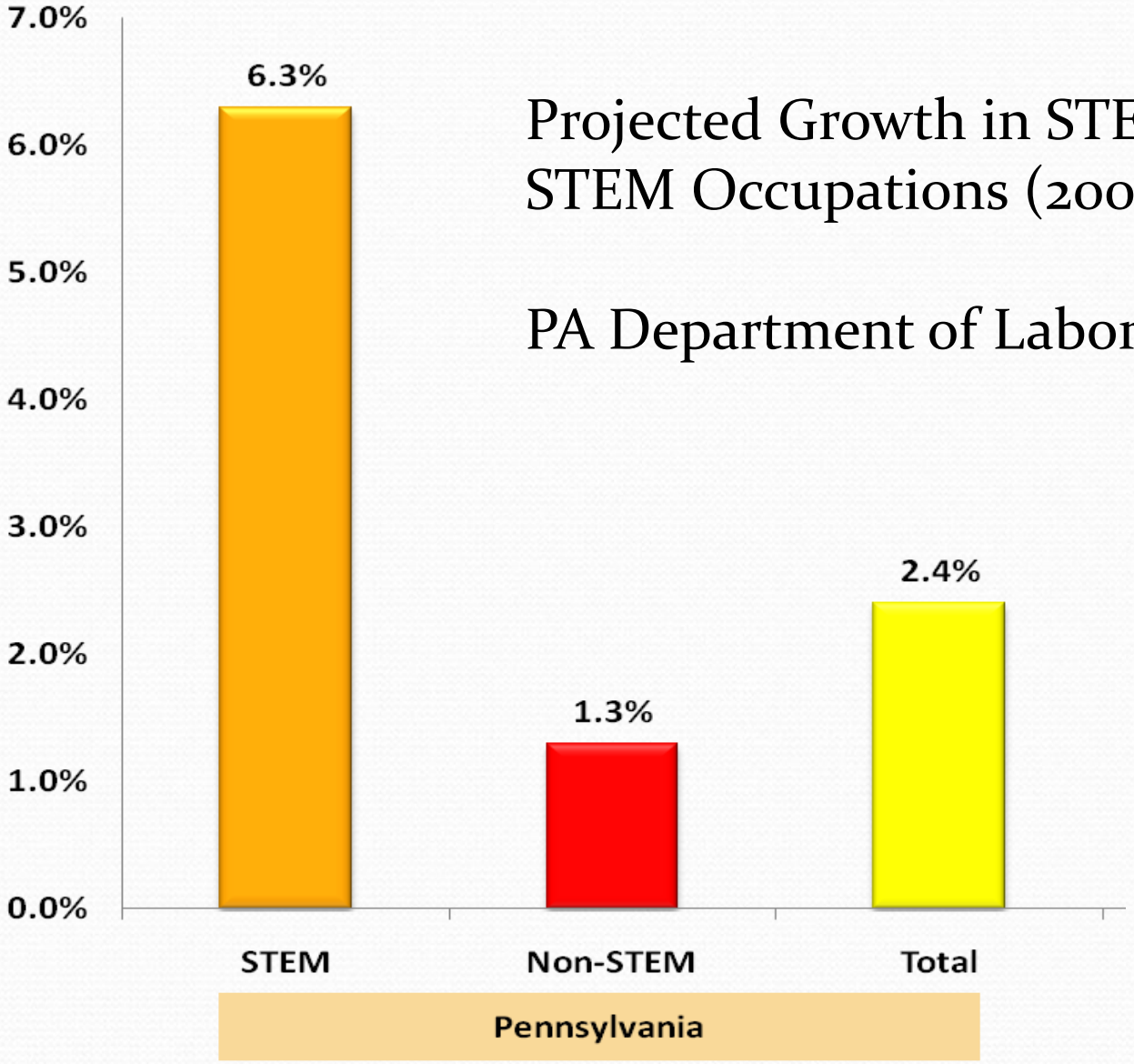
- Ready-To-Learn Federal Grant
- Grants--regionally and nationally--National Science Foundation, Toshiba and the Bemis Company as three to pursue initially
- Local and state industry, university and STEM business connections—resource and financial support

TOSHIBA
Leading Innovation

Bemis

NATIONAL SCIENCE FOUNDATION

STEM Focus for Occupations



Projected Growth in STEM and Non-STEM Occupations (2008-2018)

PA Department of Labor and Industry

STEM Focus for Teaching & Learning

- For our students' future, we must:
  - continue to provide students with opportunities to explore STEM content courses and pathways; and
  - provide faculty with professional development to support a teaching/learning process that is inquiry, problem-solving and/or engineering design based.
- Tap in to the creativity and imagination of students—provide scenarios, hands-on lab/exploratory, and virtual experiences that challenge their thought processes and greater depths of knowledge.

NATIONAL
MATH + SCIENCE
INITIATIVE

The U.S. needs 1 million more STEM professionals over the next decade than it is projected to produce at the current rate.

@NMSI