

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.

Dive In: Oceanographic Engineering

Designed for Grades 4 - 5

Although some is known about the oceans, many believe that there is still a majority of the oceans that remains unexplored. The oceans are home to wide variety of organisms and are constantly changing. Humans rely on the ocean for a multitude of reasons including food, products, recreation, and energy. Engineering is involved in all aspects of harnessing these resources. During Dive In: Oceanographic Engineering, students will be engaged in identifying problems, designing, testing, and evaluating potential solutions.

Upon completion of this curricular unit, students will:

- Engage in and evaluate modeling and simulations.
 - Use real world data.
- Develop an awareness of engineering opportunities provided by the oceans
- Gain a global perspective on the importance of the oceans

Dive In: Oceanographic Engineering

Unit Summaries

Dive In: It's Trivia

The ocean is extremely diverse, used by humans for a variety of its resources, and covers a major part of the Earth. A general introduction to the ocean occurs through the game Dive In: It's Trivia.

The students will:

- Determine the importance of oceans on human life.
- Explore marine life

A-Salt on Water

Accessibility and availability of clean, fresh water are becoming increasingly critical for humans. Modeling of desalination in A-Salt on Water provides opportunities to explore the processes behind possible solutions

Students will:

- Model the distribution of salt to fresh water, and the availability of potable water on the planet.
- Generate ideas for desalination.
- Calculate the amounts of freshwater needed for a population.
- Investigate methods of removing salt from salt water.
- Model the process of osmosis.
- Investigate the process of desalination.

Dive In: Oceanographic Engineering

Unit Summaries

C Pearl Farms

Aquaculture can be explained as farming in the water, in this case, the oceans. One aspect of this industry, pearl farming, will be explored by students in **C Pearl Farms**.

The students will:

- Design, build, and evaluate a prototype
- Observe, collect, analyze data
- Describe conditions needed for pearl oyster farming
- Make decisions based on facts & evaluate trade-offs
- Explore optimal solutions
- Work collaboratively to solve a problem
- Develop strategies for solving a problem
- Identify properties of pearls

You've Got to Move It

Millions of dollars of consumer goods are traveling on the ocean at any given time. **You've Got to Move It** explores the use of the ocean for transportation, tracking the shipping industry, and ocean currents.

Students will:

- Research using a data base
- Identify and evaluate strategies to solve a problem
- Interpret ocean currents map
- Use evidence to develop an explanation
- Design a scale drawing
- Define a solution to a problem based on materials and time
- Develop a plan for scaling up production of a product
- Evaluate trade-offs of product development

Dive In: Oceanographic Engineering

Unit Summaries

Bioprospecting

Many new products, including medications, are being inspired by life in the ocean. **Bioprospecting** introduces students to the processes involved in the phases of ocean based medicine development.

The students will:

- Identify products made from aquatic organisms.
- Design a method for a population count
- Work collaboratively
- Evaluate a model
- Develop and follow a procedure
- Use data to make and defend decisions
- Collect, analyze, interpret, and present data
- Determine latitude and longitude
- Convert between measurement units

Over the Ocean

What are the optimal conditions for selecting a building site for an island? Many factors, both biotic and abiotic, affect that decision. Choosing the location for the construction of an island will be a problem solved during **Over the Ocean**.

Students will:

- Evaluate the pros and cons of a situation and make a decision based on evidence
- Evaluate order of operations mathematical problems
- Locate order pairs on a circular sonar grid

Dive In: Oceanographic Engineering

Unit Summaries

Crash Waves

Alternate energies come in many forms, including harnessing energy from the ocean. Wave energy converters may be used to achieve this goal. **Crash Waves** engages students in exploration of these concepts.

The students will:

- Discover that oceanic waves involve the movement of energy, not the forward movement of water.
- Explore devices that harness the energy from oceanic waves.
- Analyze wave energy devices (WEC's) to determine their benefits and challenges.
- Redesign an existing WEC with specific conditions in mind.

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Unit Summaries

Island Engineer-ity

Islands are surrounded by water and may be natural or artificial. Many materials may be used in the construction of an island, but the primary component is sand. **Island Engineer-ity** explores characteristics of the materials that could potentially be used in this process. The students will:

- Observe different types of sands and categorize based on textural differences.
- Test the various sand samples to determine which sand type can be used to build the most stable structure.
- Test a variety of additive materials to see which materials work best to reinforce the stability of sand structures.

Power Up

There are many applications for different pressure systems. Work can be completed by harnessing the forces and effects of fluids and air. One application of these systems is a Crane. Exploration of these effects and applications will occur in **Power Up**. Students will:

- Explore and analyze the behavior of water pressure in a system.
- Build and test a pressure-controlled mechanical system model.
- Explore the closed system pressure principal
- Construct a model of a closed system air pressure
- Evaluate the performance of the closed air pressure system

Dive In: Oceanographic Engineering

Unit Summaries

City Development

Tourism is a large part of many island economies. Thoughtful city planning must be completed in order to maximize the benefits of the island. Location of housing, parks and recreation center, and construction of an efficient public transit system will be challenges posed during **City Development**.

The students will:

- Evaluate, assess, and apply factors involved in city map development including conceptual residential and commercial potential development
- Investigate social responsibility concept toward the community
- Design, build, test, and analyze infrastructure creation and development according to climate conditions
- Calculate and develop a public transit time schedule
- Calculate costs based on supply and demand
- Use observations and inquiry to form hypotheses

Something's Fishy

Fish are a primary food source for many humans, particularly in coastal areas and islands. The variety of food that comes from the ocean is a large part of economies across the world. How do issues such as market value, transportation, and availability affect a seafood business? These and other concepts are explored in **Something's Fishy**.

Students will:

- Learn about various food products harvested from the ocean, their availability and monetary worth to the food industry.
- Understand that availability and distribution of products affects the cost.
- Devise a mathematical expression that explains how to determine the cost of a dish on a menu given the seafood cost per serving, general utility costs per month, and shipping.
- Solve various seafood distribution and availability challenges based on real world issues.
- Discuss ways by which society might help prevent such issues from occurring.

Dive In: Oceanographic Engineering

The ocean has long been used for recreation and sport. Certain geographical locations provide greater challenges than others when it comes to surfing. Through investigation of the surf boards, topographical features, and Mavericks, students gain an understanding of the science and math involved in Surf's Up.