Problem-based Interdisciplinary STEM with Hummingbird Robotics

VSTE
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Dr. Paula Leach, paula@ittip.org
Stephanie Playton, stephanie@ittip.org
PISTEM: Overview

• Grades 5-12

• All subjects

• Summer PD
  – School year follow-up
PISTEM: Overview

- Hummingbird Robotics
- Problem-based Learning
- STEM & Engineering Design

http://www.ittip.org
VSTE: Problem-based Interdisciplinary STEM with Hummingbird Robotics

PISTEM: Overview

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http://www.ittip.org
Hummingbird
In Virginia Schools

Over 200 Loaner Kits
19 Counties

48 Teachers

http://www.ittip.org
• **Hummingbird**
  Developed through CREATE Lab at Carnegie Mellon University -
  Now, Birdbrain Technologies

*Kit Contents*

1- Hummingbird Duo Controller
1 – Power Supply
1 – USB Cable
8 – LEDs
2 – Tri-Color LEDs

Image from: http://www.hummingbirdkit.com
• **Hummingbird**

*Kit Contents (cont.)*

2- Vibration Motors
4 - Servos
4 – Servo Extensions
2 – DC Motors
1 – Light Sensor
1 – Temperature Sensor
1- Microphone Sensor
1 – Distance Sensor
1 – Rotary Knob

Image from:  http://www.hummingbirdkit.com
• Hummingbird

Integration of Arts & Crafts into Engineering

http://www.ittip.org
• Hummingbird

*Improvements (Duo)*

- Microcontroller Arduino-powered standalone mode
- Works with other interfaces/shields
  - Pixy (a camera)
  - Vernier Probes
  - Third Party Shields
- Bluetooth controlled (iPad)

Images from:  http://store.birdbraintechnologies.com/
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• Hummingbird (recommended grades 2 - 12)

  Programming

  Beginner (Age 8+)
  Visual Programmer
  Intermediate (Age 11+)
  Scratch 2.0
  Snap!
  Advanced (Age 13+)
  Python
  Raspberry Pi
  Calico
  Processing
  Java

Image from: PI STEM, SCHEV Grant, 2014
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• Visual Programmer
  Training Comics
  Training Videos

Images from: Visual Programmer interface

http://www.ittip.org
Scratch

*Lifelong Kindergarten Group at the MIT Media Lab (2003)*
Visual programming
Ages 8 to 16
*Promotes creativity, systematic reasoning, & collaboration*
Storytelling
Animation
Games
Other

*Statistics*
*Free*

Scratch online/offline
“Sister” programs (like “Snap”)

Image from: http://www.catrobat.org/
• Scratch

Getting Started w Scratch
Step-by-Step Intro

Getting Started Guide

Video tutorials

Scratch “cards”

http://www.ittip.org
• **Scratch**

**Scratch with Hummingbird**

**More Blocks**

- Set the power to motor on the port used (1 or 2).
- The range is -100 to 100. If the speed is set to "0", the motor is not moving.
- Reads in Celsius.
- Reads value of sound sensor, 0 to ~ 100.
- Reads value of distance sensor, 0 to 100.
- Reads value of knob, 0 to 100.
- Integrate some "control" blocks with your LED block(s).

[Image of Scratch code blocks with Hummingbird components]
Problem-based Learning

Students solving a problem with multiple solutions over time in a real-world context.
Problem-based Learning

Why?

- Provides students with a context for learning
- Naturally connects different subjects
- Effective for different types of learners
In isolation, PBL is NOT:

- A culminating project at the end of a unit
- Completing a STEM project
- Solving word problems in a mathematics worksheet
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http://www.ittip.org
• Lesson Plans

http://www.ittip.org/index.php/lesson-plans

Search “PISTEM”

21 published lessons
VSTE: Problem-based Interdisciplinary STEM with Hummingbird Robotics

• Overall

Time

Quick Programming Example - 30 minutes
Problem-based learning - 6 - 8 hours

Successes

Great for facilitating 5 Cs
Coding experiences

Challenges

Understanding the parts and how they work

http://www.ittip.org
• Questions

Dr. Paula Leach, paula@ittip.org @ITTIPSTEM

Stephanie Playton, stephanie@ittip.org @STEMGal