Journey of a Robotics Program @ SAS

How we got started

Why we chose that route

Where we are right now

Ready-made programs/competitions

Professional Development for teachers

Where we hope to be in the short future

Barbara Boyer
&
Tim Boyer

Shanghai American School

Email Address
Barbara.Boyer.sas@gmail.com
Timothy.Boyer@saschina.org

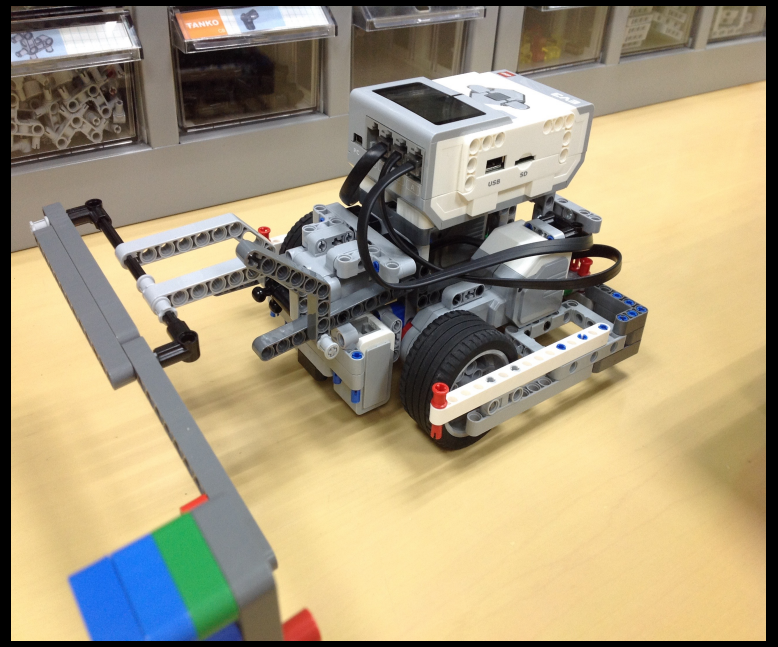
Twitter at
@saspdlib & @barbaraboyersas

Blog at
boyerbookends.wordpress.com

- Barbara Boyer- Tim Boyer- With SAS Team 78-At World Festival 2016

We do Robotics in the Library

- **Because we have the tools that can help advance students beyond the confines of the classroom and help them grasp for a world that is unimaginable!**



WHAT IS FIRST

– For Inspiration & Recognition of Science & Technology

From -https://www.youtube.com/user/FIRSTWorldTube

Four Levels of FIRST

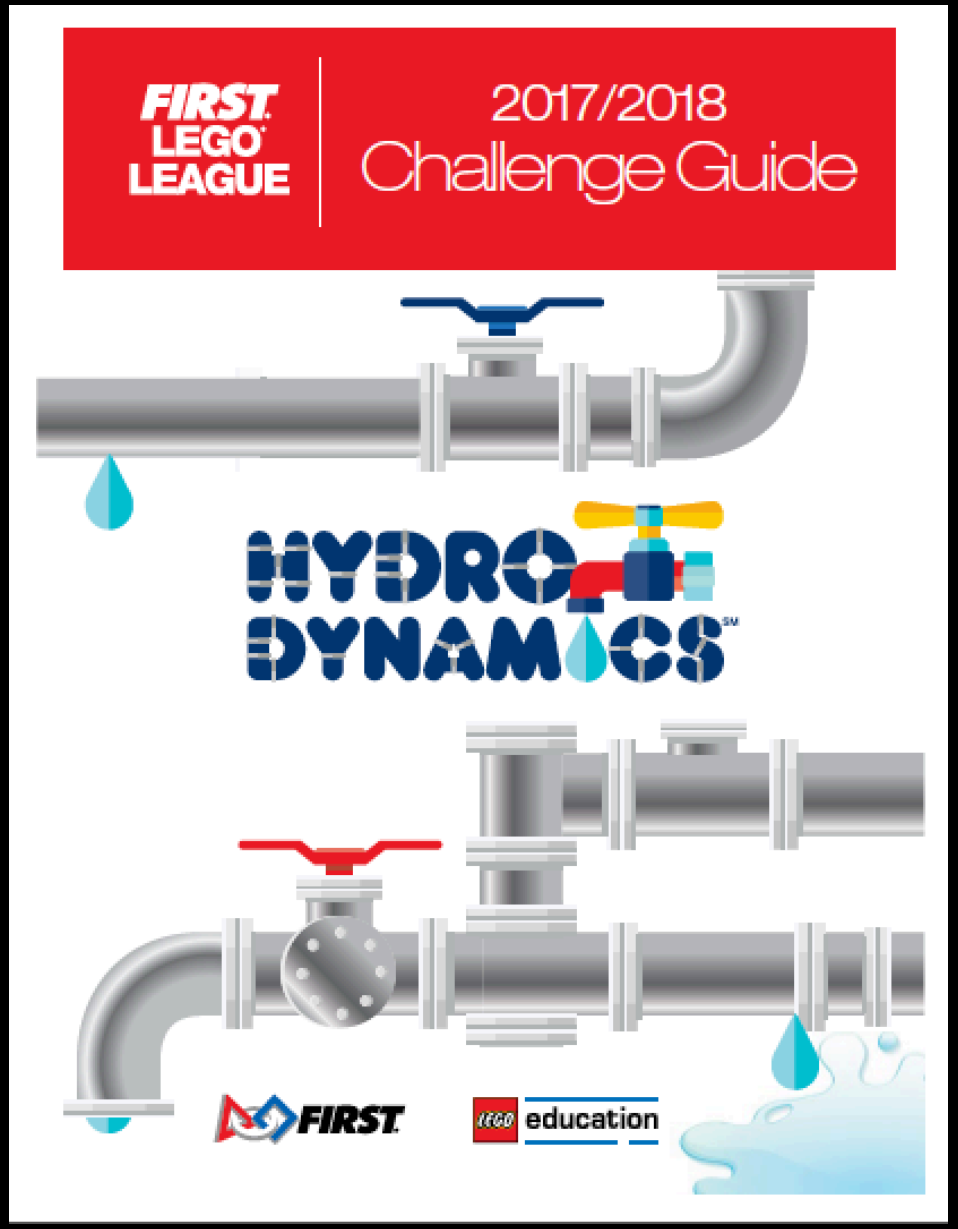
FLL – What is FLL

From http://droidecomunidad.com/wp-content/uploads/2014/09/LEGO-Mindstorms-EV3-Education-45544.jpg

From https://youtu.be/mbiH2tOKqoc

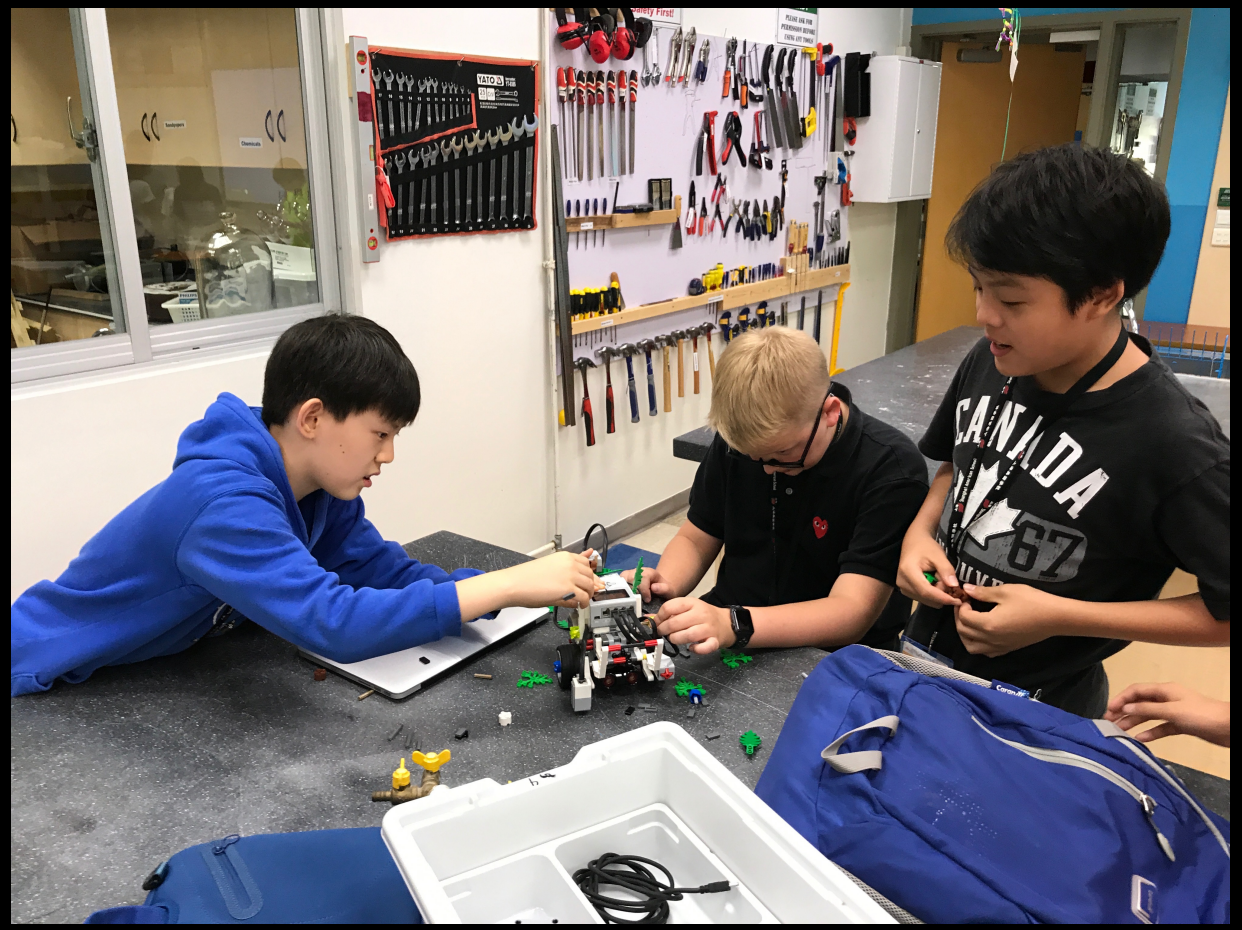
FLL is Made up of Four Parts

- ***Mission Game*** – Head to Head Robots on the Game Field
- ***Robot Design/Programing*** – Develop a Lego robot to play on the Mission Board
- ***Core Values-*** Work and Play using Gracious Professionalism & Cooperation!
- ***Research*** – A solution to a Real World Problem

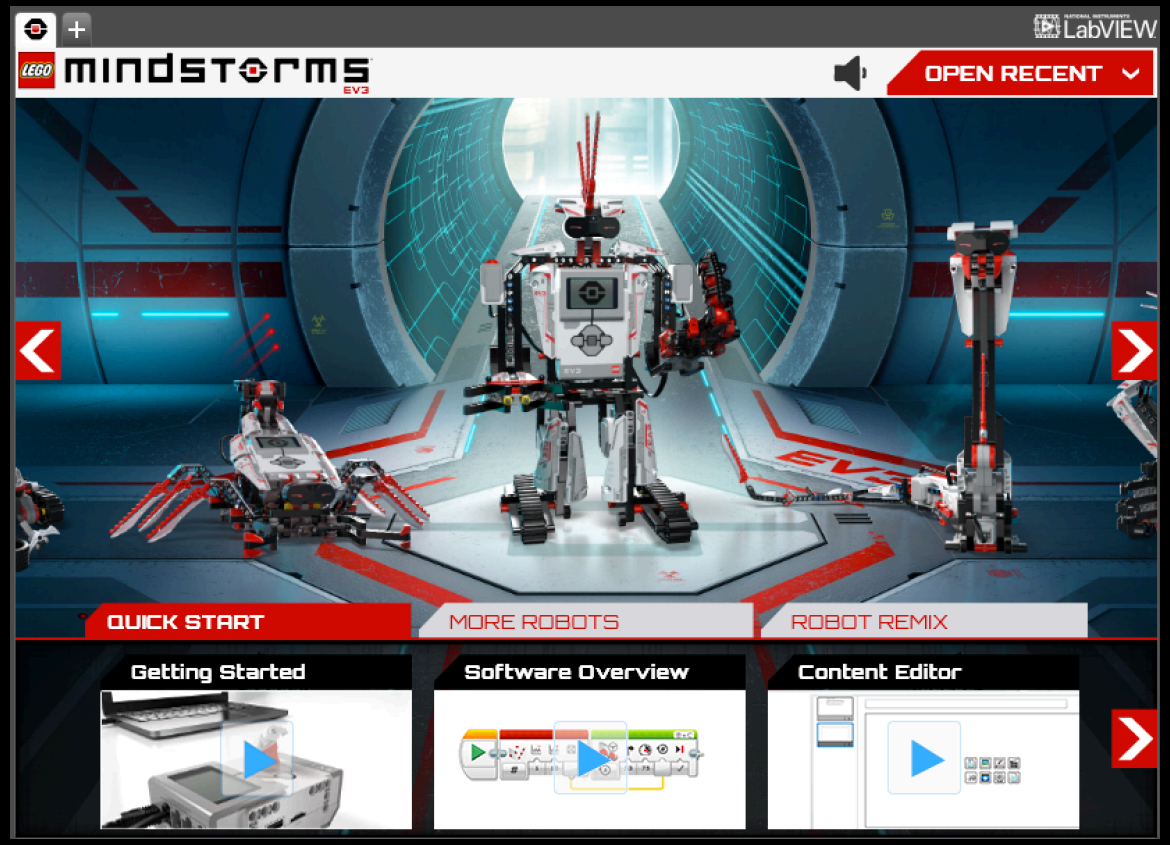


Build a Robot

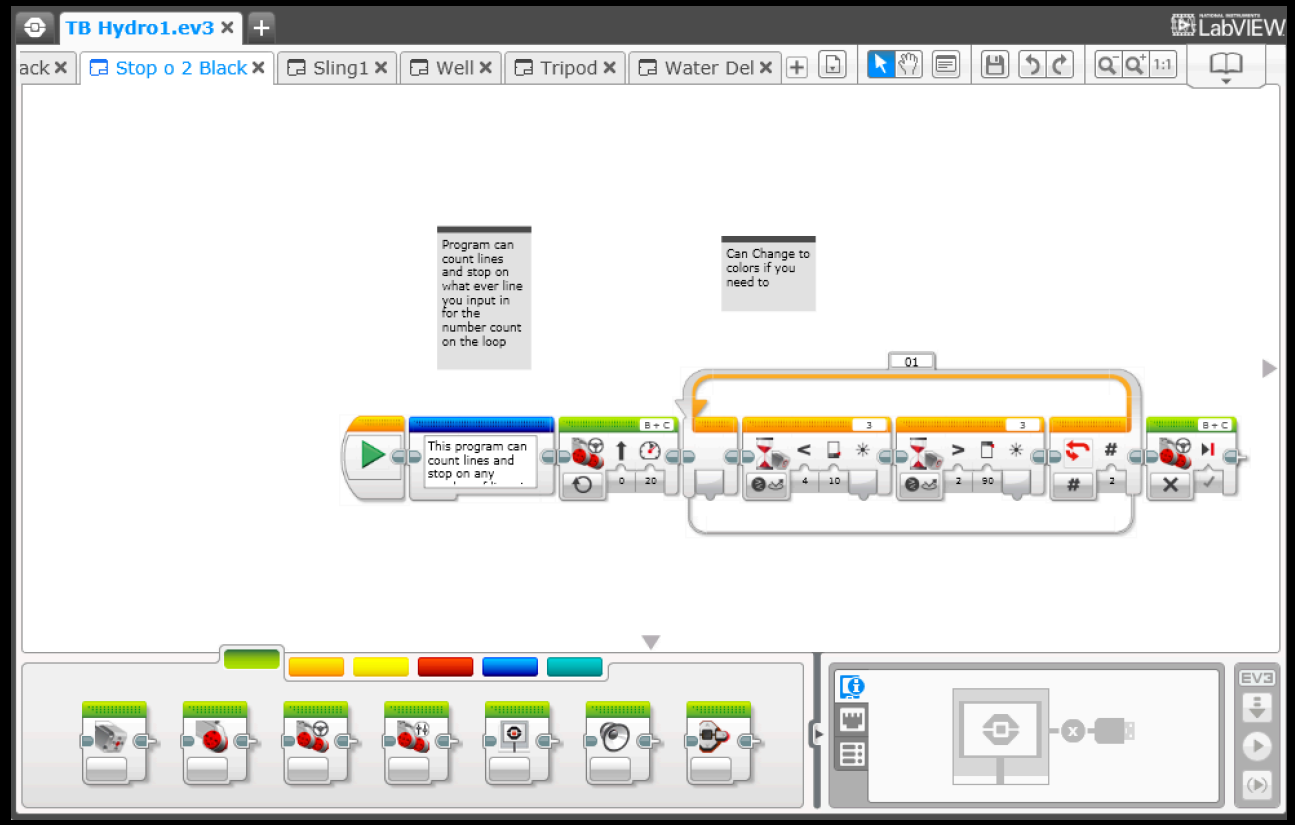
Use Lego EV3 Mindstorm Educational Kit



Programming with Lego MindStorms



Drag and Drop Graphical Programming Language



RDES – Robot Design/Programing

Robot Design Executive Summary

An “executive summary” is often used by engineers to briefly outline the key elements of a product or project. The purpose of the Robot Design Executive Summary (RDES) is to give the Robot Design Judges a quick overview of your team’s robot and all that it can do.

From this….

To This…

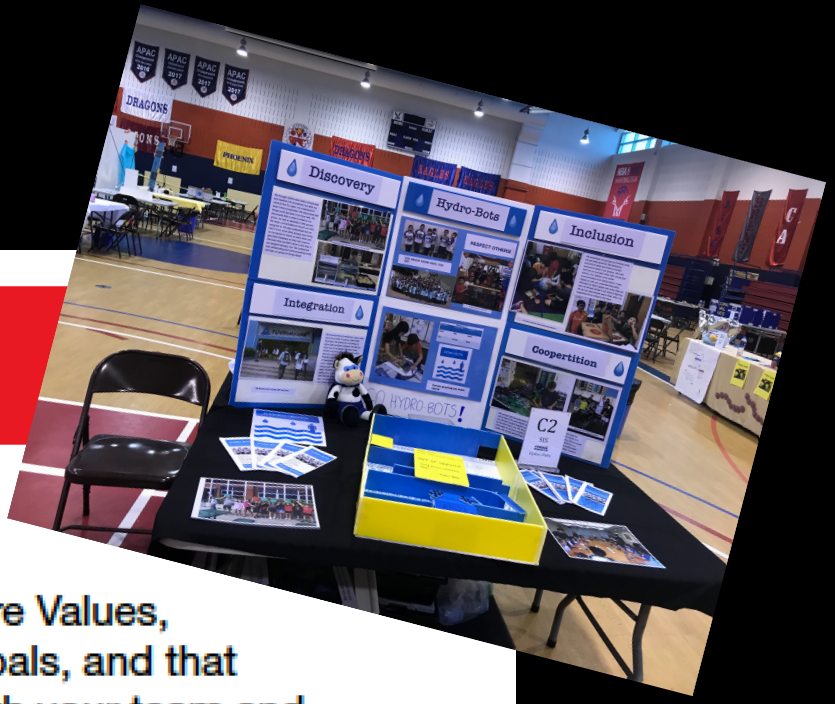
From Google Images - https://makerzone.mathworks.com/files/2014/07/lego-ev3-IMG_0994.png

Mission Game

2 teams
2.5 minutes
Side-by-side competition

Core Values

The Core Values



The Core Values are the heart of *FIRST*® LEGO® League. By embracing the Core Values, participants learn that friendly competition and mutual gain are not separate goals, and that helping one another is the foundation of teamwork. Review the Core Values with your team and discuss them whenever they are needed.

- We are a team.
- We do the work to find solutions with guidance from our coaches and mentors.
- We know our coaches and mentors don't have all the answers; we learn together.
- We honor the spirit of friendly competition.
- What we discover is more important than what we win.
- We share our experiences with others.
- We display *Gracious Professionalism*® *and Coopertition*® in everything we do.
- We have FUN!

Research – Real World Problem to Investigate

The Project In-depth

Think About It

People use water every day, but your team members probably don't think much about how and why they use water. Whether it's directly (drinking or washing) or indirectly (manufacturing the products they use or producing energy), they have a lot of different needs for water.
Your team's Project challenge this season is to improve the way people find, transport, use, or dispose of water.

FLL Tournament Rubrics

FIRST LEGO League — Robot Design

Team Number _____
Judging Room _____

Directions: For each skill area, clearly mark the box that best describes the team's accomplishments. If the team does not demonstrate skill in a particular area, then put an "X" in the first box for Not Demonstrated (ND). Please provide as many written comments as you can to acknowledge each team's hard work and to help teams improve. *When you have completed the evaluation, please circle the team's areas of strength.*

		Beginning	Developing	Accomplished	Exemplary
Mechanical Design	**Durability** — Evidence of structural integrity; ability to withstand rigors of competition				
	ND	quite fragile; breaks a lot	frequent or significant faults/repairs	rare faults/repairs	sound construction; no repairs
	Mechanical Efficiency — Economic use of parts and time; easy to repair and modify				
	ND	excessive parts or time to repair/modify	inefficient parts or time to repair/modify	appropriate use of parts and time to repair/modify	streamlined use of parts and time to repair/modify
	Mechanization — Ability of robot mechanisms to move or act with appropriate speed, strength and accuracy for intended tasks (propulsion and execution)				
	ND	imbalance of speed, strength and accuracy on most tasks	imbalance of speed, strength and accuracy on some tasks	appropriate balance of speed, strength and accuracy on most tasks	appropriate balance of speed, strength and accuracy on every task
Comments:					
Programming	**Programming Quality** — Programs are appropriate for the intended purpose and would achieve consistent results, assuming no mechanical faults				
	ND	would not achieve purpose AND would be inconsistent	would not achieve purpose OR would be inconsistent	should achieve purpose repeatedly	should achieve purpose every time
	Programming Efficiency — Programs are modular, streamlined, and understandable				
	ND	excessive code and difficult to understand	inefficient code and challenge to understand	appropriate code and easy to understand	streamlined code and easy for anyone to understand
	Automation/Navigation — Ability of the robot to move or act as intended using mechanical and/or sensor feedback (with minimal reliance on driver intervention and/or program timing)				
	ND	frequent driver intervention to aim AND retrieve robot	frequent driver intervention to aim OR retrieve robot	robot moves/acts as intended repeatedly w/ occasional driver intervention	robot moves/acts as intended every time with no driver intervention
Comments:					
Strategy & Innovation	**Design Process** — Ability to develop and explain improvement cycles where alternatives are considered and narrowed, selections tested, designs improved (applies to programming as well as mechanical design)				
	ND	organization AND explanation need improvement	organization OR explanation need improvement	systematic and well-explained	systematic, well-explained and well-documented
	Mission Strategy — Ability to clearly define and describe the team's game strategy				
	ND	no clear goals AND no clear strategy	no clear goals OR no clear strategy	clear strategy to accomplish the team's well defined goals	clear strategy to accomplish most/all game missions
	Innovation — Creation of new, unique, or unexpected feature(s) (e.g. designs, programs, strategies or applications) that are beneficial in performing the specified tasks				
	ND	original feature(s) with no added value or potential	original feature(s) with some added value or potential	original feature(s) with the potential to add significant value	original feature(s) that add significant value
Comments:					

Strengths: Mechanical Design | Programming | Strategy & Innovation

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FIRST LEGO League — Core Values

Directions: For each skill area, clearly mark the box that best de
team does not demonstrate skill in a particular area, then put a
(ND). Please provide as many written comments as you can to
help teams improve. *When you have completed the evaluation,*

		Beginning	Developing		
Inspiration	**Discovery** — Balanced emphasis on all three aspe *FIRST* LEGO League; it's not just ab				
	ND	emphasis on only one aspect; others neglected	emphasis on two aspects; one aspect neglected		e
	Team Spirit — Enthusiastic and fun expression of th				
	ND	minimal enthusiasm AND minimal identity	minimal enthusiasm OR minimal identity	fun; clear identity	enthusiasm & fun; clear identity
	Integration — Application of *FIRST* LEGO League values and skills outside *FIRST* LEGO League (ability to describe current and potential examples from daily life)				
	ND	team does not apply values and skills outside *FIRST* LEGO League	team able to describe at least one example	team able to describe multiple examples	team able to describe multiple examples, incl. individual stories
Comments:					
Teamwork	**Effectiveness** — Problem solving and decision making processes help team achieve their goals				
	ND	team goals AND team processes unclear	team goals OR team processes unclear	clear team goals and processes	clear processes enable team to accomplish well defined goals
	Efficiency — Resources used relative to what the team accomplishes (time management, distribution of roles and responsibilities)				
	ND	limited time management AND unclear roles	limited time management OR unclear roles	excellent time management and role definition allows team to accomplish most goals	excellent time management and role definition allows teams to accomplish all goals
	Kids Do the Work — Appropriate balance between team responsibility and coach guidance				
	ND	limited team responsibility AND excessive coach guidance	limited team responsibility OR excessive coach guidance	Good balance between team responsibility and coach guidance	team independence with minimal coach guidance
Comments:					
Gracious Professionalism®	**Inclusion** — Consideration and appreciation for the contributions (ideas and skills) of all team members, with balanced involvement				
	ND	unbalanced team involvement AND lack of appreciation for contributions	unbalanced team involvement OR lack of appreciation for contributions	balanced team involvement AND appreciation for contributions of most team members	balanced team involvement AND appreciation for contributions of all team members
	Respect — Team members act and speak with integrity so others feel valued– especially when solving problems or resolving conflicts				
	ND	not evident with majority of team members	evident with majority of team members	almost always evident with all team members	always evident, even in the most difficult situations
	Coopertition® — Team competes in the spirit of friendly competition and cooperates with others				
	ND	not evident with majority of team members	evident with majority of team members	almost always evident with all team members	always evident, even in difficult situations–and team actively helps other teams
Comments:					

Strengths: Inspiration | Teamwork | Gracious Professionalism®

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FIRST LEGO League — Project

Team Number _____
Judging Room _____

Directions: For each skill area, clearly **mark the box that best describes the team's accomplishments.** Teams should demonstrate everything at the level. If they are missing part, mark the level below. If the team does not demonstrate an area, put an "X" in the first box for Not Demonstrated (ND). Please provide as many written comments as you can to acknowledge each team's hard work and to help teams improve. *When you have completed the evaluation, please circle the team's areas of strength.*

		Beginning	Developing	Accomplished	Exemplary
Research	**Problem Identification** * — Clear definition of the problem being studied				
	ND	unclear; few details	partially clear; details missing	mostly clear; detailed	clear; very detailed
	Sources of Information — Quality and variety of data/evidence and sources cited				
	ND	minimal quality; variety limited	quality OR variety need improvement; did not include professional(s)	sufficient quality and variety; included professional(s)	extensive quality and variety; included multiple professionals
	Problem Analysis — Depth to which the problem was studied and analyzed by the team, including extent of analysis of existing solutions				
	ND	minimal study; no analysis	minimal study; some analysis	sufficient study and analysis	extensive study and analysis
Comments:					
Innovative Solution	**Team Solution*** — Clear explanation of the proposed solution and description of how it solves the problem				
	ND	difficult to understand	some parts confusing	understandable	easy to understand by all
	Innovation — Degree to which the team's solution makes life better by improving existing options, developing a new application of existing ideas, or solving the problem in a completely new way.				
	ND	existing solution/application	solution/application contains some original element(s)	original solution/application; potential added value	original solution/application; demonstrated added value
	Solution Development — Systematic process used to select, develop, evaluate, test, and improve the solution (implementation could include cost, ease of manufacturing, etc.)				
	ND	process AND explanation need improvement	process OR explanation need improvement	systematic process included evaluation	systematic process included evaluation, implementation considered
Comments:					
Presentation	**Sharing*** — Degree to which the team shared their Project before the tournament with others who might benefit from the team's efforts				
	ND	shared within the team and/or relatives	shared once outside the team	shared with one audience who may benefit OR one professional	shared with multiple audiences who may benefit OR multiple professionals
	Creativity — Imagination used to develop and deliver the presentation				
	ND	minimally engaging OR unimaginative	engaging OR imaginative	engaging AND imaginative	very engaging AND exceptionally imaginative
	Presentation Effectiveness — Message delivery and organization of the presentation				
	ND	unclear OR disorganized	partially clear; minimal organization	mostly clear; mostly organized	clear AND well organized
Comments:					

Strengths: Research | Innovative Solution | Presentation

*Required for Award Consideration

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Solve problems in: The Robot Game

- **Read** the Robot Game Rules in the Challenge Guide: http://www.firstlegoleague.org/challenge
- **Identify** one or more Missions to solve
- **Design** a robot using LEGO® MINDSTORMS® that can solve the Mission(s)

Missions as written below are only an overview. For full details, read the Challenge Guide.

Note: "Asterisks tell you a specific METHOD is required, and must be observed by the referee. Underlined conditions must be visible at the END of the match.

Have you ever wondered how you get the water you use in your daily life? Whether it's to brush your teeth, quench your thirst, cook your food, or even take a swim – all of us need water! Does it come from the ground, a river or a lake? How do you make sure it's safe to drink, and what happens when it goes down a drain? In this season's HYDRO DYNAMICS℠ Robot Game, you'll explore these questions and many more, and you'll get to learn about the amazing engineering used to protect your most precious liquid asset – water!

M01 – PIPE REMOVAL — Move the Broken Pipe so it is completely in Base. 20 Points

M02 – FLOW — Move a Big Water (one time maximum) to the other team's field *only by turning the Pump System's valve(s). 25 Points

M03 – PUMP ADDITION — Move the Pump Addition so it has contact with the mat and that contact is completely in the Pump Addition target. 20 Points

M04 – RAIN — Make at least one Rain come out of the Rain Cloud. 20 Points

M05 – FILTER — Move the Filter north until the lock latch drops. 30 Points

M06 – WATER TREATMENT — Make the Water Treatment model eject its Big Water *only by moving the Toilet's lever. 20 Points

M07 – FOUNTAIN — Make the Fountain's middle layer rise some obvious height and stay there, due only to a Big Water in the gray tub. 20 Points

M08 – MANHOLE COVERS — Flip Manhole cover(s) over, obviously past vertical *without it/them ever reaching Base. 15 Points EACH
FOR BONUS: Score 30 Manhole Cover points as described above WITH both covers completely in separate Tripod targets. 30 Points Added

M09 – TRIPOD — Move the Inspection camera Tripod so it is
FOR PARTIAL SCORE: partly in either Tripod target, with all of its feet touching the mat. 15 Points
FOR FULL SCORE: completely in either Tripod target, with all of its feet touching the mat. 20 Points

M10 – PIPE REPLACEMENT — (Install the Optional Loop first, in Base, if you wish.) Move a New Pipe so it is where the broken one started, in full/flat contact with the mat. 20 Points

M11 – PIPE CONSTRUCTION — (Install the Optional Loop first, in Base, if you wish.) Move a New Pipe so it is
FOR PARTIAL SCORE: partly in its target, in full/flat contact with the mat. 15 Points
FOR FULL SCORE: completely in its target, in full/flat contact with the mat. 30 Points

M12 – SLUDGE — Move the Sludge so it is touching the visible wood of any of the six dream garden boxes. 30 Points

M13 – FLOWER — Make the Flower rise some obvious height and stay there, due only to a Big Water in the purple part, touching nothing but the Flower model. 30 Points Added

M14 – WATER WELL — Move the Water Well so it has contact with the mat and that contact is
FOR PARTIAL SCORE: partly in the Water Well target. 15 Points
FOR FULL SCORE: completely in the Water Well target. 25 Points

M15 – FIRE — Make the fire drop *only by making the Firetruck apply direct force to the House's lever. 25 Points

M16 – WATER COLLECTION — Move or catch Big Water and/or Rain water (one Rain maximum; no Dirty Water) so it is touching the mat in the Water Target, *without the target ever reaching the white Off-Limits Line shown below. Water may be touching the target, and/or other water, but not be touching nor guided by anything else. Each water model is scored as an individual:
— At least one Rain: 10 Points
— Big Water: 10 Points EACH
FOR BONUS: Score at least one Large Water in its target as described above WITH one on top, which is touching nothing but other water. 30 Points (Maximum only one Bonus can score)

M17 – SLINGSHOT — Move the Slingshot so it is completely in its target. 20 Points
FOR BONUS: Score Slingshot points as described above WITH the Dirty Water and a Rain completely in the Slingshot target. 15 Points Added

M18 – FAUCET — Make the water level obviously more blue than white as seen from above the mat, *only by turning the Faucet handle. 25 Points

PENALTIES: Before the match starts, the Ref removes the six red Penalty discs from the Field, and holds on to them. If you interrupt the Robot, the Ref places one of the removed Samples in the white triangle, in the southeast, as a permanent/ unmovable Interruption Penalty. You can get up to six such penalties, worth -5 Points EACH

The Robot Game Missions can provide real-world examples for your Project research. Learn about the stories behind the Missions in the Challenge Guide: http://www.firstlegoleague.org/challenge

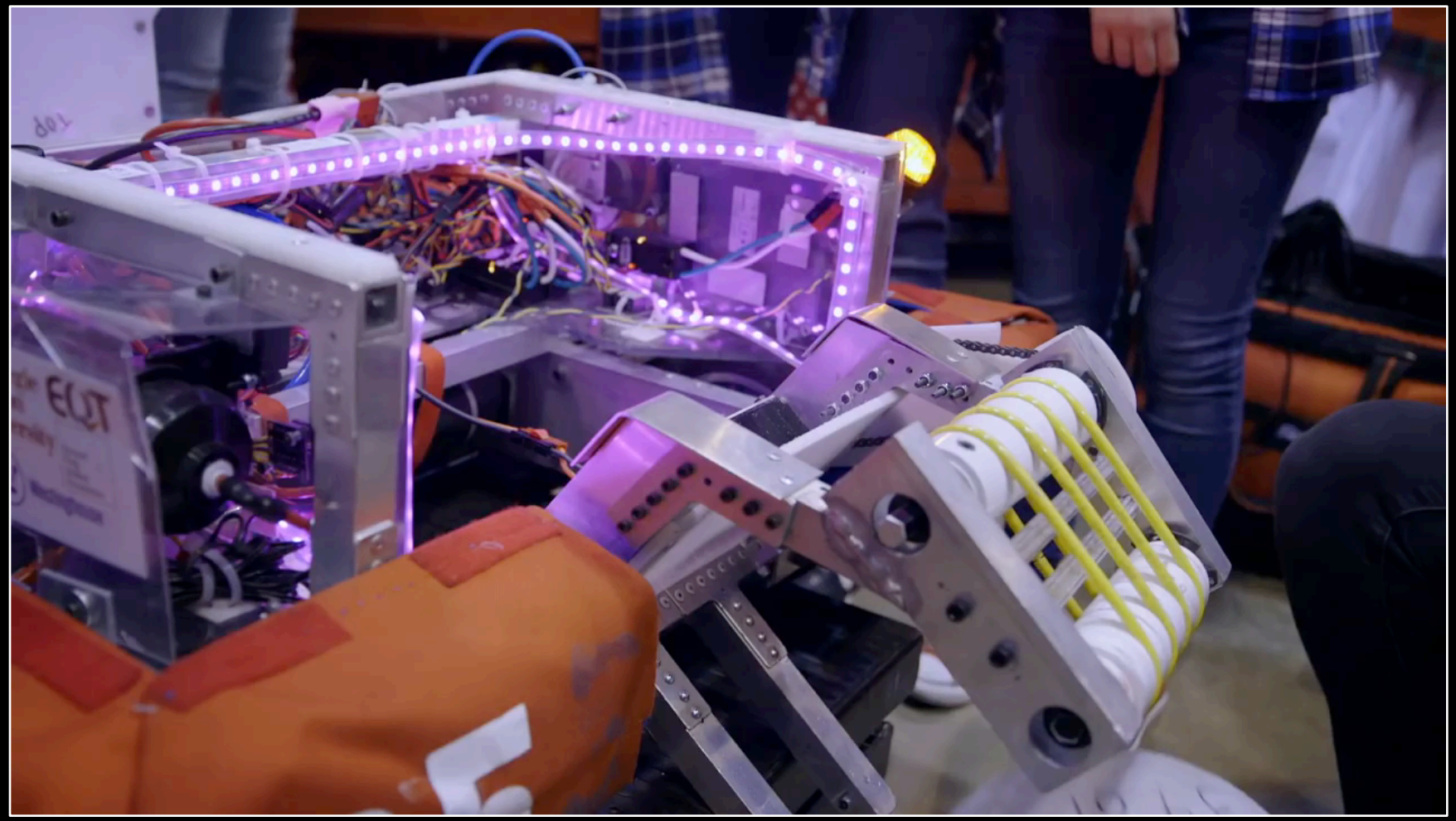
What is Robotics at SAS?

Why FIRST……

- Teachers can be coaches, mentors, space providers, and so much more as we assist students with tools to ….

Imagine and Dream

For Inspiration & Recognition of Science & Technology



From - https://www.youtube.com/watch?time_continue=10&v=mtE6Va6oOhU

Sources/Links for the FIRST Program

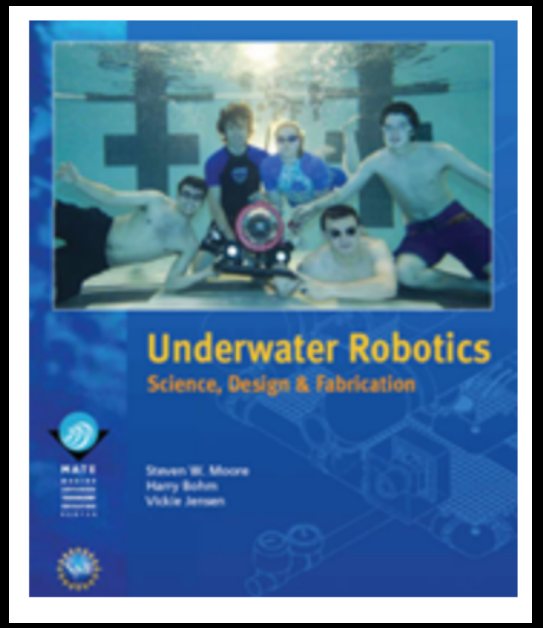
- Information about First and First Videos from
  - Dunn, H., & Blew, B. (Eds.). (2018, January). First at a glance. Retrieved from First website: https://www.firstinspires.org/
- Connecting with a program in your country: http://www.firstlegoleague.org/countries
- Data about how FIRST impacts students in STEM: https://www.firstinspires.org/about/impact
- Past Challenges: http://www.firstlegoleague.org/past-challe
- Contact Barbara and Tim Boyer – barbara.boyer.sas@gmail.com, Timothy.Boyer@saschina.org -- twitter @saspdlib and @barbaraboyersas

Other Programs/Competitions

VEX Robotics: https://www.vexrobotics.com/

VEX IQ 4th-8th Graders
VEX EDR- MS & HS
HEXBug Inventor Portal

Marine Advanced Technology Education (MATE) Link -https://www.marinetech.org/rov-competition-2/



Student Camps

Student Camps:
https://robotics.nasa.gov/students/summer_camps.php
Last updated yesterday!

NASA Robotic Academy:
https://www.spacecamp.com/robotics/academy
Students and Teachers can work/learn together

Zero Robotics Middle School Summer Program:
http://zerorobotics.mit.edu/tournaments/29/
Winning teams SPHERES compete aboard the ISS space station

NASA Robotics Camp at Huntsville

Professional Development

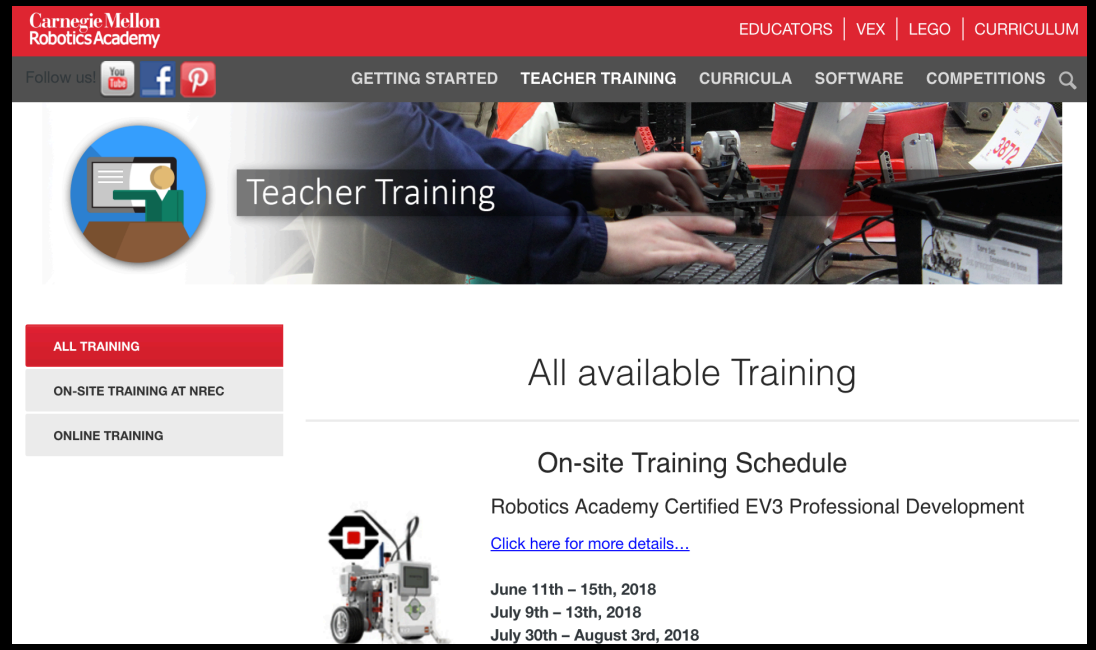
Carnegie Mellon Teacher Training:
http://education.rec.ri.cmu.edu/lego/teacher-training/

EV3 (Lego Mindstorm) -graphical programming
ROBOTC (PC based)- line programming

NASA Robotic Academy:
https://www.spacecamp.com/robotics/academy

Students and Teachers can work/learn together

NASA Robotics: https://robotics.nasa.gov/index.php



Challenges

No clarifying vision or end goal
Do we know what our stake holders want
We don't have infrastructure / materials to support
Logistical ramification of SAS experience
We have money now, what about later
Need to build and develop knowledge and skills with our stakeholders
No continuity between divisions
Time
Kids have an interest, but there is no pathway
Our model is opt in and our kids are busy
Parents, Teachers, Students have a narrow understanding of What Is Robotics
Lack of Oversight or Leadership
Not part of PK – 12 experience
Gap or lack of instruction
Just ASAs
No real subject comprehensive / reflective
Materials
Present module is backwards
Lack of diversity in participation
Lack of teacher capacity
Next practices – there are few models to learn from
Feels like an add on
What does the school want

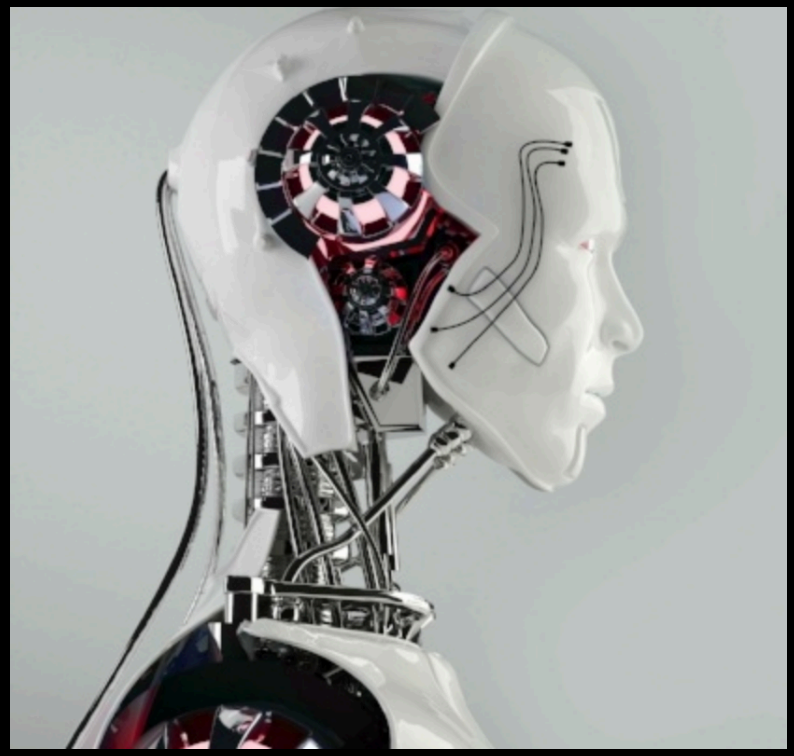
Overarching Problems
Vision goal school
Articulated
Curriculum/integration/shared responsibility
Bridge – transition - Lack of intentionality
Prof Development
Need a Mind Shift change
Value

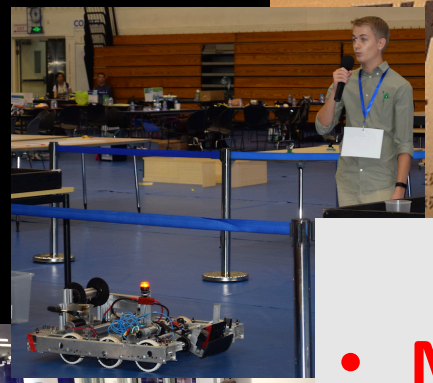
Questions to ask ourselves?

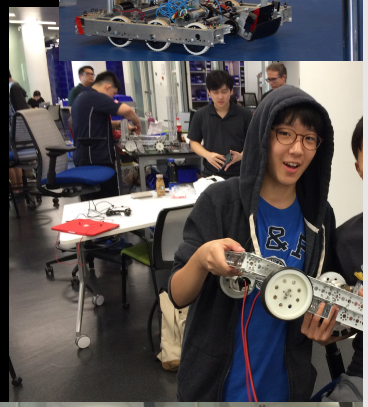
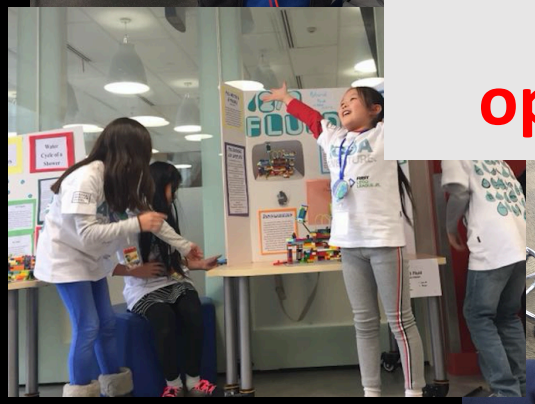
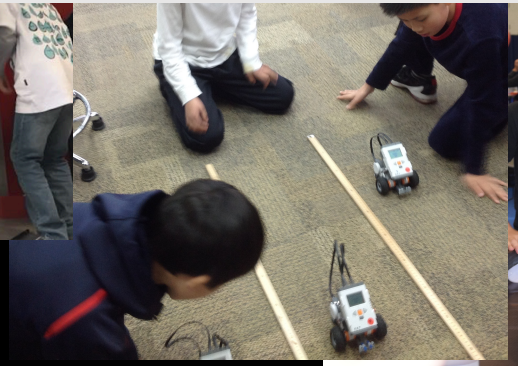
How do we define robotics for SAS ?
https://blog.robotiq.com/whats-the-difference-between-robotics-and-artificial-intelligence

What does that look like developmentally?

What does a SAS graduate with robotic learning know how to do?





Robotics in the Future for SAS

- Money into Personnel, Materials, Curricular structure

- What that looks like, not sure????
- Aim-to have robotics and engineering integrated into the K-12 curriculum which provide students the opportunities to advances on the world stage.

Future of SAS Robotics

What we hope is that we will have a PK-12 robotics program that is integrated into the curriculum at all grade levels so that students can develop and pursue their dreams and if desired compete on the world stage.