Easton, Redding & Region 9 STEM Study

Tri-Board Presentation
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Why Study STEM?

Guiding Questions

- How is STEM defined in ER9?
- How do our STEM course offerings support a K-12 continuum of learning?
- What is considered “best practice” in STEM education?

Guiding Questions

- To what extent do our course offerings in the STEM subjects provide integrated learning opportunities?
- To what extent do our methods of measuring student learning reflect an ability to transfer understanding to authentic contexts outside of the school environment?

STEM: an Emerging Definition

STEM,

STEAM,

STEM + Art + Movement + Music =

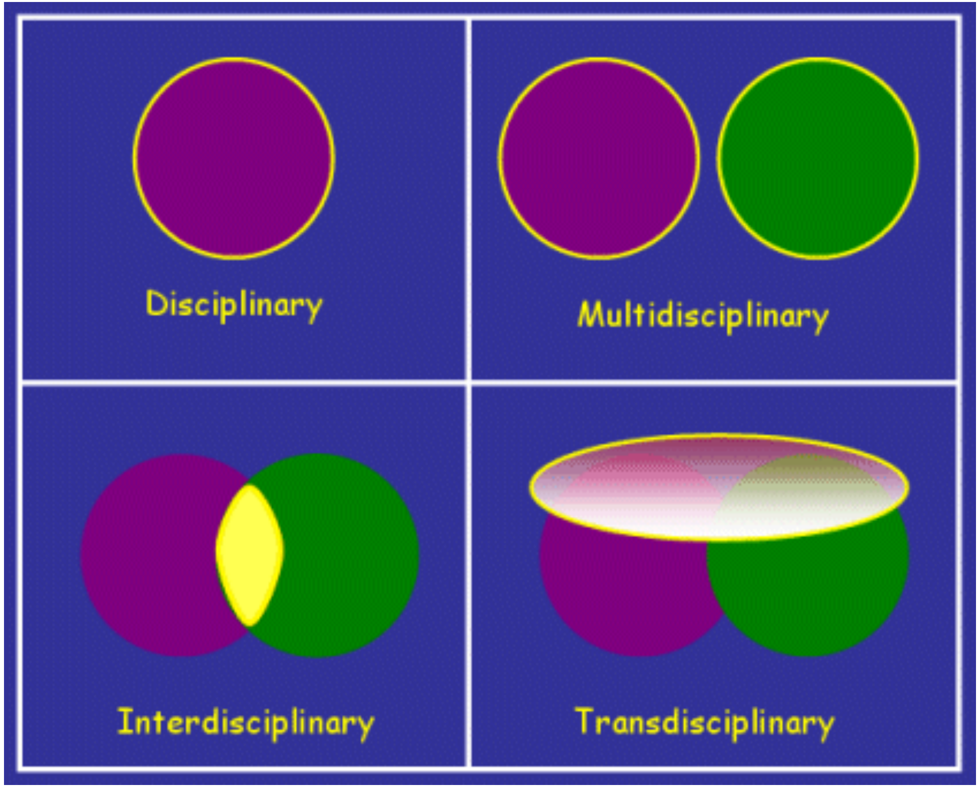
STEAMMM?

Multiple ways of learning and program design

STEM Definition & Vision

STEM education includes many approaches to achieve goals within and across science, technology, engineering and mathematics. Integrated learning opportunities and transdisciplinary approaches to teaching and learning provide students opportunities to explore and apply rigorous concepts and processes within authentic, relevant contexts. **These experiences challenge students to engage in and persevere through inquiry, exploration and reasoning, collaborative problem solving, and purposeful reflection.**

Instructional Approaches



Effective STEM Instructional Practices

- “provides students with experiences to engage them in the **practices of science**…”
- “Students...have opportunities to learn science, mathematics, and engineering by addressing problems that have real-world applications.”

National Research Council. *Successful K-12 STEM Education: Identifying Effective Approaches in Science, Technology, Engineering, and Mathematics*. Washington, DC: The National Academies Press, 2011.

Next Generation Science Standards

Science and Engineering Practices

1. Ask questions and define problems
2. Develop and use models
3. Plan and carry out investigations
4. Analyze and interpret data
5. Use mathematics and computational thinking
6. Construct explanations and design solutions
7. Engage in argument from evidence
8. Obtain, evaluate, and communicate information

Effective STEM School Conditions

- A coherent set of standards and curriculum
- Teachers with high capacity to teach in their discipline
- A supportive system of assessment and accountability
- Adequate instructional time
- Equal access to high-quality STEM learning opportunities

National Research Council. *Successful K-12 STEM Education: Identifying Effective Approaches in Science, Technology, Engineering, and Mathematics*. Washington, DC: The National Academies Press, 2011.

Deepening Our Understanding

- Survey to assess teacher perception and understanding baseline

- Curriculum analysis to provide content and assessment baseline

- Classroom walk-throughs to identify instructional practices baseline

- Research in other districts to identify promising STEM practices

Findings: ER9 Foundation

Mathematics

- Department Leadership: Math Specialists & Instructional Leaders
- Revised curriculum aligned to Connecticut Core Standards
- Full year of K-8 PD in Math Practice
- New math resource to be implemented 2014-2015, K-8

Findings: ER9 Foundation

Middle School STEM Courses

- Integration of the 4 disciplines
- Assured experience
- Explicit instruction and experiences in engineering practices

Findings: ER9 Foundation

JRMS STEM

Findings: ER9 Foundation

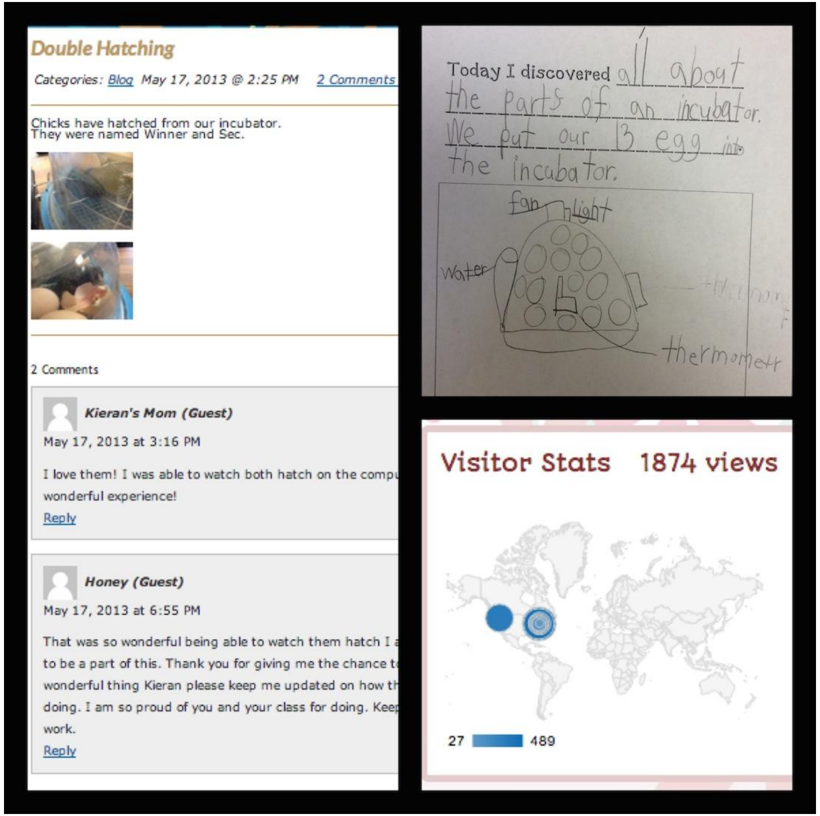
Leadership and Teacher Capacity

- Valuable benefits from addition of K-8 Science Technology Instructional Coach (STIC) position in Redding

- Evidence of early adopters

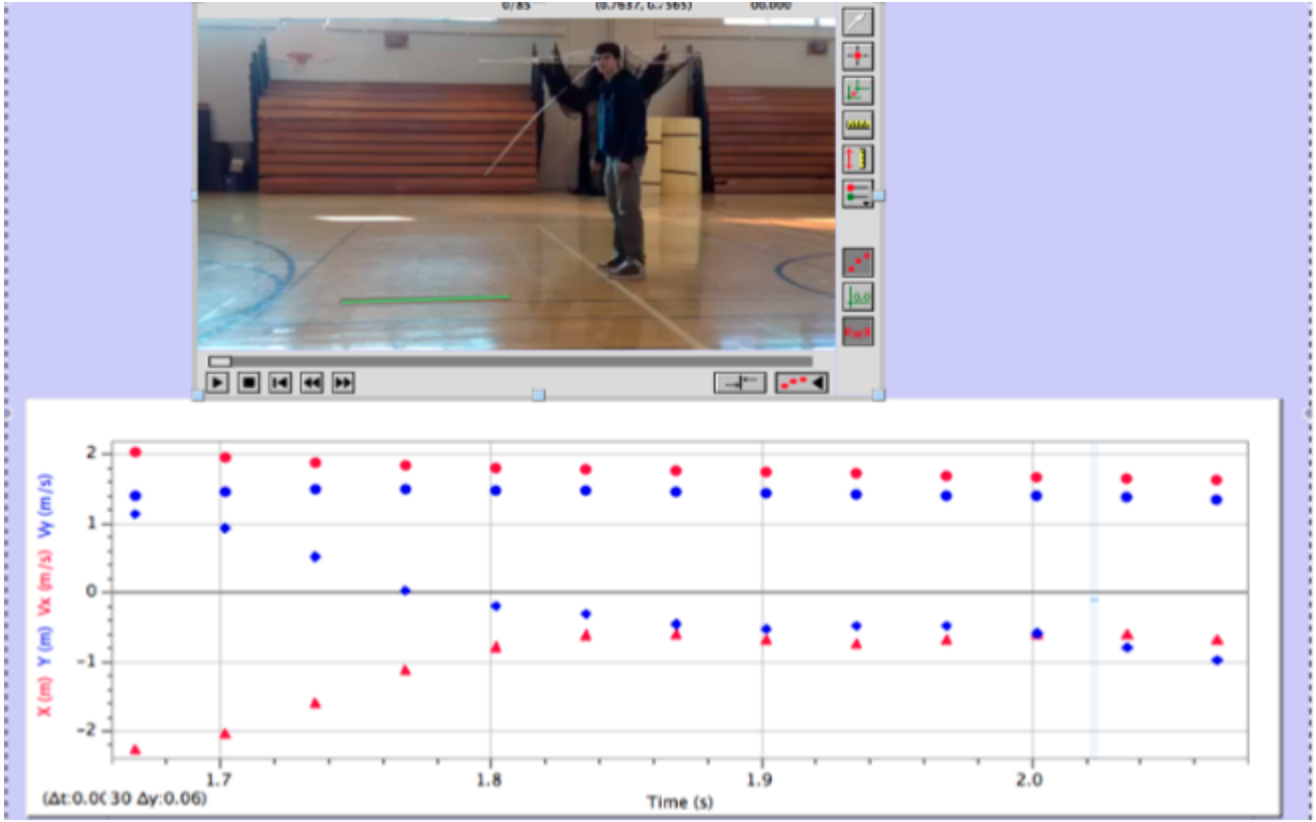
Findings: Evidence of Early Adoption

Findings: Evidence of Early Adoption



Findings: Evidence of Early Adoption

Findings: Evidence of Early Adoption



Findings: Evidence of Early Adoption

Conclusion

This open ended lab was especially helpful to our understanding because of the lack of guidelines. We were able to use all the physics we learned in the 1st semester and apply it how we saw fit, without attaining to a specific problem or equation. This is real physics. The ability to take a real world problem and apply knowledge to it to draw new conclusions is essential. Taking specific data such as mass, height, time, and other and applying it to find Kian's crouch length, and initial velocity is what made this project special. Although we will both most likely not be olympic broad jumpers or hair models (Kian), we were able to determine how to optimize broad jumps, through a 45 degree angle and the building up of momentum through pumping your arms and legs before the jump. We learned a great deal about the physics of broad jumping and how to alter equations due to specific problems that exist outside of a textbook.

Findings: ER9 Foundation

Emerging Technology

- Network infrastructure
- Hardware
- Equipment/Instructional tools

Findings: Areas of Need

Science

- Continue the curriculum revision K-12
- Professional development regarding NGSS Practices
- Develop common performance-based assessments

Findings: Areas of Need

Technology

- Implement K-8, 9-12 framework
- On-going embedded professional development regarding technology integration
- Create conditions for transformative uses of technology

Findings: Areas of Need

Engineering

- Integrate engineering practices into science curriculum
- Professional development regarding engineering practices
- Consider engineering programming K-5
- Review engineering course offerings 9-12

Recommendations

- Talent & Training: How do we create and sustain capacity within our teaching community?
- Treasure: How does our budget help us reach STEM goals?
- Terrain: How does the physical learning environment help us build STEM opportunities?
- Time: How does our school day structure support STEM?
- Tone: How do we build STEM energy & engagement amongst students and teachers?

Next Steps: Phase 1

Talent & Training

- Create a K-12 STEM leadership team
- Identify intensive learning for K-12 STEM leadership team
- Introduce all teachers to Next Generation Science Standards and Practices

Talent, Training, Time
Leadership & Collaboration Structures

- Vertical and Horizontal Collaboration
- Across departments, within school
- Across K-8 districts and departments
- Across levels- middle/high school, middle/elementary school, all levels
- Liaison - meeting participation

Next Steps: Phase 1
Curriculum

- Continue writing of science curriculum based on NGSS
- Develop and implement performance assessments
- Implement K-8 and 9-12 technology frameworks

Next Steps: Phase 1
Terrain, Time & Tone

- Expand use of STEM labs
- Explore scheduling options for collaborative use of designated STEM labs (elementary)
- Explore additional extracurricular activities and clubs to build STEM engagement

Next Steps: Phase 2

- Curriculum implementation
- Administer assured performance assessments
- Embed peer collaboration and coaching

Next Steps: Phase 3
Engineering

- Integrate engineering practices into science curriculum
- Professional development regarding engineering practices
- Consider engineering programming K-5
- Review engineering course offerings 9-12

Next Steps: Ongoing

How will we gauge our success?

What will STEM look like in classrooms in the form of student learning outcomes?

Questions