

你好

ILLINOIS MATHEMATICS AND SCIENCE ACADEMY



IMSA: INNOVATING STEM
EDUCATION.

IMSA MISSION.

The mission of IMSA, the world's leading teaching and learning laboratory for imagination and inquiry, is to ignite and nurture creative, ethical, scientific minds that advance the human condition.



INNOVATION IN EDUCATION.

Takes on 2 forms:

1. Sustaining.
2. Disruptive.



The IMSA Story
6 Examples of Disruptive Innovation

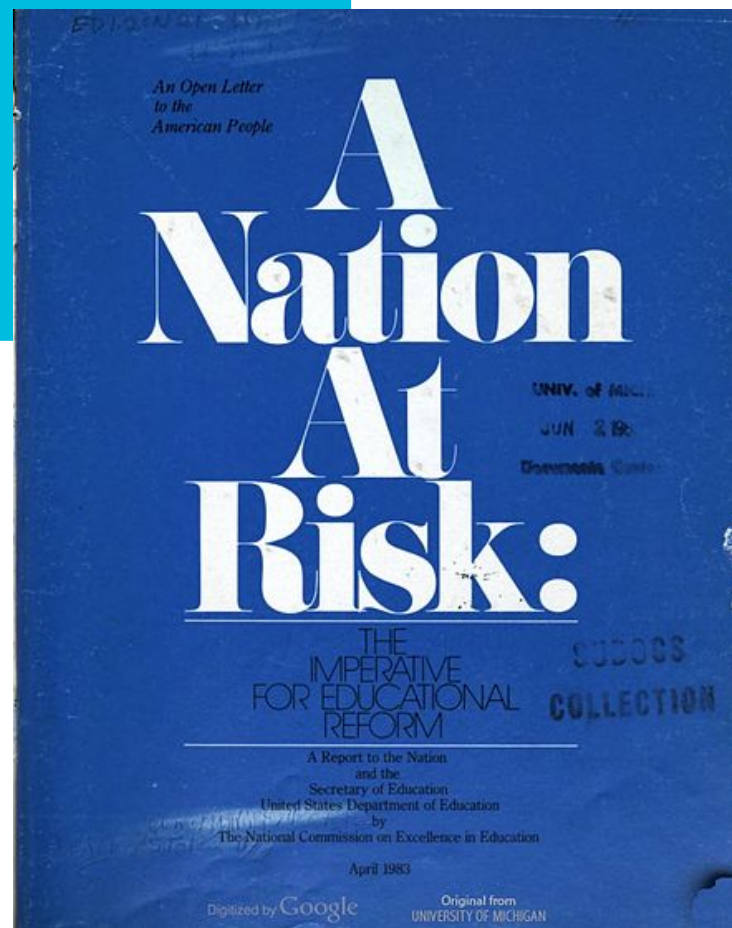
DISRUPTION #1. A NATION AT RISK.

Problem Identified:

1983 Report. A Nation At Risk:
The Imperative for Educational Reform.

Governor Thompson's Question.

Dr. Leon Lederman's Response:
Illinois Mathematics and Science Academy



WAVE OF CHANGE.

“Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it’s the only thing that ever has.”

Margaret Mead

DISRUPTION #2. IMSA. CREATION.

Legislative Mandate 1:

“The primary role of the Academy shall be to offer a uniquely challenging education for students talented in the areas of mathematics and science.”

Legislative Mandate 2:

“The Academy shall also carry a responsibility to stimulate further excellence for all Illinois schools in mathematics and science.”



IMSA.

Legislative Mandate 1:

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THE ACADEMY. AT A GLANCE.

Public, residential learning laboratory for grades 10-12

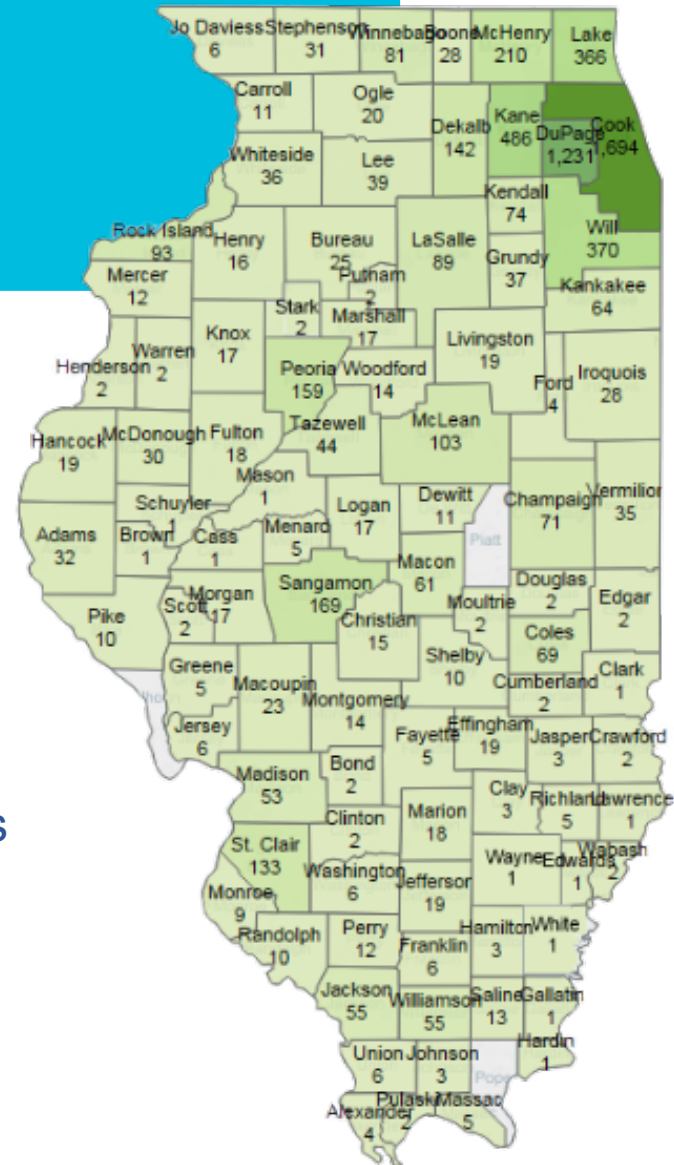
650 residential students annually.

32.2 Composite ACT Score.

SAT: 688 ERW & 728 Math (mean)

195 seniors; 46 National Merit Semi-Finalists

Ranked Top High School in the Nation by WSJ, Newsweek, Niche.



COURSES. MATH. SCIENCE.

2017-2018 Course Catalog

16 of 35
required classes
for graduation are
in math and science.
(Each class is .5 credit.)

Science 4.0 credit minimum; All science courses have a lab component

Core Courses [Sophomore]

Methods in Scientific Inquiry
Scientific Inquiries—Biology
Scientific Inquiries—Chemistry
Scientific Inquiries—Physics

Biology Electives

Evolution, Biodiversity and Ecology
Microbes and Disease

Molecular and Cellular Biology
Physiology and Disease
Seminar in Biology—Development

Chemistry Electives

Advanced Chemistry—Structure and Properties
Advanced Chemistry—Chemical Reactions
Biochemistry

Environmental Chemistry
Organic Chemistry I
Organic Chemistry II

Physics Electives

Biophysics
Computational Science
Engineering
Modern Physics

Physics—Sound and Light
Physics—Calculus-based Mechanics
Physics—Calculus-based Electricity and Magnetism
Planetary Science

Mathematics and Computer Science 3.0 credit minimum

Calculus Core Courses

AB Calculus I
AB Calculus II
BC Calculus I
BC Calculus II
BC Calculus III
BC Calculus I/ II
BC Calculus II/ III

Pre-Calculus Core Courses

Geometry
Mathematical Investigations I/II
Mathematical Investigations II

Mathematical Investigations III
Mathematical Investigations IV

Pre-Calculus Electives

Discrete Mathematics
Graph Theory with Applications
Mathematical Modeling
Modern Geometries
Problem Solving
Statistical Experimentation and Inference
Statistical Exploration and Description

Post-Calculus Electives

Advanced Problem Solving
Advanced Topics in Mathematics
Differential Equations
Introduction to Algebraic Structures I and 2
Multi-Variable Calculus
Number Theory
Theory of Analysis

Computer Science Core Course [Sophomore]

Computer Science Inquiry

Computer Science Electives

Advanced Programming
Computer Seminar—
Advanced Web Technologies
Computer Seminar—Cyber Security and
Android App Programming
Object Oriented Programming
Robotics Programming
Web Technologies



More at imsa.edu.

COURSES.

English 3.0 credit minimum

Core Courses [Sophomore]

Literary Explorations I
Literary Explorations II

Core Courses [Junior]

Literary Explorations III

Junior/Senior Electives

Creative Writing Workshop
Graphic Novels—Image and Text
Modern Theater
Speculative Fiction Studies
Topics in World Literature—
Modern World Fiction

Topics in World Literature—
Victorian Fiction

Senior Electives

African American Studies
Gender Studies
The Idea of the Individual

Shakespeare
Tolkien—Language and Literature

Social Science 2.5 credit minimum

Core Courses [Sophomore]

American Studies

Core Courses [Junior]

The World in the Twentieth Century

Junior Electives

Ancient World Religion and Philosophy
Art, Worldview and Society in History
Conflict in World History
History of Cultural Contact

Senior Electives

African American Studies
History of Astronomy
History of Biology
History of Philosophy
History of Technology and Culture
Modern Genocide and Mass Violence

Political Theory
Rise of the Atlantic World 1492–1815
Topics in Current Affairs
United States Government
and the Constitution

World Languages 2.0 credit minimum

A student must complete two years of world language study, with one year at level II or higher

French I
French II
French III
French IV
French V

German I
German II
German III
Japanese III

Mandarin Chinese I
Mandarin Chinese II
Mandarin Chinese III
Russian I
Russian II

Russian III
Spanish II
Spanish III
Spanish IV
Spanish V

Fine Arts 0.5 credit minimum

Music

Chamber Choir
Chamber Strings
Concert Band
Concert Choir
Music Appreciation
Music Theory
String Orchestra
Wind Ensemble

Visual Arts

Art Design
Drawing and Illustration
Observational Drawing
Printmaking

Wellness Education 1.0 credit minimum

Core Course [Sophomore]
Moving and Learning

Wellness Electives

Dance
Movement and Relaxation
Net and Wall Games
Outdoor and Indoor Games

Independent Learning

Independent Study
Student Inquiry and Research (SIR)
Total Applied Learning for Entrepreneurs
(TALENT)



More at imsa.edu.

GRADING.

More at imsa.edu.

Collaborative exploration
and discovery.

No grade point averages.

No class averages.

No class rank.

No valedictorian.



INQUIRY BASED.

“Wise world shaping requires that our students think in *decidedly different* ways. This is the cognitive context within which the imperative to reimagine and redesign STEM academies now resides.”

Stephanie Pace Marshall, Ph.D.



“Decidedly different learners.”

STUDENT INQUIRY AND RESEARCH. (SIR)

A process where students are matched with research mentors investigating projects of interest to students then guided through their projects by a cooperative effort of IMSA and the research mentor.

Sample SIR Student Projects

Cancer Research.
Motivation in Education.
Geoengineering.
Water Filtration.
Great Terror.
Renewable Energy.
Irish immigration.
Swarm Engineering.
Epidemiology.
Genocide.
Organic Light Emitting Diodes.



SIR REQUIREMENTS

Authentic research experiences on and off campus.

Requirements:

- Proposal
- Investigation
- Progress report
- Abstract
- Investigation paper
- Presentation at IMSAloquium

WHAT DOES AN “I” DAY LOOK LIKE?



10th graders

Navigation. LEAD. MSI (Methods of Scientific Inquiry).
Study Groups.

11th and 12th graders

SIR (Student Inquiry & Research). TALENT (Total
AppLied ENTrepreneurship). LEAD Leadership.
Independent Study.

LEAD. SERVE.

Students Learn Through Leadership.

200 hours of service required for graduation.

Develops students' personal, social & academic skills.

LEAD – Leadership Education Development.

Social Entrepreneurship. Public Policy. Research Development.



TOP 10 HIGH SCHOOLS. NICHE.COM

Illinois Mathematics and Science Academy

★★★★☆ 211 reviews
Aurora, IL · 10-12 · Public, Alternative

 [Add to List](#)



#4 in Best Public High Schools in Illinois

A+

Overall Niche Grade

[How are grades calculated?](#)

A+ Academics

A Diversity

A+ Teachers

A+ College Prep

A+ Clubs & Activities

A+ Health & Safety

A Administration

C Sports

A+ Food

A Resources & Facilities

IMSA.

Legislative Mandate 2:

“The Academy shall also carry a responsibility to stimulate further excellence for all Illinois schools in mathematics and science.”



IMSA PROFESSIONAL FIELD SERVICE.

**60,000 Hours of STEM
Professional Development in the
past 5 Years.**

91% of Educators demonstrated
enhanced classroom teaching methods.

Award-winning
IMSA FUSION

Partnership with Flinn
Scientific

**Total Statewide Student
Outreach: 76,019.**

Total State-wide outreach
14,758 registered students with
complete address details
(shown by county).



DISRUPTION #3. 2007 IMSA STRATEGIC PLAN.

Catalyst for reimagining innovation at IMSA.

2 key outcomes:

1. Build a physical innovation space.
2. Build a virtual innovation space.



DISRUPTION #4. IMSA KIDS INSTITUTE. 1997-2012

**Where student
ideas take flight.**

Science Explorers

Real Science

IMSA on Wheels



DISRUPTION #5. 2016 - ? UN SUSTAINABLE DEVELOPMENT GOALS.



Seeing
problems
as
possibilities.



THE GIFT.



2013 lead gift of \$1M from IMSA alumnus and YouTube co-founder, Steve Chen and wife Jamie to build an innovation center at IMSA.



DESIGN.

Online input.

PB & J Innovation.

Design Charrette.

IMSA Intersessions.



Creating a “third space.”

STUDY BEST PRACTICE.



Sharon Zeng
12 minutes ago · Edited by Sharon Zeng · Allowed on Timeline

This past week I have had the privilege of meeting some of the most funny, cool, friendly, brilliant, awesome high schoolers ever. Thank you for a fantastic trip around the Bay Area. I'm sure I learned as much from all of you as you did about the tech industry (hopefully). Please continue to be amazing.

Also, many thanks to the friends that made the trip happen. I owe all of you so much: Britta, Summer, Kevin, Stephanie, Royce, Emily, Rajeev, Christopher, Rebecca, Claudia, Ben, Jasmine, Adam, Jeffrey, Peter, Kyle, and Jeff. — with Leon Wang, Shreya Shanker, Rhea Harsoor and 13 others.

Tag Photo Add Location

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You and 3 others like this.

Write a comment...



Silicon Valley.
Illinois.
Boston.



DISRUPTION #6: IN2. Steve and Jamie Chen Center for Imagination & Inquiry.



“IN2 is a manifestation
of STEM learning.
Cultivating and
catalyzing innovation.
It is the new
engagement paradigm.”

Stephanie Pace Marshall, Ph.D.



IN2 FUNDING. A START-UP WITHIN A STATE AGENCY?

Revenue Streams

- Donations
- Memberships
- Sponsorships
- Program fees



Expenses

- Salaries
- Equipment
- Program supplies

ENTREPRENEURSHIP.

Students as developers,
not just consumers.

Internships.
TALENTED.
ThiNK Cafe.
eleMENT.
Camps.



ENTREPRENEURSHIP.

Students as developers,
not just consumers.

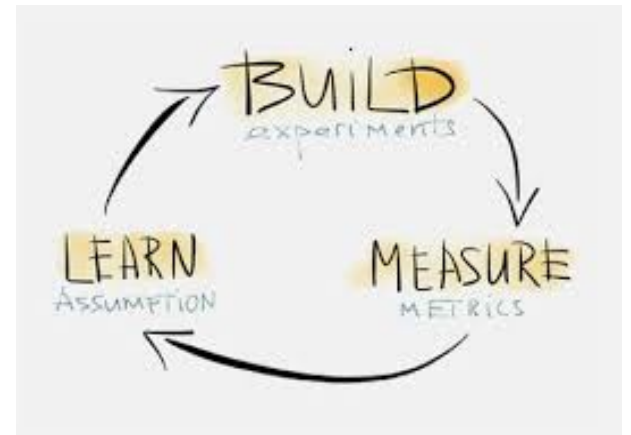
First
Attempt
In
Learning

It all begins with a pain point.

And failure is key.



ENTREPRENEURSHIP.



How do we turn students into creators?

According to Eric Ries (2011) “Empower them with entrepreneurial thinking – teach them Lean Start Up methodology.”

Build. Measure. Learn. (Iterate)

BOSIDNA.COM

Builder.

Opportunist.

Specialist.

Innovator.



 BOSI ASSESSMENT

Discover Your BOSI DNA. What's Your Current Role?

a Business owner with full-time employees

b Startup founder/Co-founder

c Self employed/Solopreneur

d Soon-to-be entrepreneur

e Employee

f Student interested in entrepreneurship

VENTURES 2 VULTURES

Mind-stretching.
Creativity.
Pitch Practice.

VENTURES TO VULTURES

Truck



VENTURES TO VULTURES

Bubble



VENTURES 2 VULTURES

Partner Play.

VENTURES TO VULTURES

Digital



VENTURES TO VULTURES

Garbage



Flip

00 : 00

Start

Stop

Reset



MAKERS. INVENTORS.

“The ‘maker movement’ leads to a new pedagogy – ‘Tinkquiry’ – Tinkering + Inquiry.”

Peter Skillen



THE ARTS INSPIRE CREATIVITY IN STEM.

Music.
Theatre.
Photography.
Video.
CAD.
Gaming.
Virtual Reality.



MAKERSPACE EDUCATION.

Interdisciplinary.
Class projects.
Personal projects.
Club projects.
SIR/Inquiry projects.
Professional Development.



MAKERSPACE PROGRAMS.

Try-it Tuesdays.
Demonstration Bench.
Fieldtrips.
FunShops.
Summer Camps.
Open Making.



PARTNERSHIPS.

Creating “Win Wins”
for education and industry.

zSpace virtual reality.



WELCOME TO THE (UN)REAL WORLD.

Passion driven learning.

Inspired. Motivated.
Team work.
Deliverables.
Service.



GRANTS.

MEET MALIK.

External funding
Supports Internal
Innovation and turning
student (and faculty/
staff) ideas IN2 reality.



SPONSORS.

Fermilab Fall Seed Harvest.

Green Apple Day of Service.
Community Service.
Field Science.



PROBLEM. SOLVING. PROGRAMS.

Hackathon.

2017 “Get the Lead Out”

2018 “Live to Eat, Eat to Live”



PROBLEM. SOLVING. PROJECTS.

IN2 Project Teams.

Open and closed.

Teams tackle real world problems. Together.



The screenshot displays a web interface with a dark blue header containing three tabs: "PROJECTS", "PROGRAMS", and "EVENTS". Below the tabs is a vertical list of project cards. The selected project, "June's Learning Laboratory", is shown in a detailed view on the right. This view includes a title, a descriptive paragraph, a "Led By" section with the name "H. Harvard", a "UN Sustainable Development Goals" section with "Gender Equality", and a "Driver/Champion" section with "David Lundgren" and an email address "dlundgren@imsa.edu".

PROJECTS **PROGRAMS** **EVENTS**

CLICK ON A PROJECT TO VIEW IT HERE

June's Learning Laboratory

June's Learning Laboratory is our first step to creating a better world by advocating for a more culturally accepting society that appreciates everyone regardless of our abilities. Our innovative curriculum encourages cultural competency in high schools worldwide. We also work to build and design free 3D printed prosthetics for any child who needs a helping hand. We believe "lending a helping hand" to kids will make a profound impact and better ourselves in the process.

Led By
H. Harvard

UN Sustainable Development Goals
Gender Equality

Driver/Champion
David Lundgren
dlundgren@imsa.edu

Phocus

Coding 4 Children (C4C)

June's Learning Laboratory

Adaptive Sailboat Control System

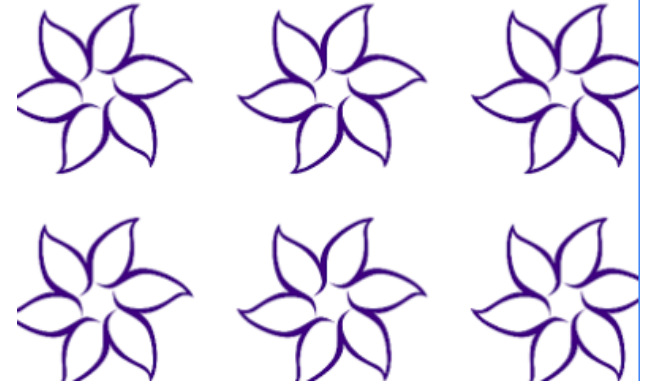
IMSA Kenya Project

Concussion Prevention Gear (CPG)



CREATIVITY EXERCISE.

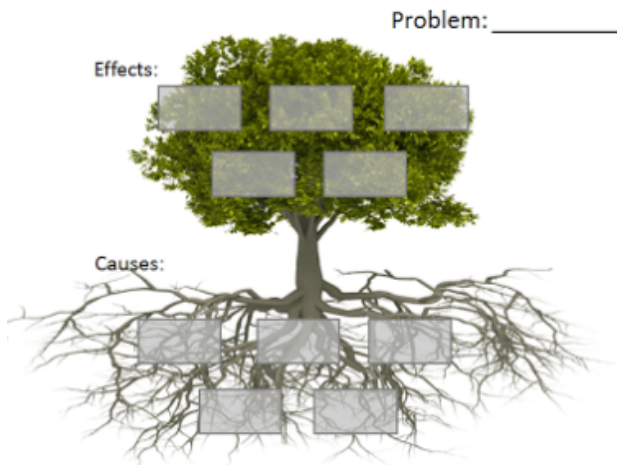
Problem: _____



LOTUS FLOWER.

Start by putting a problem in the center.

Add contributing factors or related items to the petals.



IN2 PROGRAMS: GIRLS IN2 STEM.

STEM mentor pipeline

Middle School.

High School.

Industry.



IN2 PROGRAMS: TEEN STEM CAFE.

Sponsored by
Caterpillar

Partnership with Northern
Illinois University



IN2 PROFESSIONAL DEVELOPMENT.

Contract for Services

Innovation space design.
Makerspace inservice.
Entrepreneurship.
Design Thinking.



MEASUREMENT.

How do we know?

- Filled programs.
- Turnstyle counts.
- Pre/post program surveys.
- Interviews.
- # Applicants to IMSA.
- # Accepted to IMSA.
- Testimonials.
- Mentor reference letters.
- 2017 Chicago Innovation Award!



WHAT SKILLS ARE NEEDED IN 21ST CENTURY LEARNERS?

**I Say...
Call the
“M.E.D.I.C”**

- M** Making.
- E** Entrepreneurial Thinking.
- D** Design Thinking.
- I** Information Fluency. Inquiry.
- C** Connected Learning. Collaboration. Communication.
Critical Thinking.

THE FUTURE.

Co-Creating
Possibilities

STEPHANIE
PACE MARSHALL



“The future prosperity and sustainability of our global community resides in igniting, nurturing, and connecting our children’s creative and imaginative genius in STEM to the needs of the world.”

Stephanie Pace Marshall, Ph.D.
IMSA Founding President and President Emerita



LEAD BY FOLLOWING.



@IN2IMSA



@brittamckenna



imsainnovation.com

bmckenna@imsa.edu



謝謝



BRITTA MCKENNA
CHIEF INNOVATION OFFICER

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IMSAINNOVATION.COM