Robotics for Experiential and Applied Learning ("REAL") was developed in partnership with representatives from education and industry to provide cost effective, experiential STEM based learning as part of existing curriculum and course requirements and made available to all 4th graders. REAL was borne out of the realization that students who are exposed to STEM based applied learning early on are more apt to stay on the education pathway and pursue careers in STEM-related fields. By bringing robotics to the classroom, REAL has the potential to introduce students to cutting-edge technology at a young age - igniting their passions for STEM education, inspiring them to reach beyond the fence lines, and fostering a healthy spirit of creativity and innovation. It is intended to address several issues inherent in the education system today: lack of experiential learning (extracurricular and/or in class); lack of encouragement/mentorship (adults from STEM careers and parent/teacher/peer), and lack of resources/opportunities.

REAL was developed to meet the following design criteria:

- Target students early when they are able to focus, learn and retain STEM based curriculum
- Ignite STEM education and stimulate creative thinking
- Provide experiential, project-based learning in a team environment and the hands-on experience required to succeed in STEM careers
- Ensure it is cost effective, fits into existing curriculum and supports existing course requirements
- Provide access to all students, regardless of background, ability, or financial constraints
- Provide a path to continued project-based learning opportunities through robotics
- Link students throughout the education continuum by providing experiential learning opportunities for older students through "train the trainer" models and mentor programs
- Leverage the program as vehicle to enhance teacher STEM skills
- Provide a mechanism for companies and other organizations to help build the talent pipeline and project a positive brand image through sponsorship opportunities
- Ensure the program model can be scaled and sustained

> *"When rotating through a range of working groups and wide spectrum of roles (including leadership, coding, assembly, course design, troubleshooting, operations)* ***<u>all</u>*** *students were equally excited and engaged no matter the gender, learning level, or demographic."*

The program was successfully piloted in 2017 - 2019 as way to provide access to children of all means as part of their existing 4th grade curriculum in. It was noted at the time that while some student populations had access to extra-curricular activities, competitions and various elective programs that included experiential learning through robotics, many schools could not afford to make such programs available - and many students could not afford to participate in programs that may be available outside of the school. Programs such as FIRST Robotics had demonstrated that robotics was a natural vehicle to engage children project-based learning, however not all schools had the financial wherewithal to fund competition teams, leaving out a majority of the population from access to the program. ***Go here to this link to hear to see 4th grade students in REAL action and to hear the perspective on REAL from their teacher:*** https://youtu.be/n4PWKu_UzGQ

The REAL program aligns well with existing STEM programs and provides an initiation into the more formal continuum of STEM education. By engaging older students in the deployment of REAL as mentors, this continuum is cemented within the process; in addition, it helps to provide teachers with needed support and additional STEM project-based (teacher) development. The grade-to-grade mentorship also creates excitement in the school and anticipation for further involvement. As an example, in one REAL pilot program, 3rd graders were invited to watch the 4th graders; they expressed how they looked forward to "being 4th graders" so they could be on the "REAL Team".

Why is access to REAL important for all 4th graders? With the growth in technology, workers with strong STEM backgrounds and proficiencies in related skills will be in high demand. In addition to preparing students for future careers, the STEM talent pool is, and will continue to be, necessary to maintain the leadership in innovation required to ensure national security and global competitiveness. While it is known that engaging and exciting students needs to happen early on, investments by the private sector tend to be later in the education system and more so within the realm of workforce training. REAL helps to fill this gap by being offered early-on in the existing education system. This gateway program exposes youngsters to STEM through project-based learning; teamwork, problem solving, coding, concepts in mechanical engineering, manufacturing, etc., and includes an engagement model for engineers and older students who participate in robotics programs to serve as mentors. Schools can also leverage REAL as a pathway to exposure in later grades to other robotics programs such as FIRST Robotics.

Participating in REAL is easy and cost effective. Each participating classroom requires one REAL kit which includes everything you need: parts for 5 robots, instructional material and online support. Parts are packaged with the learning experience geared to 4th graders in mind. The robots are extremely durable, operate from an online app and are designed for in-class programs as well as intermural competitions. For in-class use, students break out into various teams such as programing/coding, manufacturing/assembly, course design, operations, etc. Teams build the robot, design the course, come up with a "mission" for the activity, perform the required coding, etc. Students can rotate among the teams in order to obtain the full experience.

REAL kit pricing is based on quantity, so it is more cost effective for school districts to pool their orders. Kits contain 5 units and are suited for class sizes of up to 30 students.

Current pricing is as follows.

- $605/unit-$3,025/kit (between 1 - 25 units) (4 – 6-week lead time)
- $515/unit-$2,575/kit (between 25 - 100 units) (4 – 6-week lead time)
- $455/unit-$2,275/kit (between 100 - 250 units) (6 – 8-week lead time)
- Over 250 units/50 kits require special quote and timing estimate

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The 4th Grade REAL program, when combined with middle school activities and support, provide a continuum of learning that is important in creating a lifelong STEM education pathway.

The REAL Experience

Foundational Program 4th/5th grade (age 10-11) Critical time for experiential STEM learning

- *Goal:* Leverage the natural diversity in classrooms to inspire STEM enthusiasts
- *Description:* Students assemble, code and troubleshoot robots to navigate an obstacle course to reach a pre-determined destination

The REAL Design

Extended Engagement Program 4th/5th grade (age 10-11) Critical time when student's interest in STEM either declines or shifts towards pathways

- *Goal:* 360 mentoring to inspire student confidence and enthusiasm for STEM
- *Description:* Students assist and observe the 4th Grade REAL program then work in teams to identify, select, design, execute and evaluate changes to the REAL package for improvement in performance, cost quality, manufacturability by applying concepts of concurrent design

Combined 4th Grade Experience + Extended Engagement generate interest in other available programs and link to a continued education and career pathway

Aligned with required education standards

R.E.A.L. ROBOTICS for Experiential and Applied Learning