- Introducing “Project Challenge-Trees” for Jr Botball®
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Introducing “Project Challenge-Trees” for Jr Botball®

This Paper is **for the educator & researcher breakout sessions** in the following categories:

- Curriculum for robotics education
  Tell us how you design and implement your curriculum in regular classroom or extracurricular activities.
- Informal robotics education
  Highlight your best practices and successes while sharing your ideas!

Topics Covered:

• **The Power of the Project Trees** (Creating an Active Learning Zone™ Robotics Space)

• **The Power of “Not Yet”** (Project Checklists & Pass/Try Again Coaching & Assessment)

• **Early Learning Advantage** (Creating a K-2 Pipeline for your Jr Botball Program)

Introduction:

Beginning Botball and Jr Botball Coaches often struggle with settting up a coaching environment (whether classroom or extracurricular), where *every child, in every team* is getting enough hands-on learning time *and coaching* to truly master and understanding the coding and engineering design concepts they will need to This presentation demonstrates how coaches can use Project Challenge-Trees™ to transform their Botball or Jr Botball Learning Environment to get the best of promote Curiosity, Creativity, and Confidence.

JBC Level 1: Teaching your robot to move

Math: Angles, Estimation, Metric system **Physics**: Polarity, Speed & Velocity
Computer Science: motor, msleep, printf, set_servo_position, enable_servos

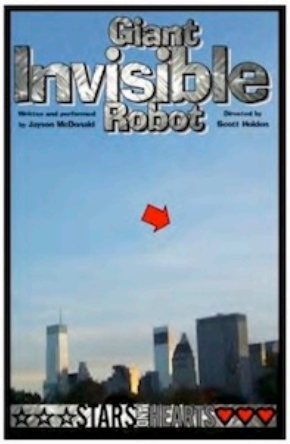
CALIFORNIA MATH & SCIENCE CHALLENGE

Final Challenge : Capture the Monster!

Use your navigation skills to safely traverse the city and capture the giant monster with your super robot!

Use all of your skills to solve this challenge.

Challenge 5: Collect resources 5
Learn to create and manipulate an effector(arm) to collect at least 20 robotic resources throughout the city. Your effector must move from a raised position and touch the resource circle in order to collect it.



*What's the difference between a **motor** and a **servo**?*

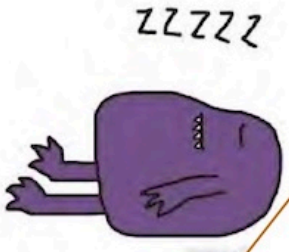
Challenge 4: Cloak and Dagger 4
Using your new cloaking technology, navigate around the monster and our spy tower in a figure 8 pattern. Return to base with information about it's weaknesses.
Flying Colors: Complete your round trip with the fastest time to earn the **master spy** title.

*Combine your computer science & **science** skills!!*

Challenge 3: 360 photo shoot 3
We need images of the monster from all sides! Travel 360 around the monster and return to base as fast as you can with your pictures!
Flying Colors: Complete your round trip with the fastest time to earn the **speed racer** award!

Which turn works best in a particular situation?

Challenge 2: Piloting our robot 2
We need to learn to pilot our giant robot safely through the streets of the city. Learn to veer, pivot and spin in order to safely park the robots in their repair hangers.



*Use the **motor** command to learn 3 different kinds of turns*

Challenge 1: Reconnaissance 1
Your team needs information about our monster before we can capture it. Drive your robot forward to investigate by just touching the monster. Don't awaken the monster by moving it!!

PROJECT CHALLENGE TREE

Why "Project Challenge-Trees"?

It's not (just) about the robots!

- Robots are ideal tools for introducing young children to the Game of STEM.
- But Robots alone won't turn our kids into *Math & Science Athletes* (who can play one of many positions on your Botball or Jr Botball Team: Programmer, Problem-Solver, Applied Mathematician, Engineer, Data Guru, Presenter and Organizer).
    - Common weaknesses of project-based learning programs
- To do this you need to embed your robots into an accelerated learning environment—what we call an "**Active Learning Zone."**
    - See "How Do We Create World Class Math & Science Athletes? "

Active Learning Zone™ Design Checklist:

How do Project Challenge-Trees help create an **Active Learning Zone**? Every Challenge-Tree is designed to:

- **1**. **Share All Learning Goals with Students** (at-a-glance, students understand and internalize all the project-challenges they must solve with their robots)
- **2**. **Give Students Choice** (students are encouraged to discover that there is More Than One Way to Solve a Problem, project-challenges are progresive but students can take them out of order)
- **3**. **Give Students Clear, Real-Time Feedback on Progress** (Visual Tracking & Mastery Checklists: Individual or Group Mastery Exam required for *every* project!; Teachers are coaches who improve performance, instead of grading it, but a checklist makes sure that team members move on without real understanding)
- **4**. **Lay out a Clear Progression of Project-Challenges** (When students Pass the exam on a Project-Challenge they look up to find a *Next-Step* Progressive Challenge that builds on the skills & knowledge they just mastered; student see the point of the work!)
- **5**. **Give Students Meaningful Challenges** ("Real-world" power over their environment; Skills they can *use without their Teacher!*; "Real World" Work: kids want to lift Star Fighters, Save their city from monsters, not solve abstract "word problems."
    - See TED Radio Talk: How Star Wars energized my physics students.

Teachers|Parents, **Download & Print PDF Version** for Students' Robotics Notebooks & for the Refrigerator at Home! • Jr Botball Challenge- Level 1 Project Tree

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Why Project Mastery-Checklists? (The Power of "Not-Yet")

Got CHECKLISTS? Without clear **Mastery-Learning CHECKLISTS** for each Jr Botball Challenge, many Team Members will not achieve real understanding or skill. To make sure that every student is getting the coaching he or she needs, we create a CHECKLIST for Each Project on the Project Challenge Tree.

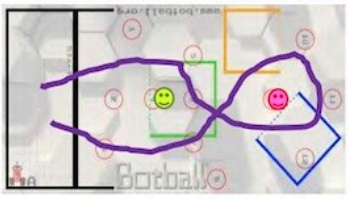
Here is the 2018 Jr Botball Level I Syllabus with Project-Challenge CHECKLISTS.

JBC Level 1 Challenge Tree:
Teaching your robot how to move

base as fast as you can with your pictures! Flying Colors: Complete your round trip with the fastest time to earn the **Speed Racer** award! As with most of our challenges, your robot must stay on the playing surface for the entire program.
In order to complete this project, you and your partner/s must:

- ☐ Write a program to travel towards the monster and then travel completely around it going either a CW or CCW rotation.
- ☐ Change your initial program to show that you can improve your completion time by at least 0.5 seconds.

Speed Racer:
- ☐ Completing the 360 Photo Shoot challenge in a time of _____



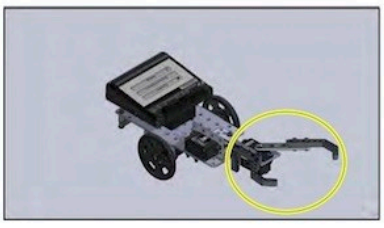
4. **Challenge 4: Cloak and Dagger** – Your research team has developed a new cloaking technology so that you can get a closer look at the monster! Using your new technology navigate around the monster located at spot #9 and our spy tower at spot #4 in a figure 8 pattern. Return to base with information about its weaknesses. Flying Colors: Complete your round trip with the fastest time to earn the **Master Spy** award.

In order to complete this project, you and your partner/s must:

- ☐ Write a program to travel towards the monster and then travels passed it looping around the monster and finally back to the starting box in a figure 8 pattern.
- ☐ Change your initial program to show that you can improve your completion time by at least 0.5 seconds.

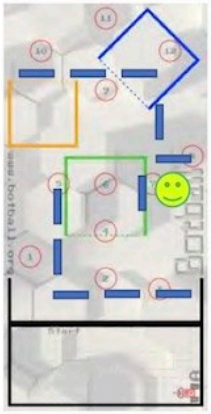
Master Spy:
- ☐ Completing the Cloak and Dagger challenge in a time of _____

5. **Challenge 5: Collect Resources** - Learn to create and manipulate an effector(arm or claw) to collect at least 20 robotic resources throughout the city. Your effector must move from a raised position and touch the resource circle in order to collect it.
In order to complete this project, you and your partner/s must:



- ☐ Write a program to travel towards a numbered circle and manipulate an effector to touch the circle once.
- ☐ Write a program to touch as many circles necessary to total 20 points or more in one run.

JBC Level 1 Challenge Tree:
Teaching your robot how to move



6. **Final Challenge: Capture the Monster!**- Use your navigation skills to safely traverse the city and capture the giant monster with your super robot! ***The walls/buildings of the city will be set up something similar to the diagram***Flying Colors: Bring the monster back to the starting box for **Mission Impossible Award**!!

In order to complete this project, you and your partner/s must:

☐Write a program to travel to the monster without knocking over any of the cities building or walls.
☐Activate your arm or claw to capture (just touch).

Mission Impossible Award:
☐Bring the robot back to the starting box!

Click to download PDF of Syllabus and Project Mastery Checklists:

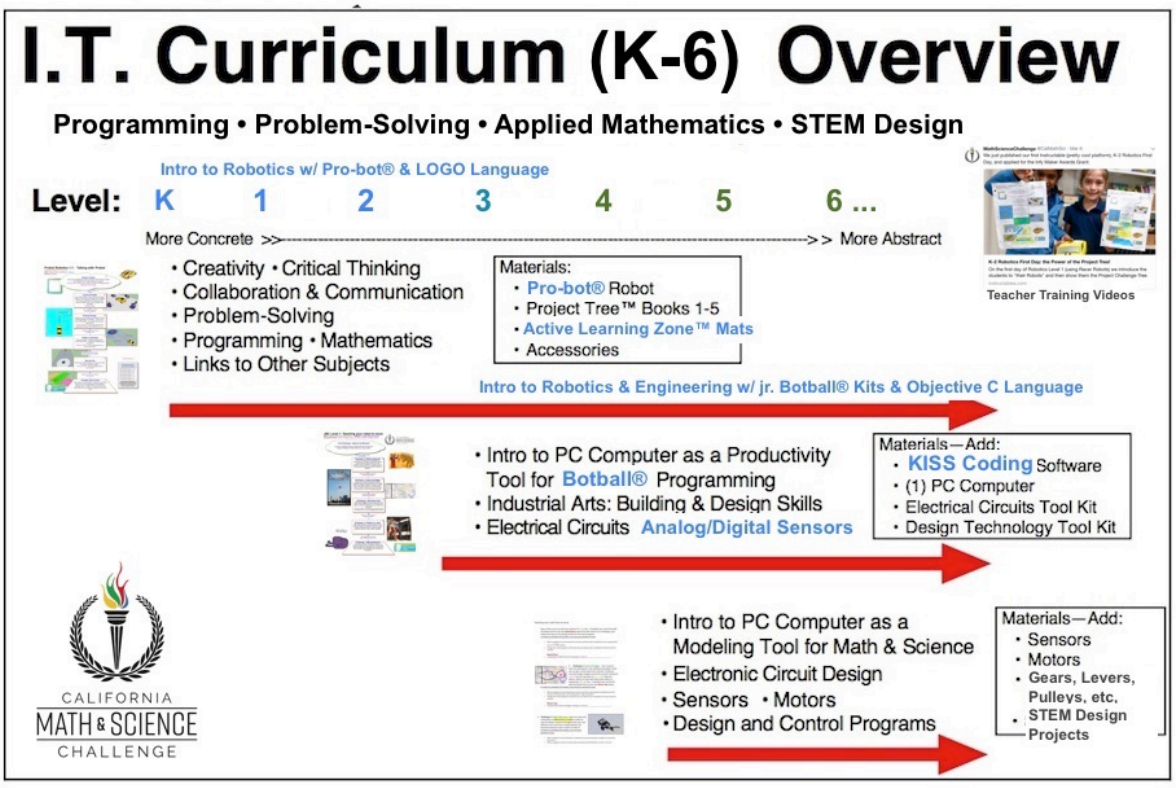
- PDF: Jr. Botball Challenge- Level 1 Syllabus

How to Set up a K-2 Pipeline for Jr Botball

Feb 23-24, 2018
Regional Training: Sr BotBall® 6th-12th Grade

Jan 2018 Early Learning Advantage: K-3rd Pro-Bot®, 3rd-6th Jr BotBall®

Let's Get Our Kids in the Game!



Author Bio & Current programs

Jeff Major has taught math, science, and robotics at The Preuss School , High Tech High, and Old Town Academy. He currently works two days a week on the CA Math & Science Challenge non-profit work, while continuing to teach in the classroom at the Montessori Institute Teacher Training Center and School and Innovations Academy.

The CA Math & Science Challenge! works with "clusters" of K-5 schools in San Diego-Tijuana (including a new school our sister non-profit BorderEducationProject.org built in East Tijuana). We help teachers interested in early learning robotics programs create "Math-Science Challenge Clusters" with neighboring schools. With support from Rotary Club and other donors we remove the barriers that prevent underserved communities from participating in early learning STEM programs, by providing: (1) Free startup training; (2) Free robotics kits; (3) Free weekend trainings for K-2 /3-5 Robotics teachers and students; (4) Free CHALLENGE-EVENTS designed to test students' mastery and provide a goal to work toward. The number of teachers we now help is limited by travel and training time. The grant would allow us to transform our web page into an online training tool and reach hundreds of teachers and thousands of students.