

Why Not TEams?

Technology Engineering and math science

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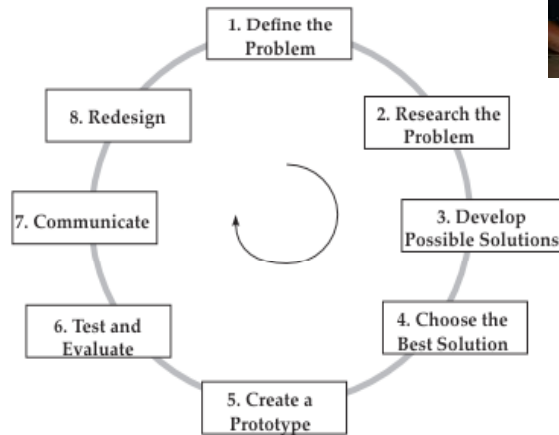
Ryan Collay,

Science & Math Investigative Learning Experiences (SMILE)

Why TEams?

- **Technology:** the study of the tools and processes that are used to make stuff and solve problems, not just computers. There's a technology for oil painting, pottery, dressmaking.
- **Engineering:** making stuff that solves problems. Taking risks to solve problems with imperfect knowledge and limited resources – time, money, materials.
- And
- **Math:** a tool to describe patterns which may or may apply to things and problems in the real world. When it does apply, math can widen one's understanding of the problem and help predict behaviors under changing conditions.
- **Science:** knowing more -- more thoroughly, reliably, repeat-ably

Engineering is a Way of Thinking



**The Engineering
Design Process
is a Team
Process**

Similar Processes—Different Goals

Engineering

- Define a problem
- Research the problem
- Generate solutions
- Create a prototype
- Test the prototype
- Communicate product
- Redesign

Science

- Identify a question
- Research the question
- Generate ideas
- Formulate a hypothesis
- Conduct an experiment
- Communicate results
- Identify a new question

Adapted from Engineering Professor Chris Rogers, Tufts University; thanks to Cary Sneider

On Thinking Like an Engineer

Advice from 12 year old participants of a workshop with picoCrickets, devices used to build projects with motion, light and sound using LEGOS and other materials

- Start simple
- Work on things that you like
- If you have no clue what to do, fiddle around
- Don't be afraid to experiment
- Find a friend to work with, share ideas!
- It's OK to copy stuff (to give you an idea)
- Keep your ideas in a sketch book
- Build, take apart, rebuild
- Lots of things can go wrong, stick with it

*From "All I Really Need to Know (About Creative Thinking) I Learned (By Studying How Children Learn) in Kindergarten" by M. Resnick, MIT Media Lab, 2007.
Downloadable at <http://scratch.mit.edu/pages/research>*

Engineering Impact

"Science seeks to understand the world as it is; only engineering can change it. ...But the truth is that full scientific understanding isn't always necessary for technological advancement."

from "Want to Engineer Real Change? Don't Ask A Scientist", by Henry Petroski, Duke University Professor, civil engineer, historian, and failure analyst, Washington Post, January 25, 2009

Why TE for engagement?

Connecting to the IES Practice Guide "Encouraging Girls in Math and Science"

- Kids want to get their hands on something, do something, make something that matters, connect to stuff they already know.
- Technology and Engineering put problems into their hands and give them a reason to apply math and science using critical and analytical thinking.
- There is no more prescriptive, informational feedback than a robot doing what you tell it to do rather than what you want it to do. (*Recommendation #2*)
- "Real world" problems and the use of tools for a goal's sake (vs. tools/toys are cool for themselves) interest both boys and girls (*Recommendation #4*)

Why TE for engagement?

- Engineers often work for cool clients on interesting problems, and the solutions matter
- TE teams are people who work together, learn to cooperate, need leaders with "new" skills, need to learn to share, to effectively communicate.
- The skills and desire to network, to have a relational workplace will benefit TE as more women participate
- Contexts build on one another as we look at "technologies" and their histories, problems and solutions, we learn about broader social networks (analog/digital music)

Strategies in the trenches

Support a team-based process and skills development

- Wait for answers
 - reward thorough thinking as well as fast thinking
- Ask leading questions
 - To lead students to successful solutions and deeper understanding
 - To lead mentors to understanding student thought processes
 - To encourage students to ask each other questions
- Reward effort and explanation as well as results
 - Encourage good process: research, experimentation, documentation, discussion, conclusion

Want More?

- The OPAS Initiative home page at <http://opas.ous.edu//>
- “In the OPASsphere” e-newsletter at <http://opas.ous.edu//OPASsphere/index.html>
- Network of Oregon Informal STEM Educators (NOISE) listserv (automagically subscribes you to “In the OPASsphere” – contact Jo)
- More Informal STEM education programs at <http://www.technosciencesupersite.org/>

Thank you for fighting the good fight!

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