Curriculum Overview

The Autodesk VEX Robotics Curriculum combines industry-leading Autodesk® Inventor® design tools with the premier educational robotics platform for middle and high schools, the VEX Robotics Design System.

This modular and project-based curriculum teaches the design process in an engaging, hands-on manner to help teachers challenge, motivate, and inspire their students. By applying STEM principles to actual engineering projects, the curriculum helps students quickly understand the relevance of what they are learning, and master the fundamentals of the engineering design process using Autodesk Inventor software and the VEX Robotics Design System.

The curriculum is created to ensure that students with varying learning styles and levels can accomplish the lesson goals. No prior robotics experience is required; beginners are able to advance sequentially through the units to gradually increase their knowledge and skill level.

Modular Unit Structure

The modular design of the curriculum includes project-based units that can be taught sequentially over a school semester or year, while consisting of many units that can be taken out individually or in groups as stand-alone lessons. Most units are outlined to fit within a one-week instructional period, but allow for flexibility with a number of units tailored for longer stretches of two or more weeks and with STEM Connections and projects that support the grouping of units.

The curriculum gives teachers the flexibility to adapt the units and concepts to meet the needs of their class. Units can be covered by students on an individual basis or in groups of students working together as a team. Teachers have the flexibility to hand pick individual units for single one- or two-week lessons, or they can use units in groups for different periods of time, be it one month, one semester, or an entire year.

The Design Process: Think, Create, Build, Amaze

Each unit is structured to cover the full design process in four different phases:
Think, Create, Build, and Amaze.

- **Think Phase –** Scientific and engineering concepts that support the project phase. It provides a foundation for understanding the topics and successfully completing the projects.
- **Create Phase –** 3D solid modeling, digital prototyping, and visualization using Autodesk Inventor. This phase supports the creative process of designing and developing an idea using Autodesk Inventor. Invite your students to join the Autodesk Student Engineering and Design Community to download a free version of Autodesk Inventor for use at home at *www.autodesk.com/edcommunity*.
- **Build Phase –** Hands-on assembly of the VEX robots. Students use the VEX Classroom Lab Kit to build subassemblies and construct a working robot. This phase validates the conceptual knowledge learned in the previous Think and Create phases.
- **Amaze Phase –** Classroom challenges, the engineering notebook, and classroom presentation. Using the completed robot, students have fun testing the limits of their robot through various challenges. The engineering notebook and classroom presentation provide students with business skills required in the real world. The challenges in the Amaze Phase have been designed for classrooms with one robot, but can be easily modified to become multi-robot challenges.

STEM Connections

The Autodesk VEX Robotics curriculum offers the opportunity to develop a solid understanding of the many interrelated scientific and mathematical concepts embedded in robotics that have real-world applications for innovation. The curriculum offers multiple pathways to develop this understanding, ranging from the application of state-of-the-art computer imaging to direct experiential learning opportunities where concepts come to life as you build, test, and explore robotic systems.

The Autodesk VEX Robotics curriculum incorporates the principles of STEM education into each unit and maps them directly to U.S. national academic standards. The STEM Connections support students in acquiring an understanding of the complex and deep interrelationships among science, technology, engineering, and math. From the design of an amusement park ride to the complex operation of a crab's claw, the STEM Connections provide a series of real-world scenarios that expand students' understanding of how theoretical concepts play out in the creation of technological innovations.

The Autodesk VEX Robotics Curriculum makes learning fun and relevant. Students not only learn, but also demonstrate what they learn, build what they imagine, and shape their future as the next generation of innovators.

The Autodesk VEX Robotics Curriculum meets content standards for Science, Technology, Engineering, and Math (STEM). Each unit provides a list of academic standards addressed within each phase of that unit.

Engineering Notebook

The Engineering Notebook is an important element of the Autodesk VEX Robotics Curriculum. Students are required to keep a detailed record of their work, the phase challenges, test results, and presentations. Recording results in the notebook teaches students to use scientific methodology, helps them build organizational skills, and enables them to evaluate and improve as they work through the design process phases.

The Engineering Notebook gives teachers a valuable tool for reviewing and evaluating their students' work as they progress through the curriculum phases and units.

Presentation

Classroom presentation provides students with the opportunity to demonstrate their knowledge of the subject and develop important public speaking and communication skills—critical to their future academic, professional, and personal lives. Classroom presentation also provides students the opportunity to develop their leadership skills and build self-confidence.

Tips for giving a successful presentation are provided in Instructor Resources.

Instructor Resources

Course Syllabus – A course syllabus template helps ensure that your students are knowledgeable about their responsibilities, including assignments and attendance, and course procedures and policies on grading, academic honesty, scheduling, and other matters.

Evaluation Rubrics – Included are various assessment resources to help you access your students' achievement. Criteria for success are clearly stated in the form of a rubric and will provide your students a clear understanding of course measurement and expectation.

Unit Pre-Tests and Post-Tests – Tests are provided to assess your students' understanding of the unit topic both at the beginning and the end of every unit.

Engineering Notebook Worksheets – Worksheets are provided for assembling the Engineering Notebook.

Getting Started

To help get you up and running quickly, the Getting Started section provides useful instructions on how to:

- Use the Autodesk Inventor icon on your desktop.
- Set up the Autodesk VEX Robotics Curriculum.
- Manage the Autodesk Inventor Old Versions folder.
- Print out Instructor Resources and unit materials.

Credits and Copyright

Curriculum Credits

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Getting Started

Desktop Navigation

Exercise: Review the Application Icon

In this exercise, you review the Autodesk Inventor application icon on your desktop.

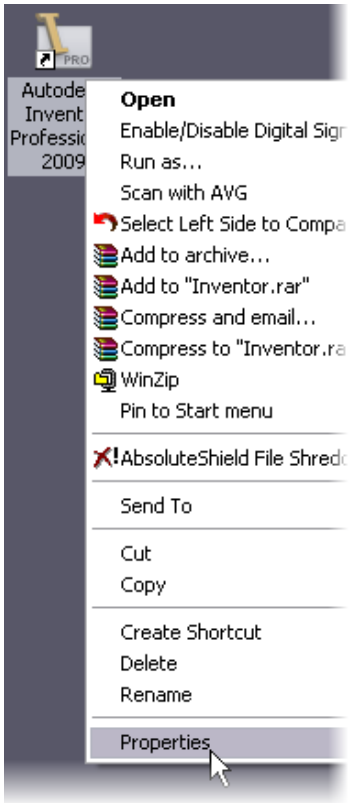
NOTE: The images in this exercise may vary from your computer depending upon the operating system.

1. Minimize all open applications by selecting the minimize icon for each application so the entire desktop is visible.

On your desktop there are icons for installed applications.

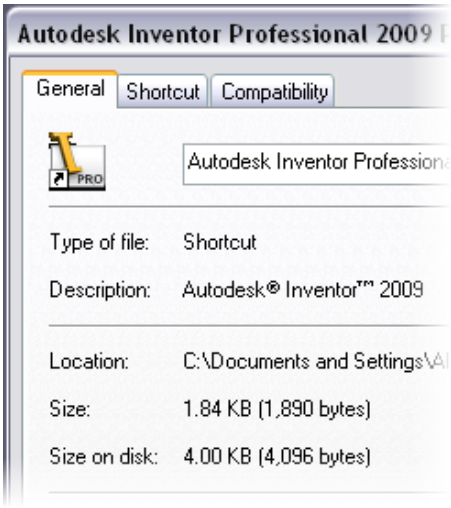
NOTE: The installed applications on this computer are Autodesk Inventor and 3ds Max Design.

2. Right-click the Autodesk Inventor icon. Click Properties.



3. On the Properties dialog box, click the General tab.

   This tab displays information on the shortcut icon for Autodesk Inventor.



4. Click the Shortcut tab.

   This tab displays the name of the file that the shortcut points to.

   In this example, the shortcut points to Inventor.exe. This file starts Autodesk Inventor.

   End of exercise.

Setting Up the Curriculum

The Autodesk VEX Robotics curriculum material features conceptual content, projects, challenges, and Autodesk® Inventor® Professional exercises. When you start an exercise found in the Create Phases, the exercise is displayed in a separate, smaller window. Resize your application and arrange the exercise window on your screen so that both are visible as shown.

The Autodesk Inventor exercise data files are located in the Inventor Datasets folder on your curriculum DVD. Also included are DWF™ files for the completed assemblies in the Build Phases.

Security Settings

Internet Explorer sets up the Trusted zone with a low security level to make it easier for you to do such things as download software without prompting. Add a site to this zone only if you trust that it would never cause harm to your computer. On the other hand, the Restricted zone imposes the highest security level for sites you deem untrustworthy; when you visit these sites, Internet Explorer will prompt you at every turn.

To avoid these security prompts with the Autodesk VEX Robotic Curriculum, you can add *http://www.autodesk.com/* to your trusted site. The following procedure will show you how to make these changes.

1. On the Internet Explorer **Tools** menu, click **Internet Options**.
2. Click the Security tab, and then click **Trusted sites**.
3. Click the **Sites** button.
4. In the Add this Web site to the zone box, type *http://www.autodesk.com* for the web address.
5. Click to remove the check in the **Require server verification** box, then click the **Add** button.
6. Click **OK** twice.

To see the list of Web sites you've added to Trusted and Restricted sites, on the Internet Explorer **Tools** menu, click **Internet Options**. Click the **Security** tab, and then click either **Trusted sites** or **Restricted sites**. Click the **Sites** button to see the list. When you're finished, click **Cancel** twice.

Warning!

If Internet Explorer asks for confirmation, you may be trying to add a site that is not secure. Internet Explorer will accept only sites to the Trusted list that make a secure connection—for example, secure banking or shopping sites.

To identify such a site, look for *https://* in the Web address. If you want to add an unsecured Web site (for example, a site that does not have *https://* in the Web address), click to remove the check in the Require server verification box.

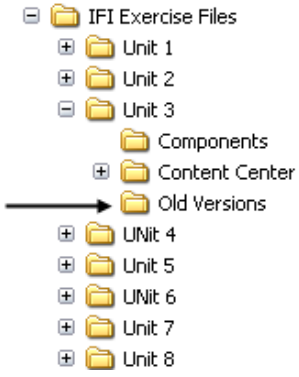
Be careful! Only do this for Web sites whose content you trust 100 percent.

File Management Techniques

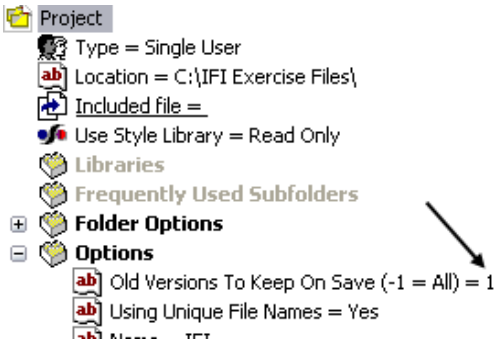
Manage the Autodesk Inventor Old Versions Folder

When you save a file in Autodesk Inventor, a new folder named Old Versions is created below your current working folder.

This folder saves the previous version of your design. It can be used for backup or reverting back to a previous design.



The number of versions saved by Autodesk Inventor is set in the active project file. In this example, one version will be saved.



Printing the Units

PDF files for the course syllabus, evaluation rubrics, engineering notebook worksheets, and the VEX Inventor's Guide are located in the Printable Instructor Resources folder on the Autodesk VEX Robotics Curriculum media.

Updates for the curriculum and PDFs for all units can be downloaded and printed from the VEX Robotics web site at *http://www.VEXrobotics.com/edr-resources*.

To print a PDF file, open the file using Adobe® Reader®. The reader must be installed on your computer. It is available for download at Adobe's website at *http://www.adobe.com/*.

Instructor Resources

Academic Standards

The Autodesk VEX Robotics Curriculum meets content standards for Science, Technology, Engineering, and Math (STEM). Each unit provides a list of academic standards addressed within each phase of that unit.

Information on academic standards for each unit can be found in the unit PDFs, which can be downloaded and printed from the VEX Robotics web site at *http://www.vexrobotics.com/edr-resources*.

International Technology Education Association Standards for Technological Literacy

The Standards for Technological Literacy: Content for the Study of Technology includes the reference guidelines teachers need to provide the best curriculum, equipment, and tools for their students.

Since its release in April 2000, the International Technology Education Association (ITEA) leads the way as the catalyst for school reform and curriculum integration. States and school districts align their curriculum offerings to ITEA standards to bolster national efforts to raise basic competency and technological literacy.

While various geographic locations require specific workforce competency and educational goals for their communities, the Standards for Technological Literacy addresses the goals of national policy.

In each unit, the Autodesk VEX Robotics curriculum refers to the appropriate ITEA standard for the learning material contained in the unit. A full description of the standards is available for viewing at *http://www.iteaconnect.org/TAA/PDFs/xstnd.pdf*.

National Council of Teachers of Mathematics Standards for School Mathematics

The National Council of Teachers of Mathematics (NCTM) provides vision, leadership, and professional development to support teachers in ensuring mathematics learning of the highest quality for all students. NCTM's Principles and Standards for School Mathematics, published in 2000, provides guidelines for excellence in mathematics education.

A full description of the standards is available for viewing at *http://standards.nctm.org/*.

In each unit, the Autodesk VEX Robotics curriculum refers to the appropriate NCTM standard for the learning material contained in the unit. The focus is on the mathematical understanding, knowledge, and skills that students should acquire from each unit.

National Committee on Science Education Standards and Assessment Science Content Standards

The National Science Education Standards present a vision of a scientifically literate populace. They outline what students need to know, understand, and be able to do to be scientifically literate at different grade levels. They describe an educational system in which all students demonstrate high levels of performance, in which teachers are empowered to make the decisions essential for effective learning, in which interlocking communities of teachers and students are focused on learning science, and in which supportive educational programs and systems nurture achievement.

In each unit, the Autodesk VEX Robotics curriculum refers to the appropriate National Committee on Science Education Standards and Assessment (NCSESA) standard for the learning material contained in the unit. A full description of the standards is available for viewing at *http://www.nap.edu/catalog.php?record_id=4962*.

Course Syllabus

The Autodesk VEX Robotics Curriculum provides resources for the delivery of a pre-engineering and engineering design course in Robotics and computer-aided design. This syllabus provides a suggested sequence for the delivery of the course. A customizable syllabus is available as a Word document in the Printable Instructor Resources folder.

The following syllabus provides a suggested sequence for the delivery of the course:

Course Title: *<Insert course title.>*

Learning Resources and Supplies

- A USB memory stick.
- Autodesk Inventor software. Join the Student Community to download free Autodesk Inventor software, so you can continue your coursework at home and can come to class prepared to build and test your robot. To do this, simply join the Autodesk Student Engineering and Design Community at *www.autodesk.com/edcommunity*.
- VEX documentation. Additional documentation resources are available under "Education and Competition Resources" on the VEX Robotics web site at *www.vexrobotics.com/edr-resources*.
- Three-ring binder for the Engineering Notebook.
- Notebook worksheets for the Engineering Notebook. Worksheets are provided with the curriculum and can be found under Instructor Resources.

Evaluation

Evaluation rubrics and pre- and post-tests. Rubrics and tests are provided with the curriculum and can be found under Instructor Resources.

Course Policies: *<Insert course policies.>*

Lab Schedule: *<Insert lab schedule.>*

Course Schedule

Unit	Introduction	Think Phase	Create Phase	Build Phase	Amaze Phase
Unit 1: Introduction to VEX and Robotics	25 minutes	50 minutes	n/a	3 hours	50 minutes
Unit 2: Introduction to Autodesk Inventor	25 minutes	n/a	50 minutes	n/a	n/a
Unit 3: Building a Protobot	25 minutes	50 minutes	3 hours	4 hours	50 minutes
Unit 4: Microcontroller and Transmitter Overview	25 minutes	50 minutes	n/a	2 hours	50 minutes
Unit 5: Speed, Power, Torque, and DC Motors	25 minutes	1 hour	1 hour	1 hour	2 hours
Unit 6: Gears, Chains, and Sprockets	25 minutes	50 minutes	2 hours and 50 minutes	50 minutes	2 hours and 50 minutes
Unit 7: Advanced Gears	25 minutes	1 hour	1 hour and 50 minutes	3 hours	2 hours
Unit 8: Friction and Traction	25 minutes	1 hour	2 hours	50 minutes	2 hours and 50 minutes
Unit 9: Drivetrain Design 1	25 minutes	50 minutes	1 hour	2 hours	2 hours
Unit 10: Drivetrain Design 2	25 minutes	1 hour	1 hour and 50 minutes	2 hours and 50 minutes	1 hour and 50 minutes
Unit 11: Creating a Tank Tread Drive	25 minutes	50 minutes	1 hour and 50 minutes	2 hours	1 hour and 50 minutes
Unit 12: Object Manipulation	25 minutes	50 minutes	1 hour	2 hours and 50 minutes	1 hour
Unit 13: Rotating Joints	25 minutes	50 minutes	1 hour and 50 minutes	3 hours	1 hour and 50 minutes
Unit 14: Accumulator Design	25 minutes	50 minutes	50 minutes	4 hours	1 hour and 50 minutes
Unit 15: Linkages	25 minutes	50 minutes	2 hours	4 hours	2 hours
Unit 16: Bumper and Limit Switch	25 minutes	50 minutes	1 hour and 50 minutes	2 hours	1 hour and 50 minutes
Unit 17: Systems Integration	25 minutes	25 minutes	n/a	2 hours and 50 minutes	2 hours

Evaluation Rubrics

Included are various assessment resources to help you access your students' achievement. Criteria for success are clearly stated in the form of a rubric and will provide your students a clear understanding of course measurement and expectation. Actual grading procedures for individual courses will vary. Applicable National Science, Technology, and Mathematics standards are references, but please also refer to your local and state standards as necessary for implementation of appropriate evaluations.

Evaluation Rubrics can be found as PDF files in the Printable Instructor Resources folder.

Unit Introduction and Think Phase Evaluation Rubric

INTRODUCTION and THINK PHASE	Excellent	Good	Fair	Poor
Pre-Test	Great care was taken to read and answer all questions.	Care was taken to read and answer all questions.	A minimal amount of care was taken to read and answer all questions.	Little to no care was taken to read and answer all questions.
Post-Test	A minimum of 90% of the questions were answered correctly.	A minimum of 80% of the questions were answered correctly.	A minimum of 70% of the questions were answered correctly.	Less than 70% of the questions were answered correctly.
Collaboration	Almost always listens to, shares with, and supports the efforts of others. Tries to keep people working well together.	Usually listens to, shares with, and supports the efforts of others. Does not create conflict in the group.	Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others. Often is not a good team member.

Create Phase Evaluation Rubric

CREATE PHASE	Excellent	Good	Fair	Poor
Inventor Modeling	Great care was taken to follow all directions, complete all details, and follow through with virtual testing of Inventor models.	Care was taken to follow all directions, complete all details and follow through with virtual testing of Inventor models.	A minimal amount of care was taken to follow all directions, complete all details, and follow through with virtual testing of Inventor models.	Little to no care was taken to follow all directions, complete all details, and follow through with virtual testing of Inventor models.

CREATE PHASE	Excellent	Good	Fair	Poor
Collaboration	Almost always listens to, shares with, and supports the efforts of others. Tries to keep people working well together.	Usually listens to, shares with, and supports the efforts of others. Does not create conflict in the group.	Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others. Often is not a good team member.

Build Phase Evaluation Rubric

BUILD PHASE	Excellent	Good	Fair	Poor
Assembly	Great care was taken to follow all directions, complete all details, and follow through with testing of the VEX assembly.	Care was taken to follow all directions, complete all details, and follow through with testing of the VEX assembly.	A minimal amount of care was taken to follow all directions, complete all details, and follow through with testing of the VEX assembly.	Little to no care was taken to follow all directions, complete all details, and follow through with testing of the VEX assembly.
Engineering Notebook	Notebook provides a very careful recording of any requested plans, concepts, or conclusions.	Notebook provides a careful recording of any requested plans, concepts, or conclusions.	Notebook provides a reasonable recording of any requested plans, concepts, or conclusions.	Notebook provides little to no recording of any requested plans, concepts, or conclusions.
Collaboration	Almost always listens to, shares with, and supports the efforts of others. Tries to keep people working well together.	Usually listens to, shares with, and supports the efforts of others. Does not create conflict in the group.	Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others. Often is not a good team member.

Amaze Phase Evaluation Rubric

AMAZE PHASE	Excellent	Good	Fair	Poor
Challenge	Great care was taken to follow all directions, complete all details, and follow through with all aspects of the Amaze Challenge.	Care was taken to follow all directions, complete all details, and follow through with all aspects of the Amaze Challenge.	A minimal amount of care was taken to follow all directions, complete all details and follow through with all aspects of the Amaze Challenge.	Little to no care was taken to follow all directions, complete all details and follow through with all aspects of the Amaze Challenge.
Engineering Notebook	Notebook provides a very careful recording of any requested plans, concepts, or conclusions related to the Amaze Challenge.	Notebook provides a careful recording of any requested plans, concepts, or conclusions related to the Amaze Challenge.	Notebook provides a reasonable recording of any requested plans, concepts, or conclusions related to the Amaze Challenge.	Notebook provides little to no recording of any requested plans, concepts, or conclusions related to the Amaze Challenge.
Presentation	Student is completely prepared, has obviously rehearsed, and shows a full understanding of the topic. Student is able to accurately answer almost all questions posed by classmates or the teacher.	Student is fairly well-prepared but could have been better rehearsed. Student shows a good understanding of the topic and is able to accurately answer most questions posed by classmates or the teacher.	Student is somewhat prepared, but it is clear that rehearsal is lacking. Student shows partial understanding of the topic and is able to accurately answer a few questions posed by classmates and the teacher.	Student is unprepared to present and does not understand the topic very well. Student is unable to accurately answer questions posed by classmates or the teacher.
Collaboration	Almost always listens to, shares with, and supports the efforts of others. Tries to keep people working well together.	Usually listens to, shares with, and supports the efforts of others. Does not create conflict in the group.	Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others. Often is not a good team member.

STEM Connections Evaluation Rubric

STEM CONNECTIONS	Excellent	Good	Fair	Poor
STEM Connections	A minimum of 90% of the questions carefully answered demonstrates a sound understanding of unit concepts.	A minimum of 80% of the questions carefully answered demonstrates a good understanding of unit concepts.	A minimum of 70% of the questions carefully answered demonstrates a fair understanding of unit concepts.	Less than 70% of the questions carefully answered demonstrates a poor understanding of unit concepts.
Engineering Notebook	Notebook provides a very careful recording of any requested plans, concepts, or conclusions related to the STEM Connections.	Notebook provides a careful recording of any requested plans, concepts, or conclusions related to the STEM Connections.	Notebook provides a reasonable recording of any requested plans, concepts, or conclusions related to the STEM Connections.	Notebook provides little to no recording of any requested plans, concepts, or conclusions related to the STEM Connections.
Presentation	Student is completely prepared, has obviously rehearsed, and shows a full understanding of the topic. Student is able to accurately answer almost all questions posed by classmates or the teacher.	Student is fairly well-prepared but could have been better rehearsed. Student shows a good understanding of the topic and is able to accurately answer most questions posed by classmates or the teacher.	Student is somewhat prepared, but it is clear that rehearsal is lacking. Student shows partial understanding of the topic and is able to accurately answer a few questions posed by classmates and the teacher.	Student is unprepared to present and does not understand the topic very well. Student is unable to accurately answer questions posed by classmates or the teacher.
Collaboration	Almost always listens to, shares with, and supports the efforts of others. Tries to keep people working well together.	Usually listens to, shares with, and supports the efforts of others. Does not create conflict in the group.	Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others. Often is not a good team member.

Pre- and Post-Tests

Tests are provided to assess your students' understanding of the unit topic both at the beginning and the end of every unit. Pre- and post-tests can be found as PDF files in the Printable Instructor Resources folder.

Engineering Notebook Worksheets

The following notebook worksheets are provided for assembling the Engineering Notebook:

- Cover sheet with a place for student's name and graphics.
- Blank page with grid background. Print out enough copies of this page for each student notebook to accommodate the units covered in the classroom.
- STEM Connections worksheet.

Worksheets can be found as PDF files in the Printable Instructor Resources folder.

Presentation

Here are some helpful tips for your students for developing a successful presentation.

- Know your audience.
- List your objectives.
- Outline your message.
- Lay out your presentation.
- Create and assemble your presentation materials. For example: poster board, slides, graphics, animations.
- Write speaker notes and prepare handouts.
- Rehearse your presentation and revise if necessary.
- Rehearse as much as possible.

VEX Equipment Storage Tips

Organizing your VEX workspace and helping student teams manage their VEX creations and equipment is an absolute must for maximizing instructional and build time in the classroom or laboratory.

Once your VEX equipment is unpackaged for the first time, you'll need to store and care for it. Each situation is different, and knowing your own space, storage needs, and classroom/lab setup is paramount. You'll also have to decide how portable your equipment needs to be and decide if you'd like some storage containers to fit inside of other storage containers. However, here are some suggested ideas for storing and managing your VEX equipment. Based on a single VEX Robotics Classroom Lab Kit, the following summarizes some suggestions for storage and care of equipment.

Mechanisms Being Built and Robots in Process and Transmitters

Space Requirement MINIMUM: 14″ long x 14″ wide x 14″ high

Possible Storage Solutions:

- Secure labeled shelf space
- Stackable flip-top container
- Stackable tub

Example of a flip top container

Example of a tub container

Large VEX Parts: Wheels, Microcontrollers, Long Chassis Metal, Etc.

Space Requirement MINIMUM: 6″ long x 14″ wide x 6″ high

Possible Storage Solutions:

- Secure labeled shelf space
- Toolbox
- Storage container

Example of a toolbox

Small VEX Parts and Tools: Fasteners, Most Gears, Switches, Wrenches, Etc.

Space Requirement MINIMUM: 10″ long x 14″ wide x 3″ high

Possible Storage Solutions:

- Closable storage container with compartments
- Plastic food containers with lids
- Re-sealable plastic bags
- Baby food jars

Example of a storage container with compartments

Example of a storage container with compartments

Additional Considerations

Here are a few more hints from some of our VEX Robotics veteran classroom users.

- **Label Your Equipment**: Using markers or printed labels works great. Label by team/group number or any way that makes sense for your needs.
- **Battery Charging Stations**: In most cases it's best to manage the VEX rechargeable battery packs as a single "charging station" where every team/group is responsible for its own batteries. Nothing slows down a project more than the lack of available batteries.

Example of a battery stationbox

- **Phone Cable Tethers**: If you are not using WiFi for controls, we suggest all teams/groups have a phone cable for a tether. This allows for most testing to take place without crystals. Please see your VEX materials for proper use of tethers.
- **Crystal Storage**: It may be best for an instructor/lab leader to manage all crystals rather than the teams managing them. See your VEX materials for proper use and care of crystals. We suggest the use of tethers for most testing when possible and practical, then distributing crystals for Amaze Phase Challenges and competitions.
- **Antenna Care and Storage**: These tend to bend and break if not properly cared for. Again, if tethers are being used, there is no need to use antennas. They can even be unscrewed and stored separately until they are needed to use with the crystals.
- **Challenge and Project Supplies**: Don't forget that the Amaze Phases call for some additional materials such as tennis balls, etc. You will occasionally need some additional storage space, so plan accordingly.