Robotics in K-12 Education

Philippines K12 Experience
Robotics in K12 Education
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- Students Learn 21st Century Skills through Robotics
- Japan Education - programming and robotics by 2020
- Vietnam - strong Senior HS robotics program beating Japan every year
- Malaysia - robotics from MARA to All schools
- Indonesia focuses on skills for building robots.
Robotics in K12 Education

- WHAT is ROBOTICS in Education
- WHO teaches/ who learns
- WHEN
- WHY do robotics (21st Century Learning Skills)
- HOW to do robotics
What is Robotics?
The different definitions
What is Robotics?

- The technician’s point of view (To Fix, To build)
- The College professor’s point of view (an EXPERT)
- The IT point of view (Technical * Programming)
- The K12 Teacher (NOT FOR ME)
- The Misconception (Robotics Major)
- The Misconception (Robotics as a Subject)
DESIGN
invent
PROGRAM
create
ENGINEER
build
This 17-year old Filipino built a working BB-8 droid

Angelo Casimiro, the same student who made shoes that charge smartphones, is at it once again and this time, he builds a fully-functioning BB-8 droid from the latest Star Wars movie.
What is Robotics?

- Robotics in Education is a “MEANS to an end”
- Robotics is an EXPERIENCE with multi-disciplinary activities
- Robotics is a HOOK that keeps students striving for more challenges
- Robotics is a doorway to build and develop Thinking Skills.
What is Robotics?

• Robotics as Cute
• Humanoids
What is Robotics?

- HOOK!!!
- Problem Solving at the Core
What is Robotics?

• HOOK!!
• Problem Solving at the Core
Who does Robotics?

Students and Teachers
Who does Robotics?
Who does Robotics?
Who does Robotics

- Computer Teacher
- Science Teacher
- Math Teacher
- TLE Teacher
- Language Teacher
Who does Robotics?

- For students,
- For Teachers,
- Special group
- All students
When to do Robotics?
Timing in the school year
When to do Robotics?

- Center on Contest
- National Robotics Competition
- WORLD ROBOT GAMES
- Other International Robot Contests
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When to do Robotics?

- Throughout the school year
- One semester or one quarter per grade level
- Incremental Activities
- School-wide contest
- Project exhibits for parents and community
When to do Robotics?
Why do Robotics?

Primary motivation
WHY do Robotics?

• Strong MOTIVATION!
• Thinking Skills (21st Century)
• TLE Psychomotor Skills (Maker Technology)
• Grading better (not harder)
• Differentiated Instructions/Learning
• Understanding by Design (Backward approach)
• Community-based Problem themes
How to do Robotics?

Process
Experience since 2007

- 10 years of trying out different curriculums
- 10 years of training teachers
- 10 years of guiding schools
- 10 years of making learning materials
- 10 years of doing educational research

- We share our experience with you.
Methodology

• Build habits of "Thinking"
• Build habits of "Engineering Process"
• Build habits of "Scientific Process"
• Build habits of doing things!
• Teacher MODELS learning
Teaching Programming

- Use of PRE-BUILT robots
- LOGO BLOCKS or C programming
- Pre-built programs to be manipulated
- Each change changes the robot behavior
- Hook is established.

iBlockly: Program_name
Teaching Programming

Engineering Design Process

- ASK: Define the problem.
- IMAGINE: Generate ideas.
- PLAN: Select a solution.
- QUEST: Creativity, Collaboration, Critical Thinking
- SHARE: Present the results.
- CREATE: Make the item.
- IMPROVE: Make needed changes.
- TEST: Evaluate the item.
Connecting to Math & Science

- Measure the distance
- Measure the angle
- Write a program… (POKE THE QUESTION!)
- Use an inclined plane, add a load
- Be precise
Connecting to Math and Science

Engineering Design Process

- Ask: Define the problem.
- Imagine: Generate ideas.
- Plan: Select a solution.
- Quest: Make the item.
- Test: Evaluate the item.
- Improve: Make needed changes.
- Share: Present the results.
Connecting Science, Electronics.

• Use sensors (Calibrating)
• Measure the surrounding
• Respond as a switch
• Log data across time
• Incremental learning on programming
• Control devices (Environment, Car, house, etc.)
• Workshop skills in electricity

AQUA-BOT
CONSERVE and PROTECT Benham Rise

- PROVIDES High-Definition videos to monitor its surroundings clearly
- TRANSMITS Wi-Fi ready for transmission of real-time captured videos to concerned authorities
- OPERATES Monitors real-time functioning
- PROVIDES Renewable energy
- Monitors perimeter
- Monitors or...
Connecting Science, Electronics

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Connecting to Physics, mechanics

- Improve on the movement
- Movement in a different context
- Redesign, rebuild the base
- Focus on mechanical problems.
- Introduce mechanical technology…
Connecting Physics, mechanics
Building on the previous

- Previous Skills keep repeating in each increment
- Measuring & Calibrating
- Programming
- Building (workshop skills)
- Teamwork – Language skills
- Learning by Observing (other solutions)
- Asking the RIGHT QUESTIONS
Doing Real-life problems

- Research the problem
- Research known and possible solutions
- Design a new solution and method of testing
- Build
- Test
- Share with others
Connecting Real-life problems
Success Factors
(what we learned)

- Easy-to-use entry-level materials needed
- Continuing teacher training and support is necessary
- Curriculum transition takes time (3 year cycle)
- Manage misconceptions about robotics and learning objectives
- Manage Equipment (Kits, support, batteries, etc)
Moving Forward
(what we learned)

• Robot is misclassified as a Hobby Niche
• Robotics in the curriculum gaining ground
• Government budget and government-led contest will increase demand
• Demand for training in multiple levels
Moving Forward (what is needed)

- Robot Kit packages (good price point)
- Robot training packages (continuing)
- Robot training materials
- TIME, TIME, TIME
- Maintenance support – replacement parts
- Development of robot contest scene (multiple levels of difficulty)
THANK YOU!

melvin@pinoyrobotgames.org
0939 912 7127
0917 897 2349