IMSA Fusion

IMSA Fusion is a teacher professional development and student STEM enrichment program for Illinois students who are talented, interested and motivated in mathematics and science. IMSA Fusion places a special emphasis on students who are historically underrepresented in those areas. Fusion works with teachers and students in grades 4-8.

In brief, the program goals are:

- Maintain or increase students interest, involvement and literacy in science and mathematics
- Enhance the knowledge and skills of teachers in science, mathematics, and technology; stimulate excellence in schools
- Stimulate excellence in schools' science and mathematics programs
- Help increase access to programming for students who are historically under-resourced in science, mathematics and technology and for all areas of the state

By design, the IMSA Fusion curriculum is inquiry based, problem centered and integrative. The learning experiences focus on helping students "learn how to learn" and emphasize logic, mathematical thinking and experimental scientific thinking. Topics relate to the students' lives, thereby arousing their curiosity and increasing their motivation to learn.. Teachers from each participating school are supported with on-going professional development for the delivery of the curriculum and use of appropriate pedagogy.

Engineering: Design & Build

Designed for Grades 4-5

Engineering: Design & Build focuses on investigating engineering. Student led teams conceptualize, build, test and acquire knowledge while becoming familiar with the engineering design process. Using an open-ended inquiry approach students are able to foster their creativity. Students learn to apply multiple skills and develop the habits of innovators.

Students are encouraged to think about needs, requirements, and alternatives as they progress throughout the curriculum. Additionally, students consider materials, energy, inputs and outputs. Unit lessons combine generative, analytical, synthesis, and evaluative thinking to allow students to finalize their design choice and initiate construction.

Engineering: Design and Build Unit Summaries

Build-A-Boat

Build-A-Boat is a lesson that focuses on the scientific inquiry process. Students experience the concept of buoyancy. They explain why some objects sink and other objects float. Ultimately, they design and build an aluminum foil boat to hold a maximum load.

The students will:

- understand and practice scientific inquiry: questioning, predicting, observing, recording and interpreting data, and communicating results
- experience the concept of buoyancy
- explain in their own words why some objects sink and other objects float
- design and construct an aluminum foil boat to hold a maximum load

You've Got Mail

You've Got Mail is designed to enhance students' problem solving skills and team work. This lesson specifically focuses on the understanding of package design: planning, construction, testing and evaluation. Students play the role of "engineers" as they design and safely ship a package.

The students will:

- gain knowledge of product planning
- practice the engineering design process
- explore and experiment with ideas, materials, technologies and techniques
- assess solutions to a design challenge
- experience working in groups and problem solving

Engineering: Design & Build Unit Summaries

Hot Rod Hamster

Hot Rod Hamster is a lesson that focuses on the scientific inquiry process. Students become familiar with the engineering design process by using it to brainstorm solutions to a problem and then build, test, and refine their prototype.

The students will:

- become familiar with the design process by using it to brainstorm solutions to a problem and then build, test, and refine their prototype
- communicate design strategies for efficient, gravity powered cars including size, mass, and speed
- be financially responsible and purchase materials for their car within predetermined budget constraints

Let It Roll

Let It Roll is a lesson where students design and build a ski jump to launch a ball that will travel a maximum distance to a target. In addition, students design and build a foam insulation roller coaster track that demonstrates the laws of motion.

The students will:

- design and build a ski jump to launch a ball that will travel a maximum distance to a target
- design and build a foam insulation roller coaster track that demonstrates the laws of motion
- differentiate energy as potential or kinetic

Engineering: Design & Build Unit Summaries

Catapult Wars

Catapult Wars is a lesson where students design and build a catapult. Students test, evaluate and discuss possible improvements to their designs. This lesson focuses on student understanding of motion and forces. In addition, students become aware of accuracy and precision. Ultimately, students will understand that a catapult is a type of simple machine called a first-class lever.

The students will:

- design and build a catapult
- test and evaluate effectiveness of their designs
- discuss possible improvements to their designs
- communicate experimental results
- understand motion and forces
- become aware of accuracy and precision
- understand that a catapult is a type of simple machine called a first class lever

Fusion Five

FUSION Five engages participants in a case study. A series of engineering challenges to be solved with limited supplies await students.

The students will:

- identify relationships among the concepts of lever, fulcrum, load, and effort
- use simple machines to solve problems
- understand air resistance
- work in groups to design solutions to problems

Engineering: Design & Build Unit Summaries

Something Borrowed

Something Borrowed explores a different aspect of engineering. Students test and assess materials' capabilities to repel water and stains while learning about the inspiration for these ideas – nature. After learning about biomimicry, students develop a new product.

The students will:

- understand the concept of hydrophobic
- be introduced to the field of biomimetics
- preform water resistance and stain resistance tests
- design a nature inspired product

Applications of Engineering Design

In the culmination activity, Applications of Engineering Design, students apply what they have learned about simple machines and engineering design to build a Rube Goldberg machine.

The students will:

- apply what has been learned about simple machines and engineering design to build a Rube Goldberg machine

Engineering: Design & Build Extensions

Wheeling the Weight Around

For those wishing to extend the curriculum, Wheeling the Weight Around is a lesson where students physically construct a scale model of a working block and tackle system. They develop a deeper understanding of the way force can be multiplied at the expense of distance. Students use what was learned through simulation to answer challenging questions.

The students will:

- physically construct a scale model that simulates the workings of a real block and tackle system
- develop a deeper understanding of the way force can be multiplied at the expense of distance
- use what was learned through simulation to answer the challenge question

Topsy-Turvy

Another opportunity to extend learning is Topsy Turvy--a lesson where students find the center of mass of a meter stick. In addition, students explore the use of a lever as a simple machine. Finally, students apply the dynamics of levers in real-world situations.

The students will:

- find the center of mass of a meter stick
- explore the use of a lever as a simple machine
- apply the dynamics of levers in real-world situations