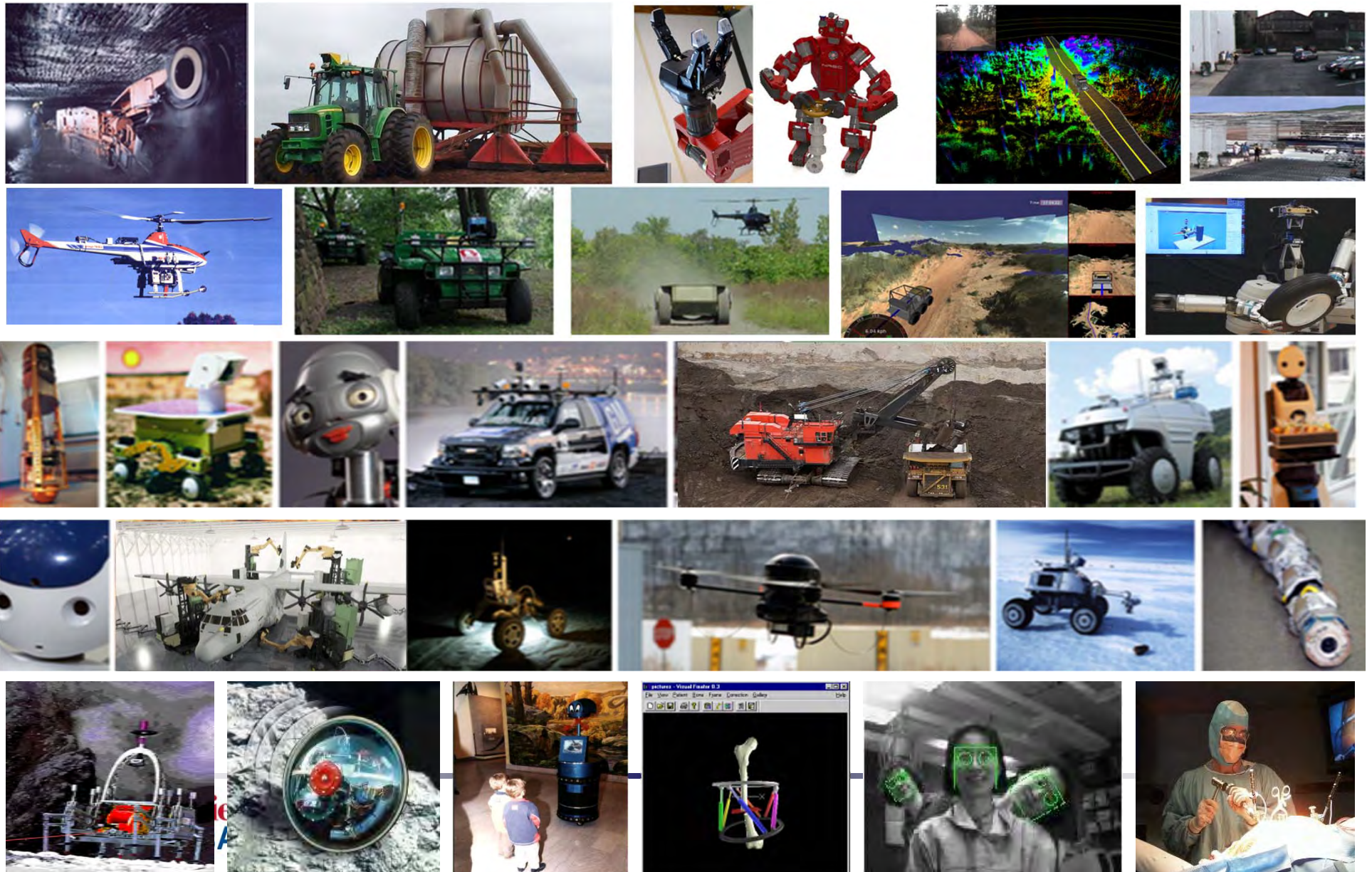


Robotics Research At Carnegie Mellon Robotics Institute



What I Will Cover Today

- Introduction
- Robotics – the Transformative Technology
- Teaching with Robotics –
 - Math – The Robot Algebra Project
 - Engineering – Training the Robotics Competition Community Project
 - Computer Science – Changing Culture in Robotics Classrooms Project
 - Robot Virtual World Math Tools
 - Expedition Atlantis
- Recruit Schools and Teachers for our DRK-12 Research Project
- Show you where to find lots of free resources for your class

Carnegie Mellon



Basic robotic
research



Applied robotic
research



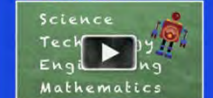
Educational
robotic
research



Mission:
Use the motivational effects of robotics to excite students about science and technology.

Vision:
All students are technologically literate, mathematically competent, and confident about their future.

Learn how Robotics is changing Classrooms



Join the CS2N Network!

NXT and VEX training available with On-Site and ONLINE Classes!

Become a Robotics Academy Certified Instructor

Posted by Cara Friez | 3/28/13

We are extremely excited to announce our new certification course! A Robotics Academy Certified Instructor is officially certified by Carnegie Mellon's Robotics Academy.

May Madness 2013 Information Released

Posted by Vu Nguyen | 3/15/13

The May Madness information has been released! Take a look to find out more...



Carnegie Mellon Robotics Academy

RVW

No Robot, No Problem! Robot Virtual Worlds is a high-end simulation environment that enables students, without robots, to learn programming.

Research has shown that learning to program in the RVW is more efficient than learning to program using physical robots. RVW simulates popular real world VEX®, LEGO®, and iDots in 3D environments while using the same language - ROBOTC - to virtual and physical robots. The environment is perfect for home, school, and competition environments!

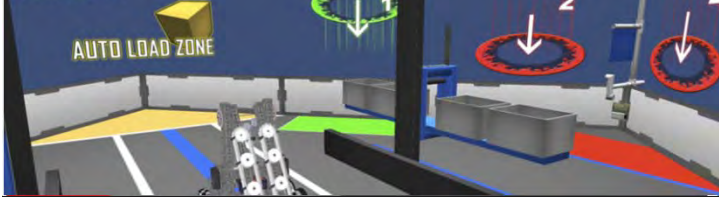
START HERE



VEX TOSS UP - CS2N MODE FALL 2013



FTC BLOCK PARTY - CS2N MODE FALL 2013



ROBOTICS MATTER EDUCATION STORE

Call us at 412-963-7310

Language: US Dollar

Categories: Shop by Robot, Shop by Classroom, Shop by Product Type, Training, Resources

Specials: All Products

Resources: How to apply for grants, Knowing what to buy, Distributors, Robotics Academy, About Robomatter

Information: How to Create a Quote

ROBOTC for CORTEX & PIC

Announcements:

- FREE Robot Virtual Worlds Webinars on Google Hangouts! (JohnWatson, 0 replies, 442 views)
- ROBOTC 3.06 Now Available (JohnWatson, 0 replies, 858 views)
- ROBOTC PREVIEW Build (3.61 Preview #1) - VEX Cortex PID (tinez, 0 replies, 615 views)

Topics: Recognizing whether or not Competition Control is plugged in, Multitasking [eticky]: When and When Not to Multitask, New RVW Sack Attack table and VEX Referee video trainers, How to connect to keyboard, Updating firmware

LabVIEW Video Trainer

LabVIEW Programming Fundamentals Vol. 1: Motion, Sensing and Control

ROBOTC Curriculum for TETRIX and LEGO MINDSTORMS

ROBOTC Curriculum for VEX and MINDSTORMS

VEX Cortex Video Trainer using ROBOTC

NXT Video Trainer 2.0

Science & Data Logging

TERRAFORMERS

Robotics Engineering

LabVIEW Training

DIGITAL MEDIA + LEARNING competition 4

BADGES FOR LIFELONG LEARNING

HASTAC, MacArthur Foundation, mozilla, BILL & MELINDA GATES Foundation

CMU Published Research

Articles:

- Liu, A., Newson, J., Schram, C., Shoop, R. Learn to program in half the time! Robot Magazine, 48-51 [Author Email] [PDF]
- Soldaat, X., Friez, T., Frit, J., Pontes and Data Structures in ROBOTC. Robot Magazine, 59-61 [Author Email] [PDF]
- Liu, A., Newson, J., Schram, C., Shoop, R. Students Learn Programming Faster through Robotic Simulation. Teen Directions, 16-19 [Author Email] [PDF]
- Frit, J., Liu, A., Schram, C., Shoop, R. (November 2012). Learning How to Program via Robot Simulation. Robot Magazine, 56-70 [Author Email] [PDF]
- Avastros, R., Chastot, H., Friez, T., Shoop, R., Veloso, M. (2011, December). Programming and Multi-Robot Communications. Robot Magazine, 74-77 [Author Email] [PDF]
- Alwood, T., Shoop, R. Carnegie Mellon Launches a Mega Million Dollar Robotics Education Initiative. Robot Magazine, 70-71 [Author Email] [PDF]
- Shoop, R. (2011, May). FIRE Unleashes Robot Virtual World Games. Robot Magazine, 75-81 [Author Email] [PDF]
- Shoop, R. (2011, January). Computer Science Student Network Project. Presented at the Symposium on Education in the 21st Century (SE21) meeting, New Orleans [Author Email]
- Higashi, R., Shoop, R. (2011, November). Organizational Expectations Presented to Private School System Teachers and Administrators. Robot Algebra Partnership Kickoff [Author Email]

CS2N

Home Activities Competitions Learn Teachers Sign in Create Account Blog Support

Easy and fun activities designed to help you learn how to program

Robot Virtual Worlds

Robot Virtual Worlds allows you to program Virtual Robots using the ROBOTC Programming Language!

Create a CS2N Account

or

Connect with Facebook

Advanced ROBOTC Programming Certification

This certificate is awarded to **Thomas Timmons**

For successfully completing the intermediate and advanced ROBOTC training course held at Carnegie Mellon University and for passing the programming certification test with a score of 90% or higher.

Advanced Level Programmer

Badges: Intro to Programming, CS Principles, CS Principles, CS Principles, Advanced CS Principles

Pictured above is an example Badge Pathway. The pathway begins with an Introduction to Programming Badge, then CS Principles, Data and Algorithms, and Advanced Principles, and ends with the Certification.



The Robotics Academy is located at NREC



Started in 1999



hosting robotics camps

Robotics Academy Team

	Ross Higashi Curriculum Specialist, Robots In		Professor Christian Schunn University of Pittsburgh, LRDC Faculty		Louis Alfieri II Post Doc, University of Pittsburgh
	Mindy Jang Research Programmer, Robots In		Norm Kerman Robotics Academy Outreach Coordinator		Jason McKenna Teacher, Beaver School District/Robomatter
	Vu Nguyen Research Programmer, CS2N In		Robin Shoop Project Manager, CS2N		Dick Swan Inventor, ROBOTC
	Timothy Hunkele Systems Software Engineer, CS2N		Krishna Pandravada Multi-Media Developer, Robot Virtual Wor		John Watson Software Support, ROBOTC
	Jesse Flot Project Manager, Robot Virtual V		Thomas Luong Multi-Media Developer, Robot Virtual Wor		Allison Liu LRDC Graduate Student
	Timothy Friez Software Engineer, Multi-Robot C Project		Ryan Cahoon Research Programmer, DML Badges/Rot Worlds		Rajadurai Balasubramanian Programmer, Robomatter

National Robotics Engineering Center

NATIONAL ROBOTICS ENGINEERING CENTER
Carnegie Mellon
Robotics Institute

*Drive state-of-art
robotics technologies
into every day use*



Accelerated system development, reusable core technologies, and extensive testing were key to winning the 2007 DARPA Urban Challenge.

Featured Project

Automated agriculture is blossoming at NREC



The Integrated Automation for Sustainable Specialty Crops (IASSC) project tests sensing and automation technologies in the orange groves of Florida. Visit its

MARKETS

NREC serves a wide sector of markets and is moving into more



Mining



Defense

Agriculture

News

Strawberry plant sorter outperforms workers



In a successful field test this fall, the machine classified and sorted harvested plants more consistently and faster than workers could, with a

The DARPA Grand Challenge

2004 DARPA Grand Challenge



The first competition of the DARPA Grand Challenge was held on March 13, 2004 in the [Mojave Desert](#) region of the United States, along a 150-mile (240 km) route that follows along the path of [Interstate 15](#).

No car finished the race.

2005 DARPA Grand Challenge



The second competition of the DARPA Grand Challenge began at 6:40am on October 8, 2005.

All but one of the 23 finalists in the 2005 race surpassed the 11.78 km (7.32 mi) distance completed by the best vehicle in the 2004 race.

2007 DARPA Urban Challenge



- Vehicle must be stock or have a documented safety record.
- **Vehicle must obey the California state driving laws.**
- Vehicle must be entirely autonomous, using only the information it detects with its sensors and public signals such as [GPS](#).
- DARPA will provide the route network 24 hours before the race starts.
- Vehicles will complete the route by driving between specified checkpoints.
- DARPA will provide a file detailing the order the checkpoints must be driven to 5 minutes before the race start.
- Vehicles may “stop and stare” for at most 10 seconds.
- **Vehicles must operate in [rain](#) and [fog](#), with GPS blocked.**
- **Vehicles must avoid collision with vehicles and other objects such as carts, bicycles, traffic barrels, and objects in the environment such as utility poles.**
- Vehicles must be able to operate in parking areas and perform U-turns as required by the situation.

New DARPA Grand Challenge Tasks!

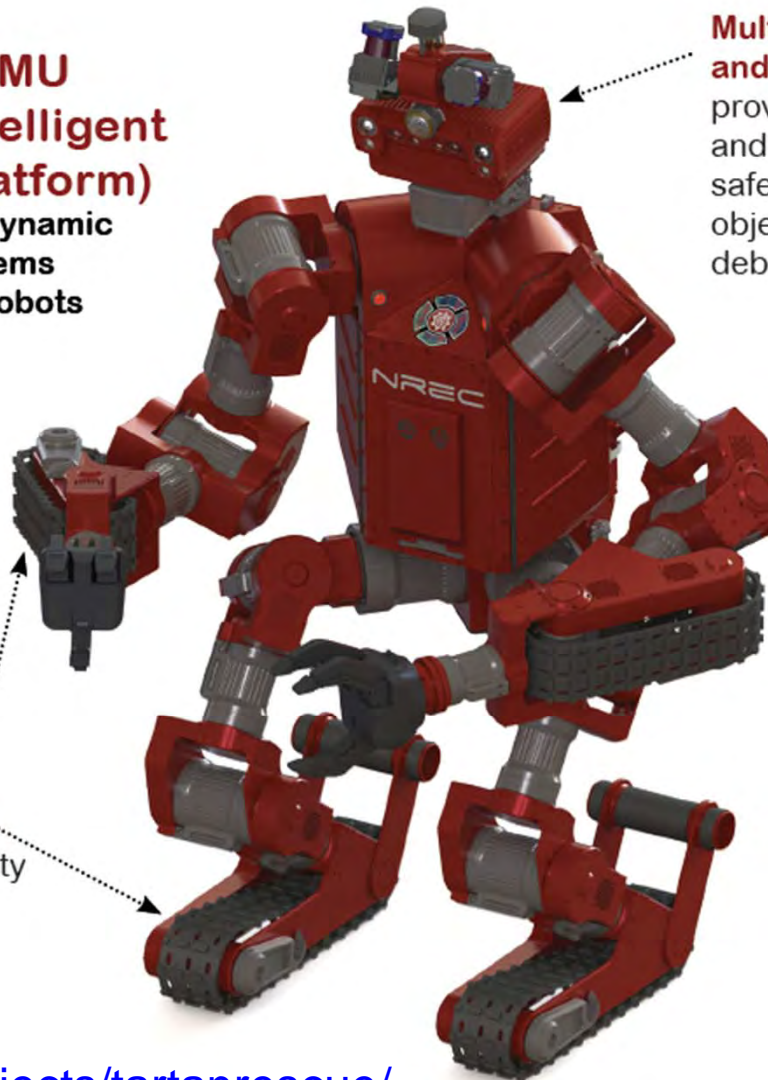


1. Drive a utility vehicle at the site.
2. Travel dismounted across rubble.
3. Remove debris blocking an entryway.
4. Open a door and enter a building.
5. Climb a ladder and traverse a walkway.
6. Use a tool to break through a concrete panel.
7. Locate and close a valve near a leaking pipe.
8. Replace a component such as a cooling pump.

Meet CHIMP



CHIMP (CMU Highly Intelligent Mobile Platform) avoids many dynamic stability problems of humanoid robots



Multi-modal head and joint sensors provide perception and feedback to safely move, handle objects, and remove debris.

Tracks on all four limbs improve mobility and stability

Drive joints allow human-like grasping and can be used in mobile manipulation and manufacturing

<http://www.rec.ri.cmu.edu/projects/tartanrescue/>



Robotics and Senior Care

1 in 5 Americans will be over 60 by 2030

Smart Kitchens that gently remind the senior citizen that the water is running in the sink or that the stove is turned on.



Systems that reminds seniors to take their medicine, gives remote access to caregivers to check to see if someone has opened the refrigerator, flushed the toilet, or turned on the stove that day.



Systems that allows telepresence so that friends and relatives can remotely share a meal together.



Service Robotics - Autonomous Driving

Consider the rapid advancement of robotic autonomous driving technology.

“When we blend the data available via Global Positioning Systems (GPS) with current networks and real time feedback from satellites we can predict that driverless cars are only a decade away...” Sebastian Thrunn, Stanford

Future roboticists will couple “Google maps like data” and real time GPS feedback with new sensing technologies ...



Service Robotics Market

70 Billion per year

Field



Cleaning



Inspection



Construction



Assistive



Logistics



Medical



Underwater



Defense



Entertainment



Education



Laboratory



Public Relations



Home Security



Domestic



Web2.0 to Web3.0

Web 3.0 – the internet is connect to sensors, software, and robotic networks globally.



The significance of these connections cannot be overstated; robotic systems that provide remote access and feedback will be everywhere.

Cars, connected to GPS, connected to traffic cameras, connected to Google maps, connected to On-Star or some other provider, connected to real time news...



Robots will have the same effect on the emerging economy as the computer did on the information age!

Transportation

- Electronic flight control systems (autopilot, fly-by-wire)
- Route planning (which planes/trucks, which routes)
- Inventory tracking (barcode scanners, RFID, satellites, web interface)
- Airport traffic control

Business & Finance

- High-speed stock trading (algorithms, online trading system)
- Business model and market simulations
- Accounting Software
- E-commerce/Credit Card Processing
- Internet Storefronts
- Router/Network Devices
- Video Monitors/Onscreen Displays

Health Care Equipment

- Heart Monitors
- CT Scanners
- Patient Monitoring
- Medicine

Security

- Security scanners (airports, sports arenas)
- Red light cameras
- Credit card fraud/theft detection
- Facial recognition and identification
- Border sensor networks

Green Homes/Buildings

- "Quality of Life" Smart Homes
 - Remote access to senior citizen homes
 - Smart kitchens and bathrooms
 - Medicine dispensers and monitors
- Thermostats HVAC
- Solar/Wind/Geothermal Systems

Embedded Systems

- Cars
- Cell Phones
- Modern Appliances (microwaves, refrigerators, stoves, dryers, washers)
- Industry/Factory automation
- Robots
- CNC machinery

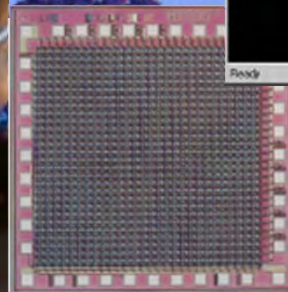
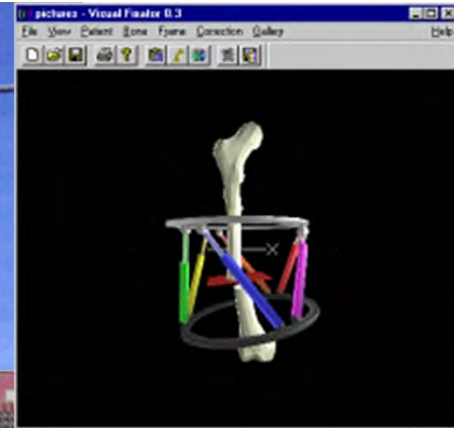
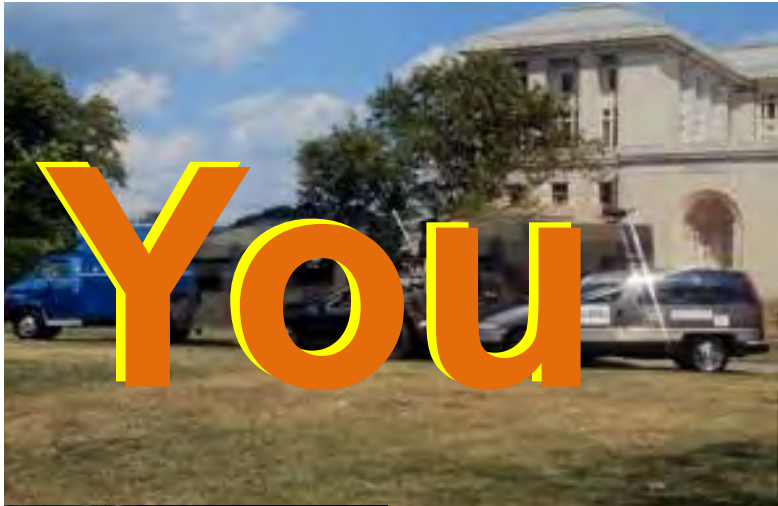
Entertainment Media

- Video games
- Special effects (algorithmic filters)
3D crowd imagery (movies with lots of digital "extras")
- Motion capture

You

Teach

Robotics!



Robotics - is a content organizer that allows you to teach many disciplines

Classroom robotics is about 15 years old. *Most robotics teachers are not trying to create future roboticists, they using robotics as a content organizer* to teach: engineering, math, CS, technological literacy...

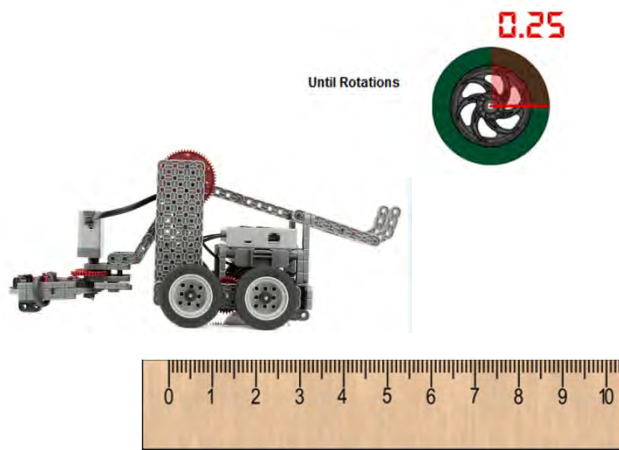
Lesson Learned – In order to be effective as a robotics teacher you have to foreground and measure the concept that you are trying to teach.

- Math
- Engineering Process
 - 21st Century Skill Sets
 - Cooperation/Collaboration
 - Teamwork
 - Problem Solving
 - Resource Allocation
 - Time Management
 - Electronics
 - Scientific Methods
 - Technological Literacy
 - Communications, English, and Language Arts
 - Persistence
- Computer Science

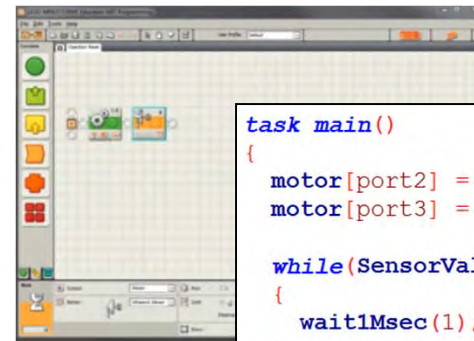


Robot Algebra Lesson Learned

A teacher needs to decide what to foreground in a robotic lesson, you can't teach everything



Math



```
task main()
{
  motor[port2] = 63;
  motor[port3] = 63;

  while(SensorValue[in8] < 45)
  {
    wait1Msec(1);
  }
}
```

Programming

Separate the Math from the Programming

Find Papers on teaching math with robotics at: www.cs2n.org/teachers/research

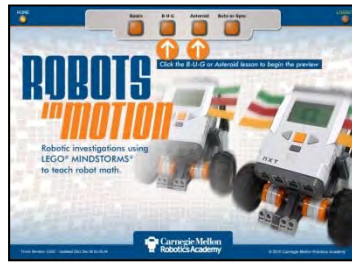




Teaching Math In Robotics Classrooms



Robots In Motion
Model Eliciting Activities



Cognitive Tutor Enabled
Robots In Motion

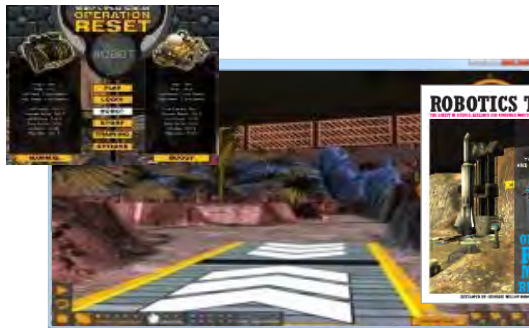


Abstraction Bridge
Word Problems



Math Enabled Robot
Virtual Worlds

Integrating Robot Math Into Gameplay



Operation Reset
Programming Game



Unlockable Badged
Achievements



Expedition Atlantis

Model Eliciting Activities

Cliff notes Version

Principles for MEA Design
Reality Principle - Will students make sense of the situation based on extensions of their own personal knowledge experience?
Model Construction - Does the task create the need for a mental model to be constructed (or modified, extended, or refined)?
Model Documentation - Will the response require students to explicitly reveal how they are thinking about the situation (define their goals, possible solutions, and work paths)?
Self Evaluation - Does the statement of the problem strongly suggest the criteria that enables students to judge for themselves when the responses are good enough?
Model Generalization - Is the model not only powerful for the specific situation and client at hand but also shareable with others and reusable in other situations?
Simple Prototype - Is the problem as simple as possible for the given instructional goals?

The problem is placed in a context that makes sense to kids

Kids have to come up with a mental model of the math

They need to describe the math

They have to evaluate either their solution or another kids solution

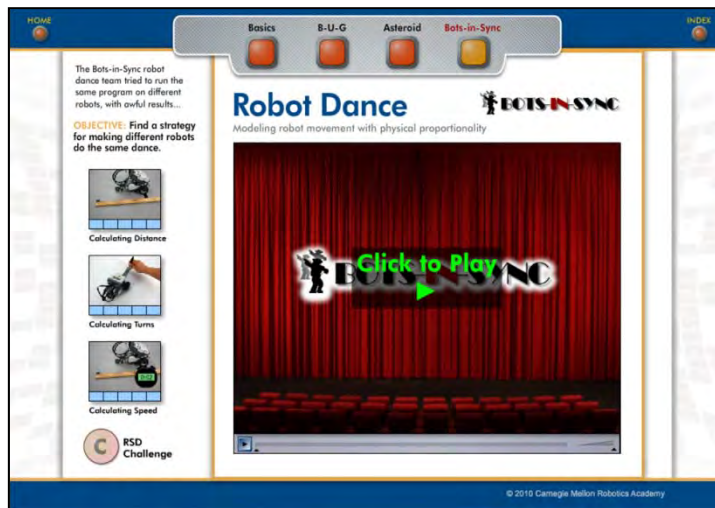
Their knowledge is generalized

Designed in a way that makes it easy for students to get started?

The Robot Synchronized Dancing Unit



Write programs to teach these 4 robots to dance in synchrony



Combines:

Robots
Music
Dancing
& Creativity

Teaches:

Proportional Distance
Proportional Turning
Proportional Speed

Measuring Distance, Angles, Rate, Scale, Conversion of Units

MEA - Robot Synchronized Dancing

Students have to Create a Mathematical Toolkit

Create a “how to” toolkit that the *Bots-N-Sync* captain can use to modify submitted dance routine programs so that all of the dancers do the routines in sync with each other. New dance routines are submitted often and new dancers will be joining the team regularly. So, a good toolkit would work for the current dance routine, but an ideal toolkit would be easy to use or adapt for new routines and new robots. An ideal toolkit would also include explanations of why the solution works, so the captain can easily understand how it works and how it can be adapted later for other similar situations. Your toolkit can utilize words, numbers, graphs, pictures, and/or any other form that effectively conveys your ideas and meets the needs of your client, the *Bots-N-Sync* captain.

The Better Deal

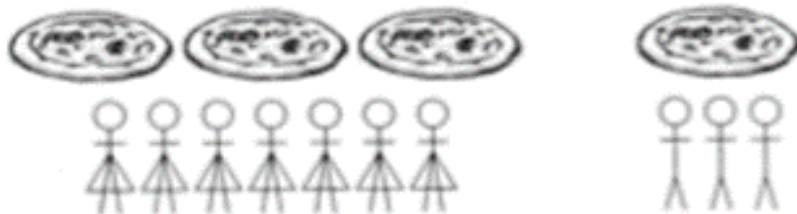
Abstraction Bridge Example

The Better Deal

Name _____

Directions: Show all work, describe how you got the answer using mathematics and words, and circle your final answer.

The Problem: Who gets more pizza, a girl or a boy? *Explain your answer using math and words.*



Make connections between robot math and other math

St. Patrick's Day

Abstraction Bridge Example

Integrate Abstraction Bridge questions into student activities

St. Patrick's Day

Name _____

Directions: Show all work, describe how you got the answer using mathematics and words, and circle your final answer.

The Problem: Will was responsible for marking the route for the St. Patrick's Day Parade downtown. He was asked to put green tape in a circle around each telephone pole on the route. There are 150 telephone poles on the route and each telephone pole is 35 centimeters wide. How many rolls of tape does Will need to finish the job if each roll is 50 meters long? *Explain your answer using math and words.*

Better Deal 2

Abstraction Bridge Example

The Better Deal 2

Name _____

Directions: Show all work, describe how you got the answer using mathematics and words, and circle your final answer.

The Problem: Two girls got into the theater on State Street for \$3.00. Five boys got into the theater on Main Street for \$6.00. Which group, the girls or the boys, got the better deal? *Explain your answer using math and words.*

How are Abstraction Bridges Used?

Integrate Abstraction Bridge questions into student activities

To Foreground the Math

- Used as a warm-up activity – as kids are filing into class the problem is on the board, they learn that as soon as the problem is finished they start the work.
- Single problem homework assignments
- They serve as formative assessment tools

Three Scaffolded MEAs



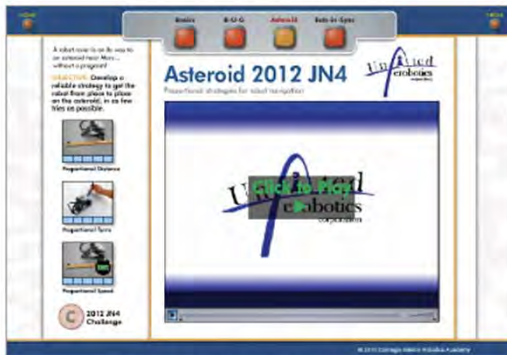
Measurement

iKnowMATION Toy Company

Students are given the job of developing testing procedures designed to ensure that each iKnowMATION toy robot:

- Travels the correct distance
- Turns the correct angle
- Travels the correct speed

← Measurement



Proportional Distance

United Areobotics Corporation

Students are given the mission of programming a remote robot that has different physical sizes than the robot that they typically work with. They only have one chance to program the robot and it must:

- Travel exact distances
- Turn precise angles
- Travel correct speeds

← Proportional Distance



Direct and Inverse Proportional Relationships

Bots-n-Sync Dance Company

Bots-n-Sync needs help. They have lots of different size robots that they need to teach to dance in synchrony. Students are tasked to develop a set of formulas that allow the programmers to teach the dancing robots to:

- Go the same distances
- Turn the same angles
- Dance the same speeds

← Direct and Inverse Proportional Relationships

Printable PDFs are at the RA website

Carnegie Mellon Robotics Academy About | Contact | Site | Botline Newsletter
Search

HOME **Educators** LEGO VEX Curriculum Electronics Blog Support Store

Get Started | Professional Development | Community | Research



- Robotics Academy / LRDC
- Using LEGO Materials
- Why Tech Ed?
- General Education



Research

Robot Algebra



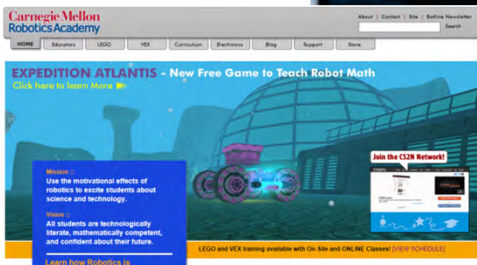
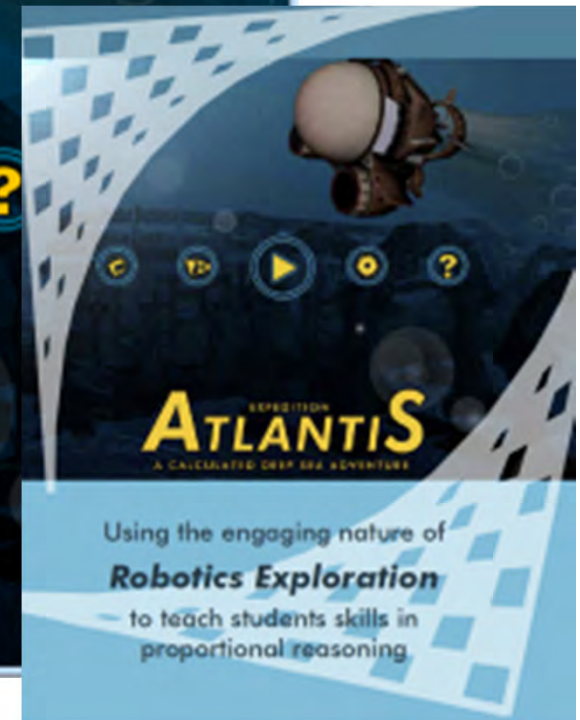
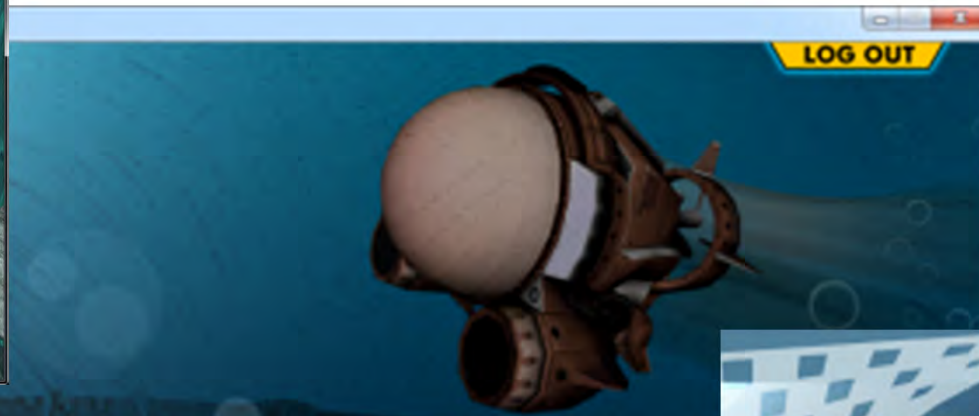
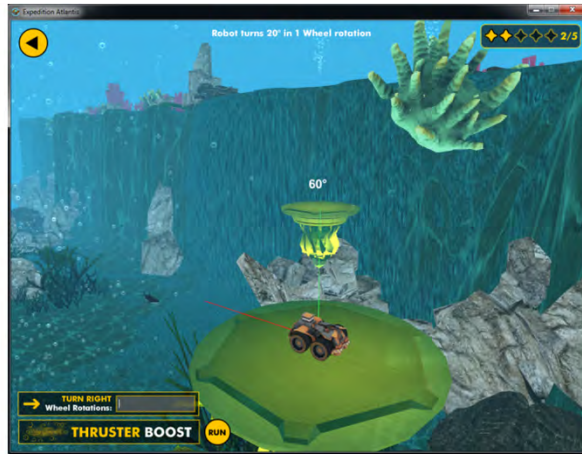
Click on the following links to access more information and classroom material

- Robot Algebra Project: Introduction
- Robot Algebra Project
- Initial Robotics Education Research
- Friction, Ratios and Proportions
- Lessons Learned with Teachers
- Abstraction Bridges
- Design Based Learning Units (DBLs)
- Robot Algebra Part 1: Robot Dancing (Example DBL)
- Robots In Motion Version One Curriculum

Check out our latest math game for FREE!



Atlantis – Free at the Robotics Academy Website



http://www.education.rec.ri.cmu.edu/content/educators/research/robot_algebra/index.htm

Engineering Education/Robotics Competitions

There are over 30,000 US Robotics Teams involved with the following competitions:

- BattleBots
- BEST
- BotBall
- FIRST FRC, FTC, FLL
- REC Foundation VEX, VEXIQ
- Trinity Fire Fighting
- TSA

The Competition Format Teaches:

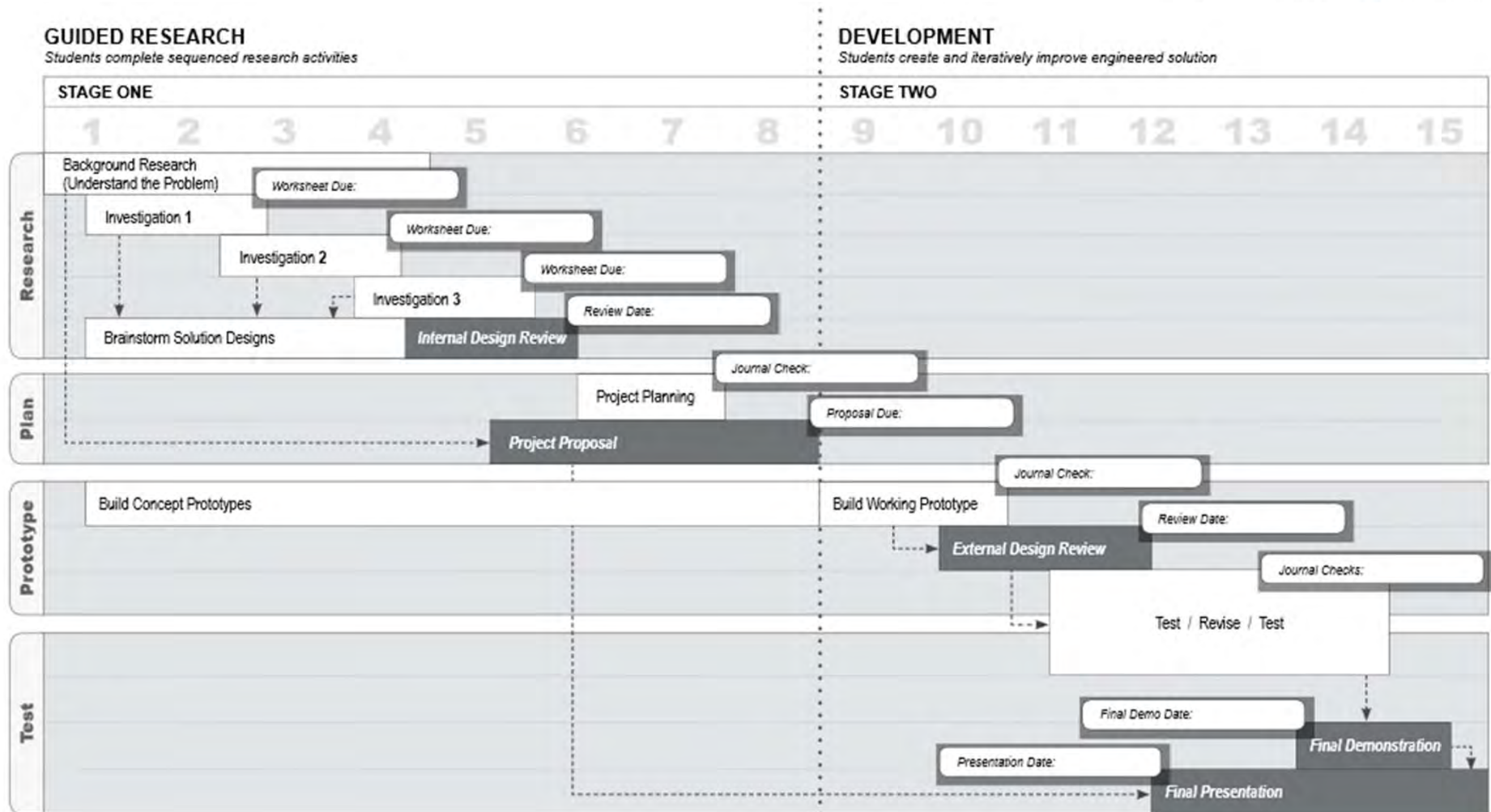
- Engineering Process
- 21st Century Skill Sets
 - Cooperation/Collaboration
 - Teamwork
 - Problem Solving
 - Resource Allocation
 - Time Management
- Electronics
- Scientific Methods
- Technological Literacy
- Communications, English, and Language Arts
- Persistence

Engineering Education/Robotics Competitions

Robotics Engineering Project Planner



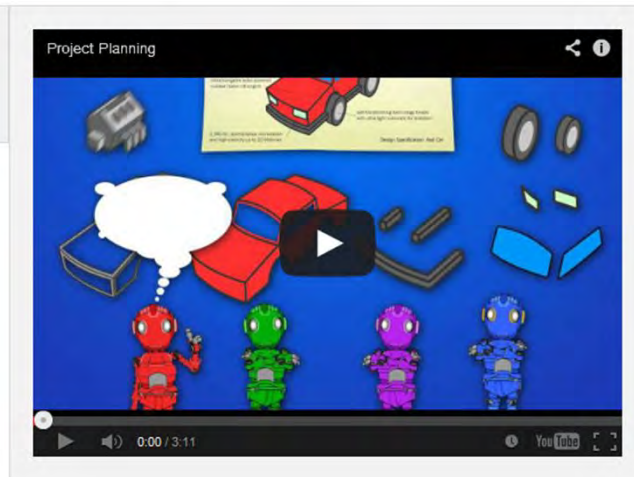
□ = Assignment ■ = Deliverable



Engineering Education/Robotics Competitions

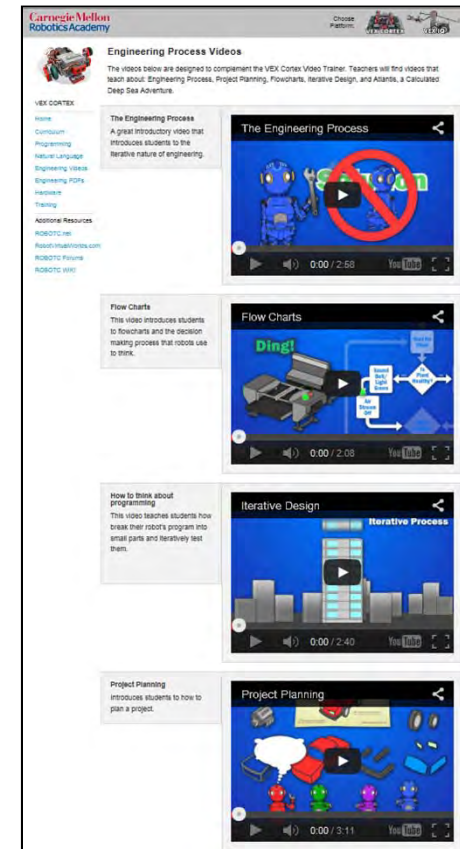
Project Planning

Introduces students to how to plan a project.



The Engineering Process

A great introductory video that introduces students to the iterative nature of engineering.



These videos and others are free at www.vexteacher.com

Engineering Education/Robotics Competitions

The screenshot shows the 'Project Management' section of the ROBOTC website. At the top, there is a navigation bar with links: HOME, Fundamentals, Setup, Movement, Remote Control, Sensing, Resources, and INDEX. Below the navigation bar, a sidebar on the left contains a list of links: Safety, Project Management, Assessment Rubrics, Introduction to Programming, Natural Language, and VEX Hardware. The main content area is titled 'Project Management' and includes a sub-section 'Project Planning Documents' with a grid of document icons: Team Building, Design Reviews, Gantt Chart, Understanding the Problem, Organizational Matrix Ideas, PERT Chart, Brainstorming, Recording Progress, and Preparing for a Competition. Below this grid, there are two more document icons: 'Engineering Process Reference' and 'Keeping an Engineering Journal'. A 'Video Trainer using ROBOTC' section is partially visible at the bottom.

The screenshot shows the main page of the ROBOTC website. The header includes the ROBOTC logo, navigation links (Download, Support, Education, Community, Purchase), a search bar, and a 'Change Region' dropdown set to USA. The main content area features a large video player for 'ROBOT VIRTUAL WORLDS LEVEL BUILDER' with a 'Real World Challenge' and 'Drag and Drop Interface'. Below the video player are four smaller video thumbnails. To the right of the video player, there is a 'Free Trial Download' button and a list of features: 'Blazing fast High Performance Firmware' and 'Interactive Run-Time Debugger'. Below the video player, there are four navigation tabs: ROBOTC Forums, Natural Language Programming, Robot Virtual Worlds, and Robot Store. The 'Latest Features' section lists 'Natural Language Programming [Details]' and 'Robot Virtual Worlds [Details]'. The 'ROBOTC Curriculum' section displays four curriculum covers: 'VEX Cortex Video Trainer for ROBOTC', 'ROBOTC Curriculum for TETRIX and LEGO MINDSTORMS', 'Teaching ROBOTC for IFI VEX', and 'Teaching ROBOTC for LEGO MINDSTORMS'.

The full ROBOTC for LEGO and VEX Curriculums are available for free at www.robotc.net

Is Computer Science Important to Tech Ed?

Transportation

- Electronic flight control systems (autopilot, fly-by-wire)
- Route planning (which planes/trucks, which routes)
- Inventory tracking (barcode scanners, RFID, satellites, web interface)
- Airport traffic control

Business & Finance

- High-speed stock trading (algorithms, online trading system)
- Business model and market simulations
- Accounting Software
- E-commerce/Credit Card Processing
- Internet Storefronts
- Router/Network Devices
- Video Monitors/Onscreen Displays

Health Care Equipment

- Heart Monitors
- CT Scanners
- Patient Monitoring
- Medicine

Security

- Security scanners (airports, sports arenas)
- Red light cameras
- Credit card fraud/theft detection
- Facial recognition and identification
- Border sensor networks

Green Homes/Buildings

- "Quality of Life" Smart Homes
 - Remote access to senior citizen homes
 - Smart kitchens and bathrooms
 - Medicine dispensers and monitors
- Thermostats HVAC
- Solar/Wind/Geothermal Systems

Embedded Systems

- Cars
- Cell Phones
- Modern Appliances (microwaves, refrigerators, stoves, dryers, washers)
- Industry/Factory automation
- Robots
- CNC machinery

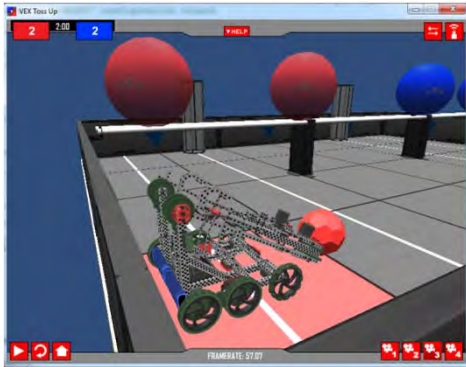
Entertainment Media

- Video games
- Special effects (algorithmic filters)
3D crowd imagery (movies with lots of digital "extras")
- Motion capture

All Emerging Technologies will be Programmed

Teaching Computer Science via Robotics

Toss Up



Block Party



The Actual Game Simulation



A Modified Game that can be Challenged using Autonomous only mode

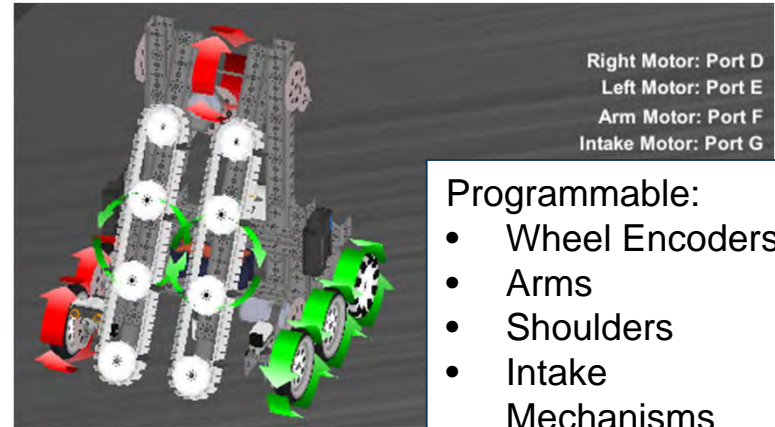
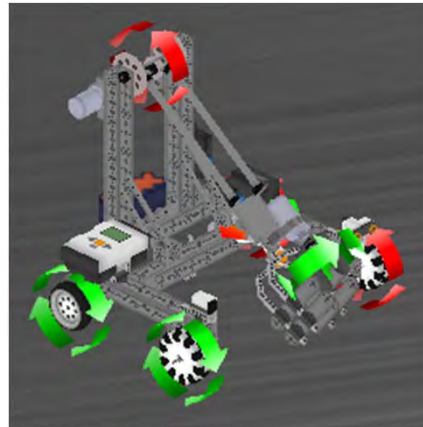
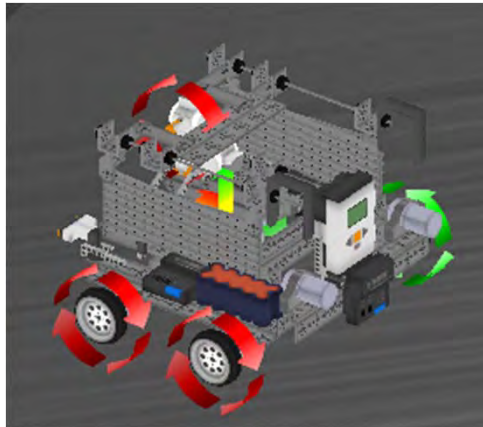
Supporting Teaching Programming in Classrooms

For the past two seasons we've made two versions of the game. At the top is the actual *FTC Game Simulation* that uses allows both autonomous and driver control.

At the bottom is a specially designed game that we've developed specifically to teach robot programming. *This game uses all of the elements of the FTC game, but includes additional features that allows the game to be challenged in an autonomous only mode.*

Multiple Programmable Robot Types

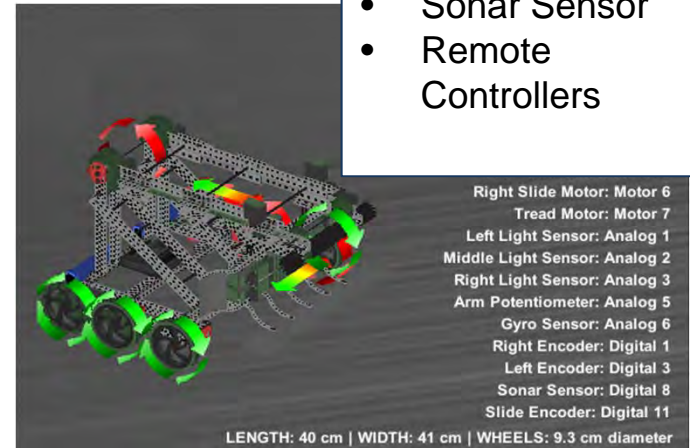
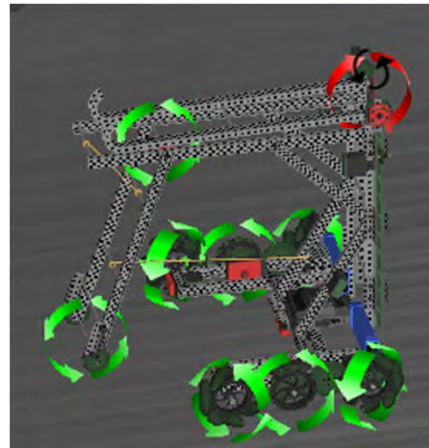
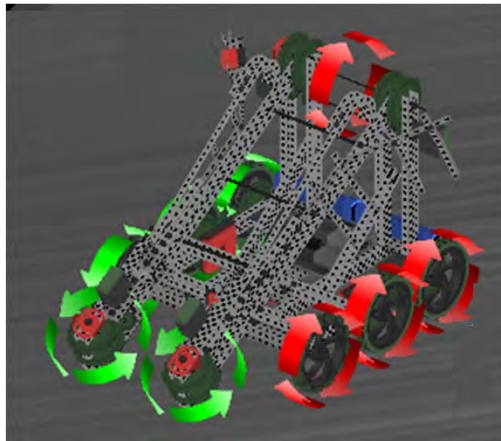
FTC Robots



Right Motor: Port D
 Left Motor: Port E
 Arm Motor: Port F
 Intake Motor: Port G

- Programmable:
- Wheel Encoders
 - Arms
 - Shoulders
 - Intake Mechanisms
 - Gyro Sensor
 - Light Sensor
 - Sonar Sensor
 - Remote Controllers

VEX Robots



Right Slide Motor: Motor 6
 Tread Motor: Motor 7
 Left Light Sensor: Analog 1
 Middle Light Sensor: Analog 2
 Right Light Sensor: Analog 3
 Arm Potentiometer: Analog 5
 Gyro Sensor: Analog 6
 Right Encoder: Digital 1
 Left Encoder: Digital 3
 Sonar Sensor: Digital 8
 Slide Encoder: Digital 11

LENGTH: 40 cm | WIDTH: 41 cm | WHEELS: 9.3 cm diameter

Computer Science Education Act – This Could Include Tech Ed

LOC.GOV CONGRESS.GOV COPYRIGHT.GOV LIBRARY OF CONGRESS

CONGRESS.GOV^{BETA} United States Legislative Information

Legislation | Congressional Record | Committees | Members | The Legislative Process About | Glossary | Help / Contact

Search All Legislation [v] Examples: hr5, sres9, "health care" GO [Search Tips](#)

[Home](#) > [Legislation](#) > [113th Congress](#) > H.R.2536 [Print](#) [Subscribe](#) [Share/Save](#) [Give Feedback](#)

H.R.2536 - Computer Science Education Act of 2013

113th Congress (2013-2014)

BILL

Sponsor: [Rep. Brooks, Susan W. \[R-IN-5\]](#) (Introduced 06/27/2013)

Cosponsors: [24](#)

Latest Action: 09/13/2013 Referred to the Subcommittee on Early Childhood, Elementary, and Secondary Education.

Major Recorded Votes: There are no Roll Call votes for this bill

Tracker:

Introduced > Passed House > Passed Senate > To President > Became Law

Primary Subject:
Education
[View all subjects >](#)

9/13/2013 – Referred to Subcommittee on Education

Future CS K-12STEM Offerings



The College Board

Computer Science: Principles

Computational Thinking
Practices

Big Ideas, Key Concepts, and
Supporting Concepts

© 2012 The College Board. All rights reserved.

Computer Science: Principles is a pilot course under development. It is not an official Advanced Placement course currently being offered by the College Board.

This document is based upon work supported by the National Science Foundation, grant CNS-0938336. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.



The National Science Foundation Provides \$5.2 Million Grant to Create New Advanced Placement® Computer Science Course and Exam

Innovative College-Level AP® Course Created To Increase Interest In Computing Degrees And Careers, Particularly Among Female And Minority Students ♦



New Course and Exam — AP® Computer Science: Principles to Launch in Academic Year 2016–17

- Overview
- Development
- Higher Education Acceptance
- Curriculum and Assessment

The College Board plans to launch a new course, AP Computer Science Principles (CSP), in fall 2016, with the first AP CSP Exam scheduled to be administered in May 2017.

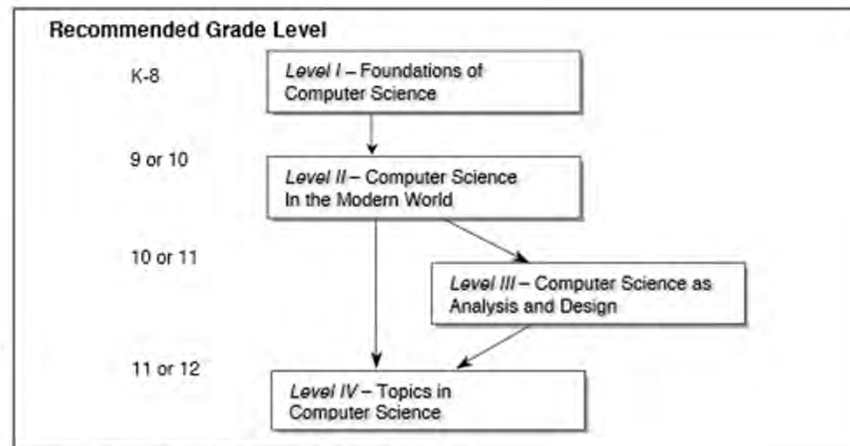


Figure 1. Structure of a K-12 Computer Science Curriculum

This Could Be Us



Exploring
Computer
Science

Exploring Computer Science With Robotics



Carnegie Mellon
Robotics Academy

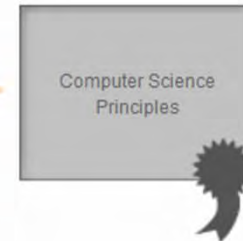
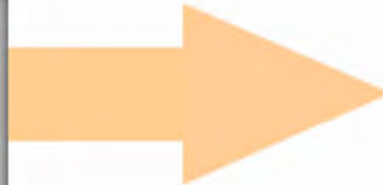
joeyEinstein's Coursework



Basic Programming
Concepts



Data and Algorithms



joeyEinstein's Artifacts and Evidence



Creativity



Abstraction



Data



Algorithms



Programming



Internet



Impact

Recruiting Partner Schools

To prepare over 1,000 Highly Competent robotics instructors able to *teach students how to use robotics as an organizer to teach students engineering process and to introduce students to the CS Principles Computational Thinking* Practices identified as important for all students to understand (Astrachan, et al., 2009-2013); and to do so through their existing robotics classes.

Recruiting Partner Schools

Using Robotics to Teach Big Ideas of CS

The CS computational artifact for:

- **Creativity** could be: a robot, a webpage, a logo for their team;
- **Abstraction**: pseudocode, variables, or a map;
- **Data**: the human genome, statistics on global warming, or collecting feedback from sensors via data logging;
- **Algorithms**: a flowchart, an algebraic expression, or an algorithm they developed to calculate a threshold value.
- **Programming**: robots that complete a variety of tasks
- **Internet and Impact**: Robotics competitions also involve team organization, fundraising, marketing, and team promotion, providing additional opportunities for students to create computational artifacts.

joeyEinstein's Artifacts and Evidence



Creativity



Abstraction



Data



Algorithms



Programming



Internet



Impact

What's in it for you?

- A Certification that could lead to Job Security
- Free training
- Free software
- An opportunity to be part of a research project

Certifying Teachers, Coaches, Mentors, and Students

Online Training Tools



Online LMS



Extensive Resources



Competition Specific Tools

Automated Assessment Tools



RVW Curriculum Companion



CS2N Groups



CS2N Learns



RVW CS2N Login

The Certification



Computer Science and Robotics Certification

- Algorithmic Thinking
- Syntax, Statements, and Structures
- Robot Mathematics
- Control and Feedback of Motors and Sensors
- Boolean Algebra/Conditional Statements
- Variables/Functions/Parameters
- Pedagogy
- Programming User Interfaces
 - Buttons
 - Joystick
- Troubleshooting/Debugging Code
- Arrays
- Case Statements
- Multi-Tasking
- Multi-Robot Communications
- Pointers
- Recursion

Badge Pathways to Certifications



Pictured above is the ROBOTC for MINDSTORMS Robotics Mastery Badge Pathway that leads to the certification



Pictured above is the ROBOTC VEX Robotics Mastery Badge Pathway that leads to the certification



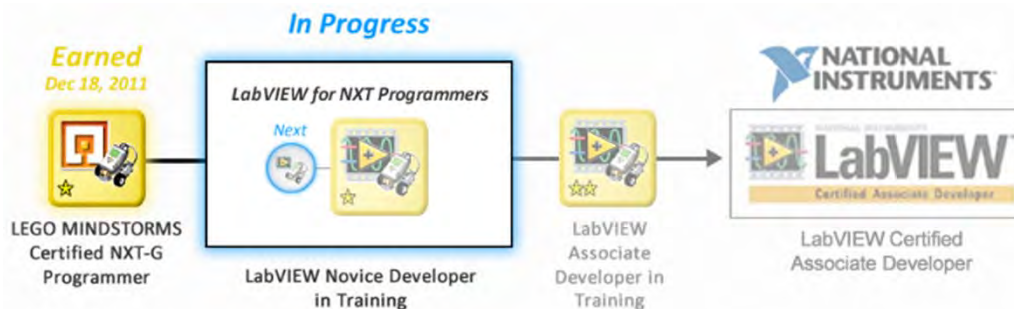
Robotics Academy Certified Robotics Instructors



+



=




Free VEX Resources






www.vexteacher.com






Choose Platform:









Welcome to VEXTeacher.com for VEX CORTEX

The resources found on this site will provide you with all of the tools you need in order to successfully teach with the VEX Cortex Robotics platform. Use the platform selector at the top of the page to see the resources for the VEX IQ hardware platform.



Welcome to VEXTeacher.com for VEX IQ

The resources found on this site will provide you with all of the tools that you need in order to successfully teach with the VEXIQ Robotics platform. Use the platform selector at the top of the page to see resources for the VEX Cortex hardware platform.


VEX CORTEX

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- [Curriculum](#)
- [Programming](#)
- [Natural Language](#)
- [Engineering Videos](#)
- [Engineering PDFs](#)
- [Hardware](#)
- [Training](#)

Additional Resources


- [ROBOTC.net](#)
- [RobotVirtualWorlds.com](#)
- [ROBOTC Forums](#)
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Expedition Atlantis



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Additional Resources

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What is VEX IQ?



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Curriculum



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Free LEGO Resources

www.robotc.net

www.nxteachers.com



www.NXTeachers.com
Carnegie Mellon University Robotics Academy

NXT Professional Development
Online Teacher Training Classes.
[Click Here](#)

Science & Data Logging CD-Rom
[Web Resources](#)

Robotics Engineering Vol. I
[Teachers Guide content](#)

NXT Curriculum Previews
[Robotics Eng. Vol. I. Intro to Mobile Robotics](#)

[Robotics Eng. Vol. II. Guided Research](#)

[Teaching ROBOTC for LEGO MINDSTORMS](#)

[Teaching ROBOTC for TETRIX and LEGO](#)

NXT Video Trainer 2.0

[Preview Overview](#)

[Deep Space Terraformers Camp-on-a-Disk](#)

ROBOTC.net Website

Legacy RCX Curriculum
[Text Curriculum](#)
Robotics Educator Companion
Printable PDF document.

[English RCX Curriculum](#)
Content from 2000

[Spanish RCX Curriculum](#)
Content from 2000

[ROBOLAB Video Trainer](#)

Legacy RCX previews
[Robotics Educator](#)
[Robotics Workbooks](#)
[Science Investigator](#)

SUPPORT

Go to [SUPPORT](#) to access files described below.

Mac OS X Downloads

For the **NXT Video Trainer 2.0** / Mac
NXT2 does not officially support macOS X 10.4. This installer is provided as a convenience for those who require it.

For **Academy Flash-Based Products** / Mac
This general-purpose application generates or re-generates the appropriate Flash Safe File on that machine.

www.education.rec.ri.cmu.edu

www.cs2n.org



Free Arduino Resources

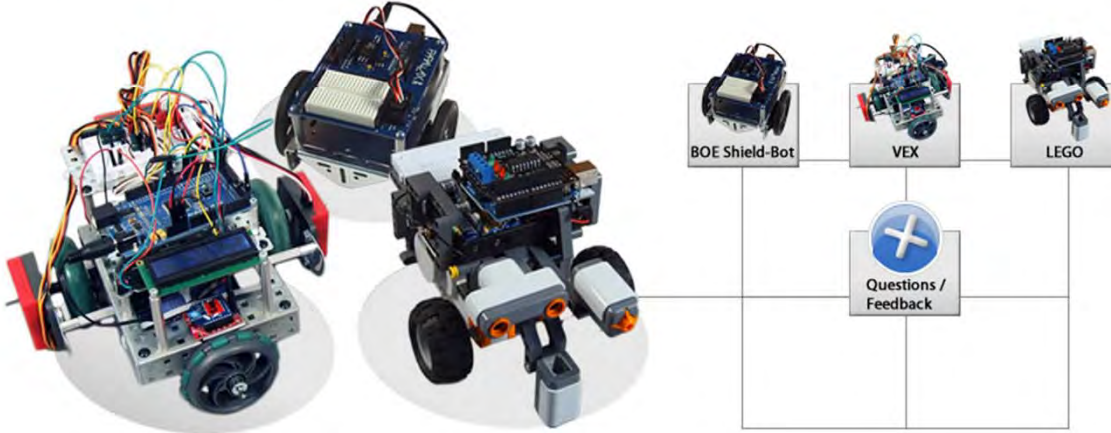
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BOE Shield-Bot
VEX
LEGO

Electronics

Here are resources that show you how to use the Arduino with popular educational robotics platforms such as the BOE Shield-Bot, VEX, and LEGO MINDSTORMS.



The Electronics material is currently in development. The information you see will continually change.

Bump Switch

Bump switches allow you to perform behaviors based on a robot's view. Learn to program "bumpstart" on your robot to manipulate a robot's behavior.

1) What is a Bump Switch?

Parts:

1. Complete BSS Shield-Bot robot with Arduino Shield
1. Variable resistor of different lengths and colors
1. ATDS Resistor (100 Ohms)

See all Requirements

2) Controlling an LED using a bump switch

Learn how to control an LED using a bump switch.

3) Bumping a program with a bump switch

Connect a bump switch to the Arduino to trigger a program.

4) Detect and avoid obstacles

Using a bump switch to detect and avoid obstacles.

5) Navigating a maze using a bump switch

Using the bump switch to navigate a maze.

Ultrasonic Sensor

Ultrasonic sensors allow you to "see" walls or obstacles in front of you. Learn how to use light your robot around these obstacles.

1) What is an Ultrasonic Sensor?

Parts:

1. Complete BSS Shield-Bot robot with Arduino Shield
1. Variable resistor of different lengths and colors
1. ATDS Resistor (100 Ohms)
1. LED of any color

2) Controlling an Ultrasonic Sensor

Learn how to control an ultrasonic sensor.

3) Programming to Avoid Obstacles

Learn how to program your robot to avoid obstacles.

4) Detecting and Avoid Obstacles

Learn how to detect and avoid obstacles.

5) Navigating a maze using an ultrasonic sensor

Using an ultrasonic sensor to navigate a maze.

Light Sensor

Light sensors allow robots to follow (or avoid) light sources. Learn how light sensors work and how to program your robot to use them!

1) What is a Light Sensor?

Parts:

1. Complete BSS Shield-Bot robot with Arduino Shield
1. ATDS Resistor (100 Ohms)
1. LED of any color
1. Phototransistor

2) Connecting a Light Sensor

Learn how to connect a light sensor to the BSS Shield-Bot.

3) Program to find light

Program your robot to find light sources using the light sensor.

4) Program to avoid light

Avoid light by programming your robot to avoid light sources.

Electronics > BOE Shield-Bot
For more projects and resources see the [ROBOTC Wiki](#)

Table of Contents

1. Getting Started
2. Resistors
3. LEDs
4. Robot Motion
5. Bump Switch
6. Ultrasonic Sensor
7. Light Sensor
8. IR Sensor

Getting Started

Look at the Arduino Uno, how to configure it, and how to use it.

1) Getting Started

Parts:

1. ROBOTC
1. Arduino Shield Kit

2) Installing ROBOTC

ROBOTC will need to be installed on the computer before you can use it to program the Arduino.

3) Installing the Shields

Install the Arduino and get the shields you need for your project.

4) Configuring the code

Check the Arduino and ROBOTC must be configured for the Arduino Uno.

Resistors

An overview of resistors and how they work.

1) What is a Resistor?

A resistor is an electrical component that limits or regulates the flow of electrical current in a circuit.

2) Reading a Resistor

To read a resistor's value, you need to know its color code.

3) Using a Resistor

When using a resistor, you need to know its value and how to connect it.

LEDs

An overview of LEDs, how they work, and sample projects on controlling LEDs.

1) What is an LED?

Parts:

1. Complete BSS Shield-Bot robot with Arduino Shield
1. Variable resistor of different lengths and colors
1. ATDS Resistor (100 Ohms)
1. LED of any color

2) How to use an LED

LEDs have polarity and must be connected correctly to the Arduino.

3) How to use an LED

Learn how to program the robot to control many LEDs.

4) How to use an LED

Learn how to program the robot to control many LEDs.

Robot Motion

Learn how to control a robot through a simple maze. This section provides projects that introduce motion and sensors.

1) What is a Light Sensor?

Learn how to use a light sensor to detect light.

2) Connecting a Light Sensor

Learn how to connect a light sensor to the BSS Shield-Bot.

3) Program to find light

Program your robot to find light sources using the light sensor.

4) Program to avoid light

Avoid light by programming your robot to avoid light sources.

IR Sensor

IR Sensors use Infra-Red (IR) light to emit and detect the amount of IR light that returns. Learn how to use them to detect objects.

1) What is an IR Sensor?

Parts:

1. Complete BSS Shield-Bot robot with Arduino Shield
1. ATDS Resistor (100 Ohms)
1. LED of any color
1. IR Sensor

2) Connecting an IR Sensor

Learn how to connect an IR sensor to the BSS Shield-Bot.

3) Program to detect an IR sensor

Learn how to program the robot to detect an IR sensor.

4) Program to avoid an IR sensor

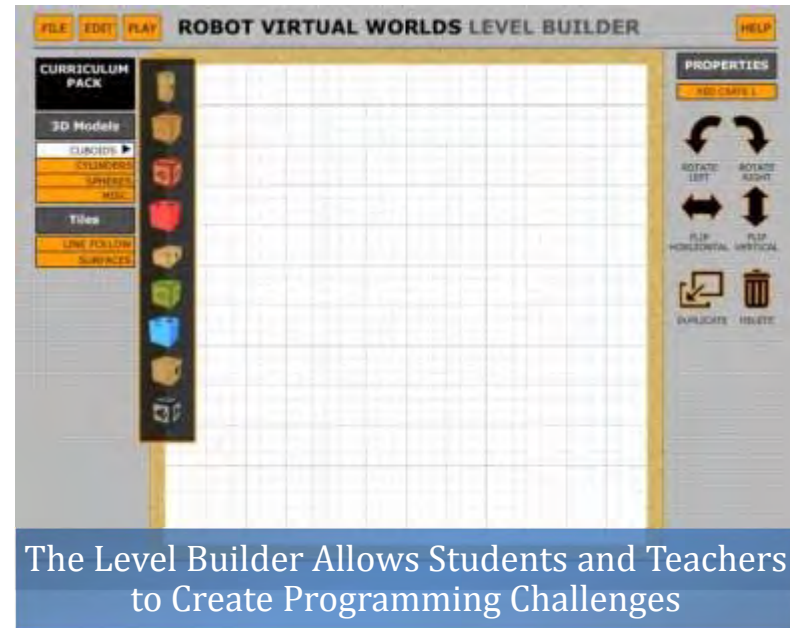
Avoid an IR sensor by programming your robot to avoid IR sensors.

Additional Virtual Tools

RVW Level Builder/Robot Transformer

The Level Builder enables teachers and students to make their own challenges using models that already exist.

Pictured below is an example of the NEW Robot Transformer Technology. Students can swap out robot parts and use them in the game.



The Level Builder Allows Students and Teachers to Create Programming Challenges





Picture above from the New Expedition Atlantis Game




Examples of User-Created Worlds

ROBOT VIRTUAL WORLDS OPERATION RESET

 Picked up a Charge Cube.
Drop it off at the Signal Tower

 Picked up a Crystal Cube.
Drop it off at the Crystal Pad


 Picked up a Fuel Cube.
Drop it off at the Fuel Pad




Robot Virtual Programming Games that work with NXT-G, LabVIEW, and ROBOTC



 TOWERS CHARGED

 CRYSTAL

 FUEL DELIVERED **FUEL**
ION PROPULSION

BADGES

MESSAGES

DASHBOARD

 ROBOTS

 1

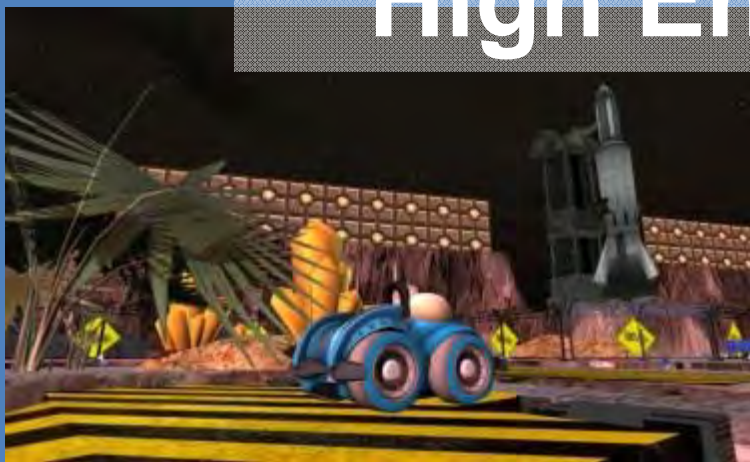
 2

 3

Robot Virtual Programming Games that now work with NXT-G, LabVIEW, and ROBOTC



High End Graphics



Story Driven
Gameplay

Additional Virtual Tools

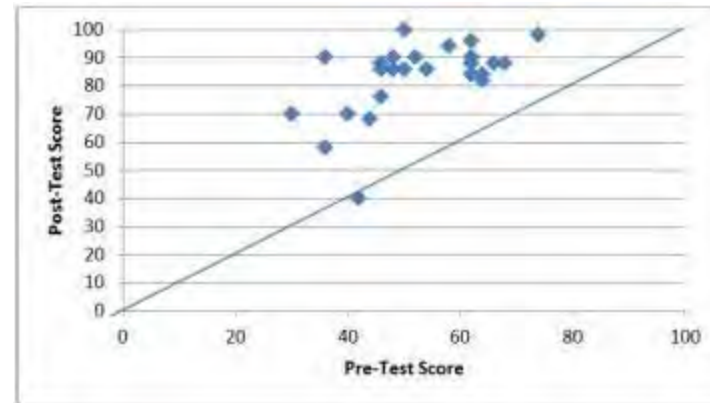
RVW Model Importer

The Model Importer allows students to draw parts using a modeling software (i.e. PTC, Autodesk, Solidworks, or Google Sketchup) and save the part as an FBX file type and import that part into their custom Robot Virtual World.

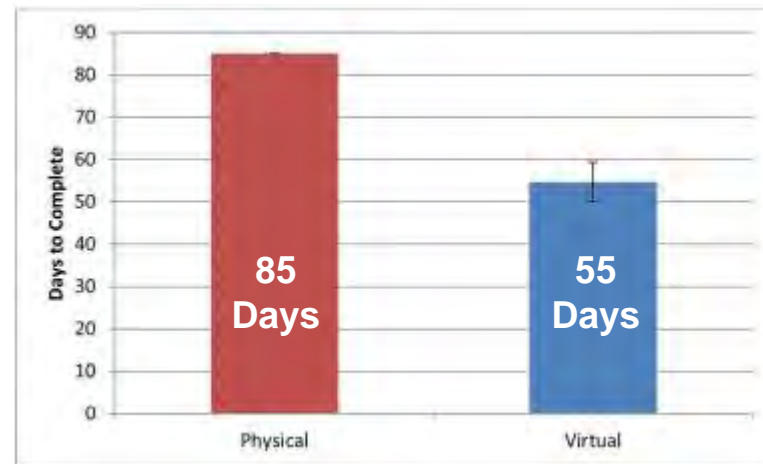
Videos that show how this works can be found at: www.robotvirtualworlds.com



Research Driven



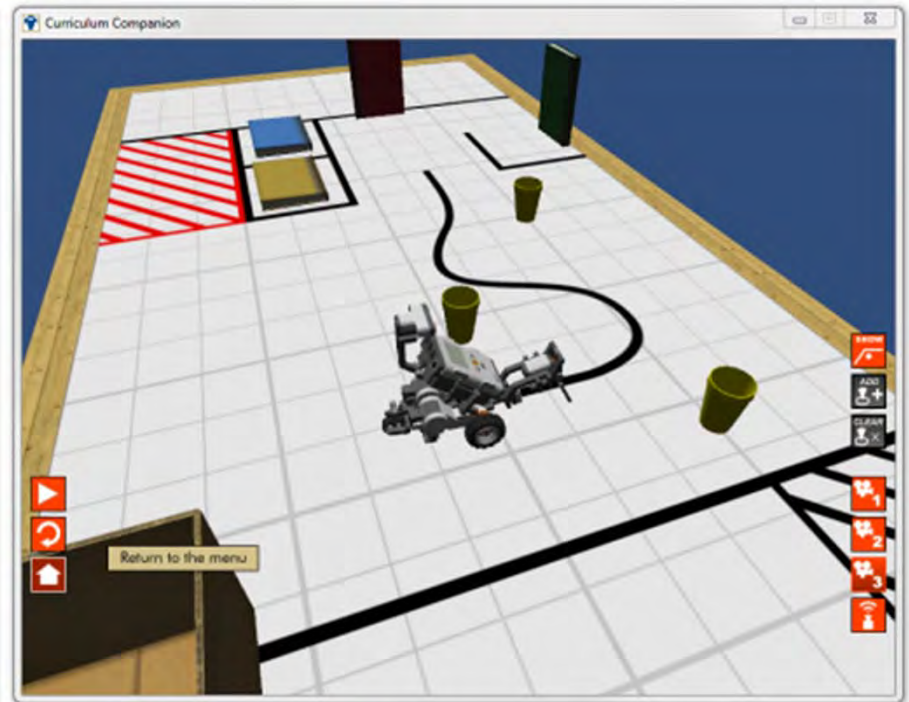
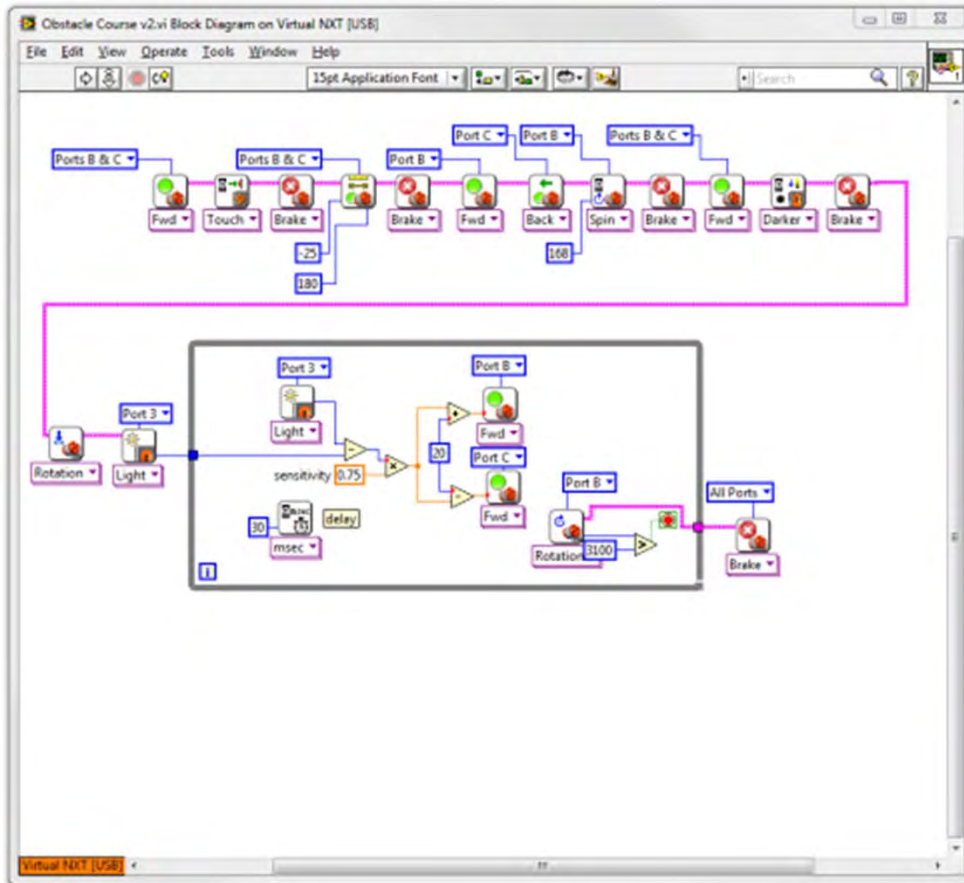
Pretest score vs posttest score. Points above the line improved on the posttest compared with the pretest.



Days taken to complete the course separated by condition.

Condition	Pre-Test Average	Post-Test Average	Average Time Taken
Physical	50.2 (SD=11.2)	82 (SD=10.6)	85.0 (SD=0.0)
Virtual	55.9 (SD=11.5)	84.5 (SD=14.6)	54.7 (SD=18.2)

RVW LabVIEW Tools January 2014



LabVIEW RVW Retail Pricing

Annual Single Seat - \$49

Annual Team License - \$149

Annual Classroom License - \$299

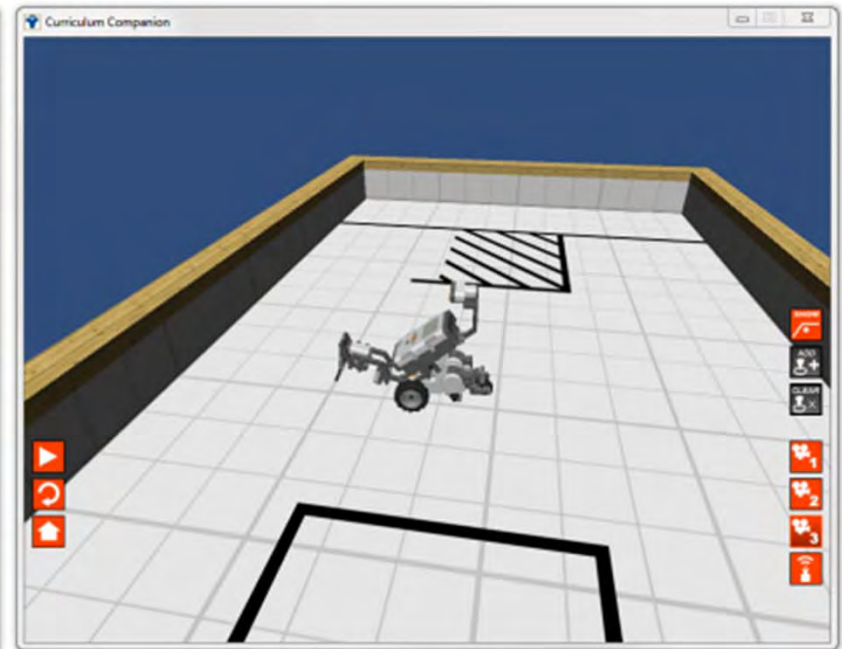
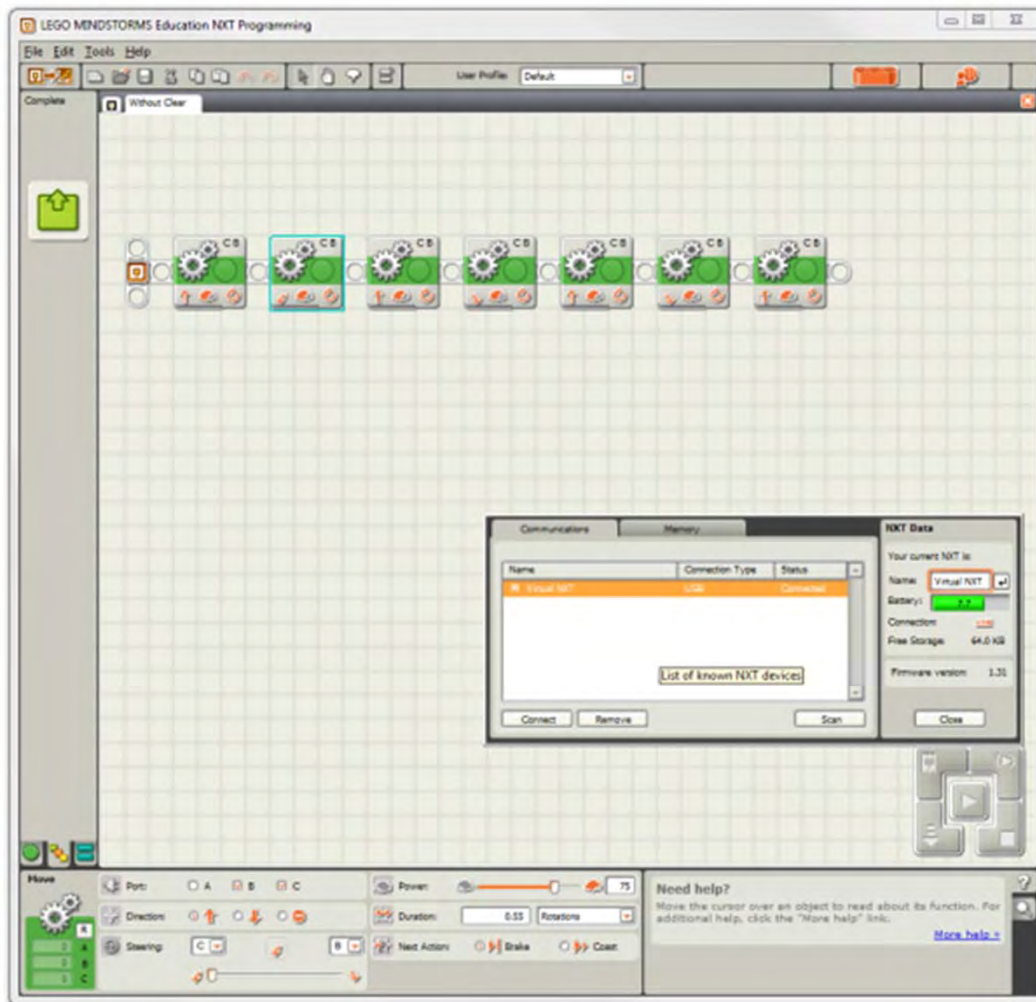
Perpetual Single Seat - \$79

Annual Team License - \$299

Annual Classroom License - \$599

Robomatter has been working with National Instruments and now has LabVIEW working with RVWs!

RVW NXT Software January 2014



NXT-G RVW Retail Pricing

Annual Single Seat - \$49

Annual Team License - \$149

Annual Classroom License - \$299

Perpetual Single Seat - \$79

Annual Team License - \$299

Annual Classroom License - \$599

Tools to Teach Programming Using Virtual Robots

Current Game-Like Worlds



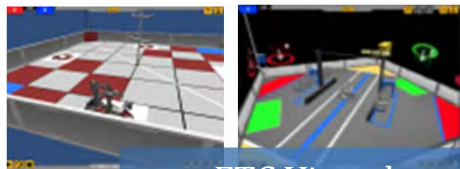
Palm Island



Ruins of Atlantis



Operation Reset

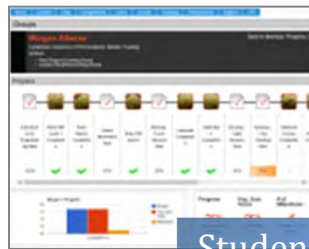


FTC Virtual
Programming Only
Competitions

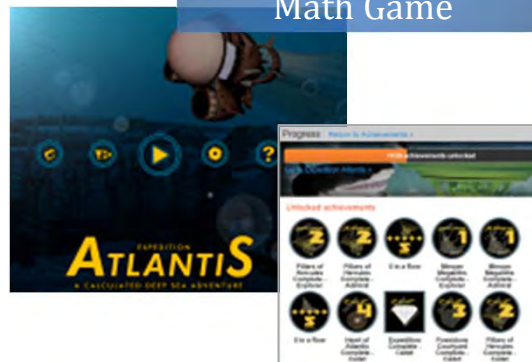
Automated Assessment Tools



RVW Curriculum
Companion



Student Earn Badges



Expedition Atlantis
Math Game

Certifying Teachers



Computer Science and
Robotics Certification

- Algorithmic Thinking
- Syntax, Statements, and Structures
- Robot Mathematics
- Control and Feedback of Motors and Sensors
- Boolean Algebra/Conditional Statements
- Variables/Functions/Parameters
- Pedagogy
- Programming User Interfaces
 - Buttons
 - Joystick
- Troubleshooting/Debugging Code
- Arrays
- Case Statements
- Multi-Tasking
- Multi-Robot Communications
- Pointers
- Recursion

Teacher/Mentor Classroom View

ES2N Computer Science Student Network

Home Content Blog Competitions Users Groups Tracking Researchers Support API

Groups

Robot Virtual Worlds for VEX Research Study [Back to Seabury Hall Spartanbots >](#)

Actions

- Export to CSV (Coming Soon)

	Introduct.. ming Quiz	Moving Fo... ward Quiz	Speed and... tion Quiz	Sentry Si... ompletion	Shaft Enc... ders Quiz	Basketbal.. ompletion	Automated ... ning Quiz	Labyrinth.. ompletion	Behaviors ... ions Quiz	Function User
Taylor Faurie	90%	100%	100%	✓	90%	✓	90%	✓		
Lena Fox	100%	100%	90%	✓	100%	✓	80%	✓		
Thomas Hayashi	90%	100%	100%	✓	100%	✓	90%	✓		
Jordan Haylor	70%	90%	90%	✓	70%	✓	80%	✓	50%	✓
Brenden Heitzman	90%	90%	100%	✓	90%	✓	90%	✓		
Makena Jost	80%	80%	90%	✓	60%	✓	70%	✓		
Jonathon Jost	90%	90%	80%	✓	80%	✓	70%	✓		
Adam Lundblad	90%	100%	90%	✓	90%	✓	100%	✓		
Kyle Mackie	70%	90%	90%	✓	80%	✓	80%	✓		
Miles Malott	80%	80%	70%	✓	80%	✓	100%	✓		
Doug Martin	100%	100%	80%	--	70%	--	80%	--		
Olivia Pagel	100%	100%	90%	✓	90%	✓	100%	✓		
Miles Spee	80%	100%	90%	--	100%	✓	90%	--		
Reyn Stisher	90%	100%	100%	✓	80%	✓	100%	✓		
Milo Turner	100%	100%	90%	✓	100%	✓	100%	✓		

Click a student Name, Assessment Marker

Member Progress Teacher View

ES2N Computer Science Student Network

Home Content Blog Competitions Users Groups Tracking Researchers Support API

Groups

Jordan Haylor [Back to Member Progress >>](#)

Seabury Hall Spartanbots

Actions:

- Print Report [Coming Soon]
- Contact Student [Coming Soon]

Progress

Introduct.. ming Quiz	Moving Fo... ward Quiz	Speed and... tion Quiz	Sentry Si... ompletion	Shaft Enc... ders Quiz	Basketbal.. ompletion	Automated ... ning Quiz	Labyrinth.. ompletion	Behaviors ... ions Quiz	Function User
70%	90%	90%	✓	70%	✓	80%	✓	50%	✓

Jordan's Progress

Bar chart showing Jordan's Progress (88%), Avg. Quiz Score (76%), and # of Milestones (5) achieved out of a possible 7.

Progress 88% of assignments completed.

Avg. Quiz Score 76% on completed quizzes.

of Milestones 5 achieved out of a possible 7.

Individual Student Progress View

Teacher Grade Book View

Learn to Program using Virtual Worlds (VEX): View: Grader report

Grader report

Separate groups Seabury Hall Spartanbots

Names	First name	Last name	Learn to Program using Virtual Worlds	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX
Taylor	Taylor	tfourie13@seaburyhall.org	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Leah	Leah	l10st16@seaburyhall.org	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Thomas	Thomas	thayahi16@seaburyhall.org	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Brendan	Brendan	bheltzman13@seaburyhall.org	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Malena	Malena	mjost15@seaburyhall.org	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Adam	Adam	adundblad13@seaburyhall.org	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Kyle	Kyle	knack4e13@seaburyhall.org	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Milo	Milo	mturner16@seaburyhall.org	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Doug	Doug	dmartin13@seaburyhall.org	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Miles	Miles	mspee13@seaburyhall.org	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Group average			100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Overall average			100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

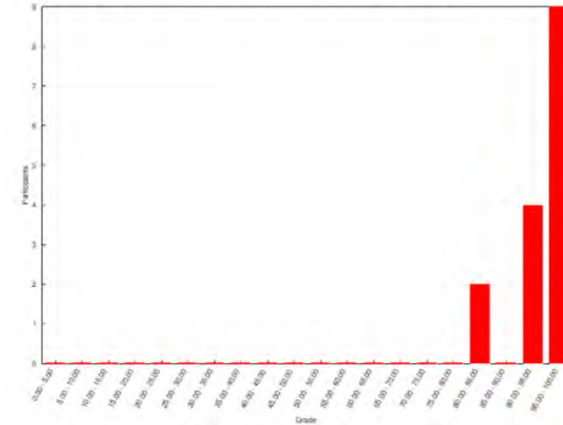
Teacher View of Student Grades

Student	Attempt	Score	Time	Grade	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	Getting Started with VEX	
Jonathon	Review attempt	100.00%	7 mins 56 secs	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
Thomas	Review attempt	100.00%	6 mins 26 secs	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
Taylor	Review attempt	100.00%	7 mins 55 secs	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
Malena	Review attempt	80.00%	3 mins 23 secs	80.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
Adam	Review attempt	100.00%	5 mins 5 secs	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
Brendan	Review attempt	90.00%	3 mins 47 secs	90.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
Milo	Review attempt	100.00%	2 mins 6 secs	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
Kyle	Review attempt	90.00%	3 mins 11 secs	90.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
Doug	Review attempt	100.00%	17 hours 2 mins	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
Miles	Review attempt	100.00%	2 mins 37 secs	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
Group average				94.47 (15)	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
Overall average				94.47 (15)	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

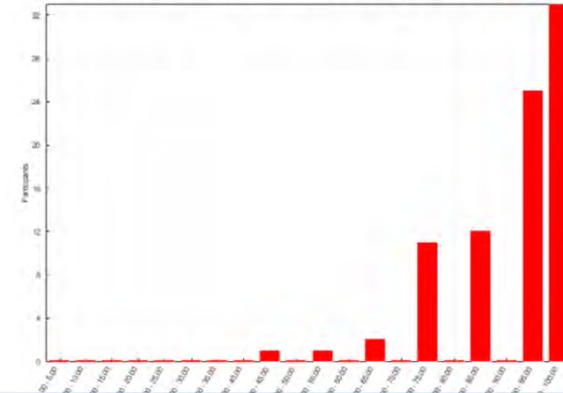
Teacher View of Student Quiz Results

Grade Distribution

Number of students in group achieving grade ranges



Overall number of students achieving grade ranges



Teacher View of Overall Results

Alfred State College	European University at St.Petersburg	Mississippi State University	Sacred Heart College	University Of Detroit Mercy
All Saints' College	Fairmont State University	Montana State University	San Bernardino College	University of Hawaii-Hilo
American University Of Sharjah,	FAMU-FSU College of Engineering	Montgomery County Community College	Southeast Missouri State University	University of Houston
Andrews University	Falukner State Community College	MT MAUNGANUI COLLEGE	Southern Polytechnic State University	University of Ljubljana
Baltimore City Community College	Florence-Darlington Technical College	Mt St Michael's College	St Louis Community College	University of Maryland
BARADENE COLLEGE OF THE SACRED HEART	Florida State University	Mt. San Antonio College	ST VIRGIL'S COLLEGE	University of Maryland Eastern Shore
Berkeley City College	Fox Valley Technical College	Murdoch University	St. Mary's University Texas	University of Minnesota
Broome Community College	Garrett College	NC A&T State University	ST. MICHAEL'S COLLEGE SCHOOL	University of Mississippi
Brown University	Georgia Tech - CEISMC Dep	NC State University	St. Peter's College	University Of North Carolina
Butler County Community College	Gonzaga University	New Mexico State University	State Center Community College District	University of North Florida
Butte College	GRAZ UNIVERSITY OF TECHNOLOGY	New York City College of Technology	Swinburne University of Technology	University of North Texas
Cal Poly Pomona,	Great Oaks Institute of Technology	New York Institute of Technology	Taft College	UNIVERSITY OF NOTRE DAME
California Lutheran University	Hamilton College	Niagara County Community College	Technical Career Institutes, Inc.	University of Nottingham
California University of PA	Hampton University	North Idaho College	Temple University	UNIVERSITY OF OTAGO
Campus School of Carlow Univeristy	HAWKER COLLEGE	Northern Alberta Institute of Technology	Texas A&M University	University of Passau/Germany
Canberra College	Herkimer		il College	University Of Pittsburgh
Carnegie Mellon	Houston C	<i>Over 240 Colleges Use ROBOTC!</i>		lgy Center @ Pulaski
Casper College	IMPERIAL			ITY
Community College Allegheny College	Imperial Variey College	Nova Scotia Community College	The Community College of Baltimore Co	University of South Carolina
Cecil College PA	Indian Hills Community College	Numazu College of Technology	The University of Texas	University of South Florida Lakeland
CECIL COLLEGE MD	Iowa State University	NYU-POLY	TOKYO INSTITUTE OF TECHNOLOGY	University of the West of England
Central Community College	Jackson State University	Oakland Community College	Tokyo Polytechnic University	UNIVERSITY OF THE WITWATERSRAND
Central Virginia Community College	Jacksonville State University	Oglala Lakota College	Trinity College	UNIVERSITY OF TOKYO
CENTRALIAN SENIOR COLLEGE	KEIO UNIVERSITY	Okanagan College	Tufts University	UNIVERSITY OF VICTORIA
Chicago State University	Kettering University	OKAYAMA UNIVERSITY OF SCIENCE	TUGGERANONG COLLEGE	University of Waterloo
Chisholm Catholic College	Kirkwood Community College	Oregon State University	University of CA DAVIS	University of West Georgia
City College of New York	Klamath Community College	Ormiston College	UCLA	University of Wisconsin-Eau Claire
Cleveland Heights-University	Lewis University	Owensboro Community & Technical College	UCSD	University of Wollongong in Dubai
College of Eastern Utah	LONE STAR COLLEGE-NORTH HARRIS	Pacific Technology School Santa Ana	Universidad Autonoma de Manizales	UNIVERSITY OF ZARAGOZA
COLLEGE OF ST. SCHOLASTICA	LONG BAY COLLEGE	Packer Collegiate Institute	UNIVERSIDAD DE GUADALAJARA	UPPSALA UNIVERSITET Phillipines
College of William and Mary	Longwood University	Palomar College	Universidad Politecnica de Valencia	UPPSALA UNIVERSITY Sweden
Colorado Academy	Los Angeles Harbor College	Passaic County Community College	UNIVERSIDAD TECNOLOGICA DE ALTAMIF	US NAVALACADEMY
Columbia State Community College	Los Angeles Harbor College	Passaic County Technical Institute	UNIVERSITAS SURABAYA	UTAH VALLEY UNIVERSITY
Community College of Beaver County	Lule University of Technology	Penn State	UNIVERSITÄT BREMEN, ZETEM	Victoria University of Wellington
Community College of Rhode Island	MAIZURU NATIONAL COLLEGE OF TECHNOLOGY	Polk State College	University of Alaska Fairbanks	Villanova University
Contra Costa College	MANCHESTER METROPOLITAN UNIVERSITY	PORTLAND STATE UNIVERSITY	University of Alberta	Waseda University
CSU, Bakersfield	Marist College	Purdue University	University of Auckland	Wayne State College
Cuyahoga Community College	MIT Lincoln Laboratory	Queen's University	UNIVERSITY OF BRADFORD	WELLINGTON INSTITUTE OF TECHNOLOGY
De La Salle Institute	McGill University	Queens College	University of Bridgeport	Wentworth Institute of Technology
DEL MAR COLLEGE	McHenry County College	Queensborough Community College	UNIVERSITY OF CALGARY	West Virginia University
Devry University	Medgar Evers College, CUNY	Rancho Santiago Community College	UNIVERSITY OF CAMBRIDGE	Westchester Community College
Drake University	Metropolitan Community College	Ranken Technical College	UNIVERSITY OF CANTABRIA	Western Kentucky University
Drexel University	Miami Dade College	Red Deer College	University of Central Oklahoma	Western Washington University
Duke University	MICHIGAN TECHNOLOGICAL UNIVERSITY	Reykjavik Technical College	University of Cincinnati	Westmoreland County Community Coll
Dutchess Community College	Mid-State Technical College	Rhode Island College	University Of Crete	Wheeling Jesuit University
Eastern Michigan University	Milwaukee School of Engineering	RIDLEY COLLEGE	UNIVERSITY OF DELAWARE	Widener University
ELON UNIVERSITY	Fond Du Lac Tribal & Community College	Rutgers University	University of Derby	Wodonga Senior Secondary College

Supporting Classrooms

Curriculum and RVW Curriculum Companion



Available for free online at www.robotc.net allowing students to complete homework. Most schools purchase the software for quick access to over 80 high resolution videos.



87 page curriculum guide that provide step-by-step instructions for teachers using the ROBOTC Curriculum

The Curriculum Companion includes over 40 virtual programming challenges that align with the robot programming challenges found in the ROBOTC Curriculum at the left.