



4-H Junk Drawer Robotics

www.4-h.org/curriculum/robotics/



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Background

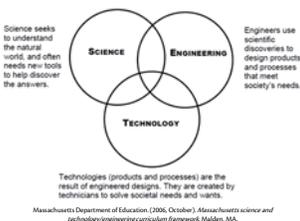
Need for Science, Engineering, and Technology Literacy

- National and international assessments have shown low levels of science literacy among school-age youth for the past several decades. No standard assessments of engineering or technology have taken place (NAEP planned for 2014).
- SET literacy is required for today's workforce.

Why Engineering & Technology?

- Engineering education may improve science and math learning.
- Scientific inquiry and engineering design differ. Engineering has constraints, tradeoffs, context, practical limitations, and aesthetics.

The Relationships Among Science, Engineering, and Technology



Role of 4-H Youth Development

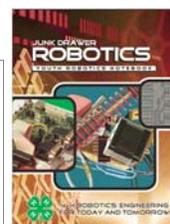
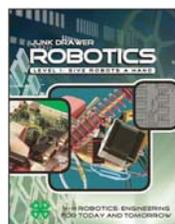
- Nonformal education programs, such as 4-H, can provide engineering and technology programs that extend science education.

Curriculum Development Process

- Authored by UC Davis faculty and UC Merced students over a ten year period.
- Activities were developed through an iterative process that included pilot testing.
- Content was peer reviewed by engineers, youth development staff, evaluation experts, and by the 4-H National Headquarters.

Curriculum

- Focus on science, engineering, and technology process skills
- Uses cross-age teachers
- Frames activities in the experiential learning cycle and promotes inquiry
- Promotes small group collaborative learning
- Reinforces engineering design with a youth robotics notebook
- Activities within a module are framed around three phases:
 - To Learn – science exploration of underlying concepts
 - To Do – engineering design
 - To Make – construction and testing of designs
- Junk Drawer Robotics contains three levels:
 - 1) Give Robots a Hand
 - 2) Robots on the Move
 - 3) Mechatronics



Evaluation

Three Phase: Expert Review, Formative, and Outcome

Methods for Formative Evaluation 2009-2010

- Implemented with 250 youth at club and afterschool sites in Merced, Santa Cruz, and Kern Counties.
- Survey administered at the conclusion of a model.
- N=250; ages 12-14.

Results

- Overall, the formative data seem to indicate the curriculum was well received by adult facilitators in establishing a productive learning environment for science, engineering, and technology.
- Youth rated engineering, on average, higher than science and technology concepts.
- Both youth and adults tended to rate their interest in the activities moderately, with notable exceptions in Level 3, modules 2 and 3. Both of these modules tend to rely on group activities which attempt to provide analogies rather than building and constructing.

<i>Evaluation results for Junk Drawer Robotics Level 1, "Give Robots a Hand"</i>	Module 2 Arms
	Youth respondents n=40
Survey question for youth	Mean Values*
The lesson/activity helped me to learn about science or science concepts.	3.25
The lesson/activity helped me to learn about technology or technology concepts.	3.56
The lesson/activity helped me to learn about engineering or engineering concepts.	3.69
The lesson/activity helped me to learn about mathematics or math concepts.	3.62
I found the lesson or activity to be interesting.	3.55
I would tell my friends that the activity was a good one.	3.36

* Means are from Likert response values: 1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree

Further information available from: Mahacek, R. & Worker, S. (in press). Extending science education with engineering and technology: Junk drawer robotics curriculum in *Advances in Youth Development (2001-2010)*, Davis, CA: UC Davis 4-H Center for Youth Development.

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