Steps to starting a VEX robotics program

Congratulations on your decision to start a VEX robotics program! Whether you are a teacher, parent, coach, or an afterschool club leader, you'll find lots of support as you move through this process.

Carnegie Mellon's Robotics Academy has compiled a comprehensive step-by-step plan to help guide you through this process. All of these steps are relevant to teachers, parents, coaches and club leaders. Teachers will also need to decide on the educational specific outcomes that they are trying to achieve as well as how robotics aligns with their school districts standards.

Step by step organizer:

1. Decide what it is that you want to teach and how robotics will be an effective organizer. e.g. are you using robots to reinforce and teach math concepts, engineering competencies, programming, teamwork, problem solving, or are you preparing your students for competitions?

2a. Select the type of VEX classroom bundle that best suits your educational goals and students' needs:

- **Starter bundle** - Introductory classroom teaching solution for robotic classes with basic kit parts.
- **Mechanics bundle** - Introductory classroom teaching solution for robotic classes with the emphasis on hardware design and engineering.
- **Programming bundle** -Introductory classroom teaching solution for educators interested in teaching programming, but who can't afford to purchase all of the sensors.
- **Sensor bundle** - Intermediate classroom teaching solution for robotic classes with the emphasis on programming. Students will be able to program both the radio controller and the VEX controller with this solution.
- **Super bundle** - Complete classroom teaching solution including all programming and mechanical options. This complete kit includes all the VEX parts required to teach the VEX Curriculum.

2b. Select the programming solution best suited for your class.

Radio (remote) control only - The starter kit comes with a fully programmable remote control that allows the students to change the characteristics of the controller including: changing polarity of the motors, the characteristics of the signal being sent

to the robot (changing power levels), motor configuration, trim, and more. Lessons on how to program the remote control can be found for free online at the VEX link at our site.

ROBOTC - Carnegie Mellon Robotics Academy recommends ROBOTC for high school and college students. ROBOTC is a C-based programming language with a Windows-based environment for writing and debugging programs. ROBOTC is the only solution that offers a comprehensive, real time debugger.

Teaching ROBOTC for IFI VEX curriculum provides teachers with multi-media, step-by-step instructions ranging from basic programming fundamentals to advanced sensor behavior. This curriculum is available online on the Robotics Academy site.

EASYC - This programming language is used by many VEX robot teams and is supported by the VEX Curriculum. The program is very easy to use initially, but is difficult to debug and presents problems when trying to program more complicated behaviors.

3. Research available curriculum and resources

Both the ROBOTC and VEX curriculums are posted in their entirety online for full review at the Robotics Academy website. In the VEX Curriculum, read the introductory materials provided in the link that says “Start Here” to quickly understand the scope of the curriculum. There is a tremendous amount of detailed content, so this overview will help you to understand how it is organized. While these materials are very deep the teacher tools will provide an effective roadmap to present the material to your classes.

4. Decide on the size and number of student teams.

a. All work should be done in teams of 2 or 4 students per robot. Teamwork is a crucial skill in the modern workplace, and the challenges of the robotics activities lend themselves to group solutions.

b. Odd numbers of students on a team can often lead to problems with one student being left out and not doing anything. Groups larger than 4 are generally too large for all the students to have something important to do.

c. For classrooms, two students per robot is ideal; for clubs and teams, many coaches need to have a higher student to robot ratio based on resources.

d. Consider one of the many VEX challenges both at the Robotics Academy site as well as through Innovation First.

e. First-time coaches typically do well with about 8 students. If possible, recruit other

mentors for your team to lead the subgroups within your team.

f. Define roles on the team and have students change roles on a regular basis, allowing them to share responsibility for all aspects of building, programming, etc.

(1) Engineer (Builder)

(2) Software Specialist (Programmer)

(3) Information Specialist (Gets the necessary information for the team to move forward)

(4) Project Manager (Whip-cracker)

g. In order to build leadership and management skills, assign students to all lead roles and hold them accountable for team responsibilities.

h. For classrooms, unisex teams are preferable; research has found that boys use an autocratic decision making process excluding girls from participating in many of the technical lead roles.. For clubs and teams, unisex pairings are recommended, when possible.

5. Identify technical and logistical requirements

a. Robots - Robotics Academy recommends one robot for each team of 2 students. Also, the teacher should have several backup robots in case of emergency situations.

b. Computers -Ideally, one computer for each robot / team of students. Most of the students' activity will be independent and self-directed as they iteratively program / test / debug their solutions multiple times during each practice. Multiple computers will provide easy access to the programming language, eliminate "traffic jams" and inadvertently changing another team's program.

c. Classroom / Practice area

(1) Room size and setup - The space should be large enough to accommodate all the student teams, computers, practice tables, projector for lessons, and storage area for the robots.

(2) Practice area - this will be different in every instance. If you have the room, you should consider purchasing the VEX Robotics Competition Field used in official VEX tournaments. The arena is well designed and enables a great playing surface for competitions. The only issue is that it is large. http://www.vexlabs.com/vex-competitions.shtml

(3) Parts storage - To keep parts organized and accessible for teams, parts organizers are necessary. There are many options – portable organizers, drawer cabinets, boxes, caddies, etc. These are readily available online and at local hardware and crafts stores.

d. Network - The software and curriculum will need to be loaded on each computer or available via the network on each computer. Programs should be included in the regular system backup or leader should make a backup to a separate disk or memory stick.

e. Projector – Teachers will find it valuable to review videos, building instructions, etc. with the entire class.

6. Prepare a budget and get funding

a. Typical classroom budget – will consist of robots, programming language, curriculum, materials, competition fees, etc. The final cost for your robotics program will depend on the size of your team, activities, etc. Here are typical costs to use when calculating your budget:

(1) Robots - Robotics Academy recommends one robot for every two students. We have designed the following VEX classroom bundles of 12 robots to fulfill specific educational goals.

- **Starter bundle** - Introductory classroom teaching solution for robotic classes with basic kit parts.
- **Mechanics bundle** - Introductory classroom teaching solution for robotic classes with the emphasis on hardware design and engineering.
- **Programming bundle** -Introductory classroom teaching solution for educators interested in teaching programming, but who can't afford to purchase all of the sensors.
- **Sensor bundle** - Intermediate classroom teaching solution for robotic classes with the emphasis on programming. Students will be able to program both the radio controller and the VEX controller with this solution.
- **Super bundle** - Complete classroom teaching solution including all programming and mechanical options. This complete kit includes all the VEX parts required to teach the VEX Curriculum.

(2) Storage bins/cabinets

This is a must have for any teacher implementing a VEX robotics program. Your budget will be dependent upon the selection of the cabinets, storage containers, and

bins that you choose. The proper storage compartments as well as classroom procedures will make teaching robotics much easier.

b. Potential sources of funding – Be sure to acknowledge your sponsors at every opportunity, e.g. print their names on your team shirts, etc.

(1) School district

(2) Local businesses

(3) Local non-profit organizations

7. Connect with the robotics educators community locally and virtually

a) Find another robotics team in your area and ask to attend their practice sessions. This is very helpful for first-time coaches.

b) Robotics Academy

c) Robotics Educators Conference

8. Attend teacher training

Recap of the steps to implement a robotics program:

1. Purchase robot kits

2. Purchase robotics curriculum

3. Load software and curriculum on your computer and school network

4. Build practice table (optional)

5. Schedule training – this can be self paced by enrolling in the free online training, or you can attend formal training.

6. Practice building and programming your robot

7. Recruit older students as mentors/assistants

8. Prepare lesson plans – comprehensive lesson plans are included in the Carnegie Mellon VEX curriculum, accessible from the Robotics Academy website at **www.education.rec.ri.cmu.edu**