

iFLY Education Program

Teacher Guide

Grades 9-12



Program focus

The High School Education Program at iFLY uses iFLY's unique vertical wind tunnel facility to make STEM exciting, relevant, and accessible to students. Our curriculum has been designed by STEM educators and scientists to support STEM learning in your classroom. Every iFLY field trip includes:

- Interactive STEM presentation, delivered by iFLY STEM Educator
- Physics demonstration in the wind tunnel
- Classroom experiment to investigate the effects of parachute parameters on flight performance
- Flying instruction & safety training
- Flying time, with one-on-one supervision from a highly-trained and certified instructor
- Pre and post-field trip activities to conduct in your classroom
- Photos and videos for the students to keep

Learning objectives

- Increasing awareness of exciting STEM careers
- Learning how STEM is used in the real-world
- Drawing and interpreting free-body force diagrams
- Understanding the nature of fluids and how they exert forces on solid objects
- Deriving equations to represent physical phenomena
- Applying engineering principles to think about tunnel design, energy efficiency, and safety factors
- Understanding variability, uncertainty, and error in experimental results

Program synopsis

Lecture and Demonstration

The program begins with a lecture and discussion with iFLY STEM Educators to introduce STEM concepts related to the wind tunnel. Students will discuss basic ideas of fluid dynamics, and learn how fluids exert pressure forces on objects. The STEM Educator will discuss the different forces at work in the wind tunnel, and how changing the shape or "frontal area" of an object will affect its speed in the wind tunnel. The STEM Educator will lead students through an exercise to derive the equation for "terminal velocity" (the air velocity required to "fly" the object). Educators will also introduce engineering careers and how engineers use wind tunnels to test their designs.

The wind tunnel demonstration segment uses various objects such as inflatable balls to show how the terminal velocity depends on an object's size, shape, and weight.

Classroom Experiment

Students move into a classroom and break into 2's and 3's to conduct an experiment. The goal is for each student to predict his/her own terminal velocity in the wind tunnel. In other words, how fast must the air in the wind tunnel move to make each student "float"? The students will use algebraic reasoning to solve the air drag equation for "v". The groups will then use measuring tapes and scales to determine their weight and frontal area.

During their flights, an instructor will be recording their actual terminal velocities. Afterwards, the students will compare their actual velocities to their predicted values. The Educator will lead them through a discussion of error and the class will brainstorm possible reasons for the error. If time is running short, the classroom teacher will be given all the materials necessary to conduct this discussion back at school.

Flight Experience

All students are given flight instruction by a certified flight instructor, including an individual flight experience in the iFLY tunnel.

Grade level appropriateness

Our curriculum has been specifically designed to support the following standards:

TEKS:

Math: Algebra I: 1, 2D, 5, 9B; Algebra II: 1; Geometry: 8A

Science: IPC: 2B-E, 3A, 3E, 4A, 4C, 4D, 5A; Physics: 2E, 2H-L, 3A, 3E, 3F, 4A, 4B, 4D, 4E, 4F

Common Core Mathematics: HSA.CED.A.1; HSA.CED.A.2; HSA.CED.A.4; HSA.REI.A.1; HSA.REI.B.3

NGSS: HS-PS2-1; HS-PS2-2; HS-ETS1-2

Making the most of your field trip

1. Deliver the "Pre Field Trip" pdf slides to your students (*This is also available in .pptx format. Contact us and we can email you this file*). This presentation will show students what to expect when they arrive at the wind tunnel. It will also introduce some of the vocabulary and STEM concepts we will cover in the field trip. At the end of the slides, you will find a page containing a "script" that you can read word-for-word to your students. No preparation necessary!
2. If you have questions before, during, or after your field trip, please do not hesitate to contact iFLY staff. We are happy to answer any questions that will make your students' better!
3. Arrive on time. Students' flight times are prescheduled and cannot be rearranged. Arriving promptly will ensure that your students do not miss any portions of their education experience.
4. During the classroom activity, the STEM Educator may ask for your assistance to help students with certain portions of their investigation. Please encourage parents and other field trip chaperones to jump in and lend a hand!
5. Please help us improve and strengthen our program by completing the Teacher Survey. We value your feedback!
6. You will receive materials and suggested activities to complete back in the classroom. Having a follow-up discussion or activity with your students after the field trip will help support the concepts they learned during their visit.