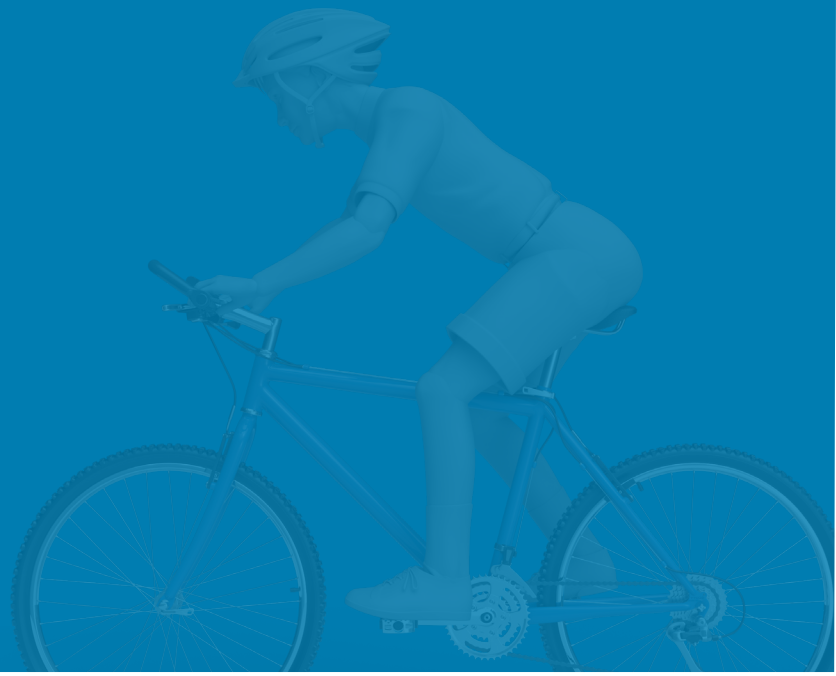
Trips for Kids
EARN-A-BIKE WORKSHOP PROGRAM
For Beginner Students Ages 15-17

CURRICULUM OVERVIEW

PRODUCED IN COLLABORATION WITH TRIPS FOR KIDS MARIN



EARN-A-BIKE PROGRAM

The nation's oldest, largest and most diverse youth cycling organization, Trips for Kids offers youth development programs that use the bicycle as a learning laboratory for valuable life lessons and hands-on STEM learning.

Our Earn-a-Bike program gives young people the opportunity to earn a bike of their own by attending after-school learning sessions that combine bicycle mechanic skills with hands-on STEM (Science, Technology, Engineering, Math) education.

Developing STEM fluency:

In an increasingly technical world, it's important that students are exposed to the mindset and skillset that enable them to solve problems, apply relevant information and evaluate evidence to make decisions.

By exposing students to STEM and giving them opportunities to explore STEM-related concepts, they can develop a passion for the pursuit of knowledge and may consider a STEM-based career.

Workers who hold STEM degrees enjoy higher earnings, regardless of their occupation.*

Learning Life Lessons:

The Earn-a-Bike program combines theoretical knowledge with hands-on learning and real-world applications to help students develop a variety of skills, including creativity, productivity, flexibility, and initiative.

The lessons in this curriculum are guided by the principles that make a great STEM lesson and include:

- Focus on real-world issues and problem-solving
- Immersion in hands-on inquiry
- Exposure to collaboration and productive teamwork
- The application of rigorous math, science and engineering content that may reinforce what students are currently learning in school—or, in some cases, surpass it
- Understanding failure as a necessary part of learning and innovation

* "7 facts about the STEM workforce." Pew Research Center, Washington, D.C. (January 9, 2018) www.pewresearch.org/fact-tank/2018/01/09/7-facts-about-the-stem-workforce

Adding STEM into the Mix

This beginning Earn-a-Bike program curriculum, designed for students ages 15 - 17, is taught over the course of six lessons of 1.5 - 2 hours in duration. It takes students through a basic mechanical understanding of the main components of the bicycle and combines this understanding with specific, STEM-related concepts and ideas that are presented through hands-on activities, live demonstrations, scientific principles, mathematical formulae and applied technology.

Each lesson follows a logical flow with iconography and colored boxes that call out supplementary content, background information and safety tips, as well as deeper explorations of some STEM concepts. Each lesson also includes thought-provoking questions as well as end-of-lesson evaluation actions that help instructors better understand if students are following along and absorbing the content.

Concentrations

The curriculum, as articulated in the accompanying Lesson Guide for Instructors, includes the following components, which span six robust lessons and five specific areas of concentration

Hands-on Activities:

Through active, hands-on activities, students gain knowledge and mechanical skills, learning:

- To identify different parts of a bike.
- How gas and pressure (PSI) work.
- How to repair a flat tire.
- Use of torque wrenches to tighten nuts and bolts to specified torque values.
- To install different parts of the bike to the frame using torque.
- How leverage and mechanical advantage work.
- To install brake levers and shift levers to the handlebars of a bike.
- How to produce and understand kinetic friction.
- How to adjust a variety of braking systems.
- How different chain speeds work and underlying mechanical principles.
- How to check a chain for wear as well as cleaning and lubrication.
- Multiple ways to break a chain.
- How to determine gear ratios.
- How to adjust shifters and derailleurs.

Demonstrations:

Instructor-led demos help students connect theories with actual practice and often prepare them for hands-on activities. Through demonstrations, students learn:

- The causes and types of tire and tube damage.
- The mechanics of different types of braking systems.
- The intricacies of front and rear derailleurs, including the importance of careful adjustment for proper operation
- The impact of cable tension on accurate gear shifting.

Science and Engineering Principles:

Science and engineering principles supply big-picture thinking that can then be applied to real-world applications. Taught scientific principles include:

- Torque
- Mechanical Advantage
- Leverage
- Momentum
- Kinetic Energy
- Frictional Force
- First Law of Thermodynamics
- Newton's Second Law of Motion

Mathematics:

Math helps develop analytical thinking and provides a deeper understanding into why—and how—things work. Students learn:

- The formula for torque and how to calculate it.
- How to measure mechanical advantage.
- The formula for kinetic energy and how to calculate it.
- The formula for momentum and how to calculate it.
- How to calculate force.
- How to calculate gear ratios.

Applied Technology:

Learning how STEM concepts are applied to bike design and other technologies is at the heart of what is being taught in this program. Students will:

- Get to know the different materials used in bike frame fabrication.
- Explore why bike tires have different tread patterns and how they affect ride and performance.
- Learn how the engineering concept of triangulation is applied to everyday architecture.
- Explore how aerodynamics, aerodynamic drag and aerodynamic efficiency affect bike rides.
- Learn how mechanical advantage is used in braking.
- Learn about kinetic energy as it applies to bike design.