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Teaching in the Classroom with the United Nations Sustainable Development Goals

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Teaching in the Classroom with the United Nations Sustainable Development Goals

Presenters: Jose M. Torres, President; Bob Hernandez, Principal; Crystal Randall, Biology Faculty and Curriculum Assessment Leader, Illinois Mathematics and Science Academy

Outline

Engagement in the United Nations Sustainability Goals (SDGs)

- *As an academy*
 - What are the UN SDGs?
 - IMSA history with the SDGs
 - ISSF 2018
- *In the classroom*
 - Introduction of UN SDG projects in core classes
 - Development of a new core course that presents key concepts in real-world context
 - Integrate UN SDGs into elective courses.
- *As a faculty*
 - Across disciplines
 - Sharing work through Digital commons
 - Student independent research program

United Nations Sustainability Goals

Sustainable Development Goals



ISSF 2018 Mission

“Significantly influencing life on our planet through cooperation and collaboration.”

- Cooperation among educators and students
 - Principals
 - Teachers
 - Students
- Collaboration on UN SDGs
 - Design sprints
 - Curriculum design
 - Lab activities
 - discussion panels



UN SDG 2: ZERO HUNGER.

End hunger, achieve food security and improved nutrition and promote sustainable agriculture.



UN SDG 6: CLEAN WATER AND SANITATION

Ensure access to water and sanitation for all.



UN SDG 7: AFFORDABLE AND CLEAN ENERGY.

Ensure access to affordable, reliable, sustainable and modern energy for all.

UN SDGs in the biology classroom

Sustainable Development Goals



Ecosystem Disruption presentations

- **Select an ecological problem**
 - explain the ecology prior to the disruption
 - define the problem
 - explain the role humans have played in the problem
 - propose solutions



<https://www.sciencemag.org/news/2019/07/breeders-toughen-bees-resist-deadly-mitesuction-to-prompt-and-topics>



<https://www.universityofcalifornia.edu/news/virus-identified-top-suspect-sea-star-wasting-disease>

Ecosystem disruption examples

Colony Collapse in Bees: potential causes of collapse; specific outcomes for ecosystem in terms of pollination impact

Death of Sea Stars: why they are a keystone species, potential causes of death rates, and specific outcomes on the ecosystem

Coral Bleaching: normal symbiotic relationships present, causes of loss, and specific outcome on the ecosystem.

Asian Carp: what is the normal food web like where they are invasive, and how do they impact it, how did they end up invading the ecosystem, and why is it a challenge to get rid of them

Changes in the epidemiology of disease driven by deforestation: how does biodiversity normally help to limit the spread of some diseases? Why does the loss of a species in an ecosystem often result in higher quantities of other organisms like insect carrying rodents? How does this impact the spread of disease?

Problems in cities

1. Availability of Groundwater : aquifers, resource usage
2. Coastal Waters : flooding, erosion
3. Industrial impact : pollution, CO₂
4. Water, health and diseases : spread of disease, pollutant contamination of water sources
5. Ocean Chemistry : pH changes and cause/impact
6. Urbanization : population, air quality, resource usage, land usage
7. Agricultural practices : runoff, land use, resources use, habitat destruction

Student work



Shruti Shakthivel '20 and Meghana Karan '20

Student video guidelines

After choosing one of the above topics, you and a partner will conduct your research, looking specifically for the following concentrations:

- A description of the environment without human impact, and how we know
- The scope of human impact, providing two different examples
- Each example detailed with source or cause of impact and consequences that follow
- Plans/efforts underway intending for remediation.
- Your potential solutions

Development of new biology course Advanced Biological Systems

Goals of ABS

Focus on United Nations Sustainable Development Goals



Essential Areas of Study

- ❑ **History and evolution of life on Earth**
- ❑ **Biological processes fundamental to cellular function, replication & diversification**
- ❑ **Metabolic processes of organisms and ecosystems**
- ❑ **Interactions and interdependence of organisms and the environment**

What do you think about the SDGs?

- How have you worked with topics relating to the SDGs?
- What ways could you see incorporating them in the future?
 - In your district?
 - At your school?
 - In your class?
 - At home?

Benefits of class structure

- Provide a framework for context centered active learning.
 - Vision and Change
 - Active learning in the biology classroom
- Helps students make connections between class concepts and with their daily lives.
- Allows students to work in groups on interdisciplinary problems.
 - building content knowledge and communication skills

At IMSA

2 ZERO HUNGER



11 SUSTAINABLE CITIES AND COMMUNITIES



6 CLEAN WATER AND SANITATION



3 GOOD HEALTH AND WELL-BEING



Sustainable city documentary

- Create an idealized city
- Three main focus points:
 - Food Sustainability
 - Personal Health and Well-being
 - Waste Management and Water Security



Sustainable city documentary project

1. We want our cities to be sustainable and healthy ecosystems.
 - a. **Focus 1: Waste management and water security**
 - i. How can we create a city that solves its own problems of waste management and water security while maintaining the environment within it?
 - b. **Focus 2: Personal health and well-being.**
 - i. More people means more sick people, and thereby more contagious people. Furthermore, apart from contagion, high concentrations of people create conditions that promote cellular and DNA damage. How can we mitigate conditions that challenge personal health and well-being for all citizen?
 - c. **Focus 3: Food sustainability.**
 - i. Consider how you might create the infrastructure to provide a secure food source wholly contained within the city. Current agricultural practice is damaging to the environment and becoming more industrially intensive as it becomes more separated from population concentrations. How can we incorporate food production within the city of the near future?

Biology electives

3 GOOD HEALTH
AND WELL-BEING



- **Cancer biology**
 - Students study the molecular mechanism of cancer as a model to understand core concepts in cellular biology.
- **Microbes and Disease**
 - Students model the pathogenesis of bacterial and viral microbes.



Bioelective (Pathophysiology)

- Study of how biological networks have evolved in a specific way to perform essential functions, the subsequent result of evolution selecting for the organisms that survive.
- Students will learn how to build models of biological systems by examining the inputs, studying.
- The interactions of the system with external and internal factors and finally predicting the possible outcomes of the system.
- Emphasis will be placed on the biochemical, molecular and physiological changes that control homeostatic cellular mechanisms and permit survival of the system.



Biology Elective (Evolution, Biodiversity and Ecology)

- **Much of the class designed around SDGs**
 - At start of each unit students research the most closely related SDG(s) to identify issues, current solutions, and potential future directions

- **Life Below Water Unit (SDG #14)**
 - Effects of climate change, pollution, invasive species, etc. on health of aquatic systems
 - Ocean science
 - Effects of oceans on global climate and climate change on oceans
 - Health of ocean ecosystems
 - Freshwater biology
 - Interconnectedness of water system and effects of pollution
 - Sampling at local pond – healthy vs stressed freshwater ecosystems

Biology Elective (Evolution, Biodiversity and Ecology)

- Life on Land Unit (SDG #15)
 - Create terrestrial food webs
 - Simulate and predict effects of small changes to the ecosystem
 - Investigate issues and solutions in biomes across the world
 - Survey of prairie site on campus
 - Ecological diversity calculations
 - Compare healthy prairie ecosystems with unhealthy prairie ecosystems.

15 LIFE ON LAND



Biology Elective (Evolution, Biodiversity and Ecology)

13 CLIMATE ACTION



● Climate Action Activities (SDG #13)

- Focus on taking **action** that will contribute to **solutions** for climate change
- Students contribute throughout the semester to citizen science projects
 - iNaturalist
 - Upload photos from nature, experts identify organisms, scientists use the data for research
- Final project
 - Students create a project to communicate ecological issues in a way that is accessible to a wide audience
- Collaborative class project
 - Fall 2019 students chose to set up a red worm compost bin to use on campus



Biology Elective (Biology of Behavior)

□ Gender Equality (SDG #5)

○ Special topic - Biological basis of Sex and Gender

- Address what biological mechanisms affect the range of expression of biological sex as well as gender in humans as well as other animals
- Importance of women's health is address through a biological lens

□ Good Health and Well being (SDG #3)

○ Effect of behavior on human health and well-being

- Human behavior unit addresses mental health issues



UN SDGs at IMSA

Incorporation of UN SDGs

- Snapshot of IMSA's courses/programs with descriptions
 - [UN SDG Snapshot IMSA](#)
- Level of Engagement (establish assessment and engagement of courses with UN SDGs)
 - [Engagement Level](#)

UN SDGs at IMSA

Courses

- History Senior Year Capstone Experience
 - [History Capstone](#)
- Engaging Students in Fundamental Biological Concepts Through UN Sustainability Goals
 - https://digitalcommons.imsa.edu/sci_pr/33/

UN SDGs at IMSA

Sharing Resources

- Digital Commons Area

https://digitalcommons.imsa.edu/sci_pr/33/

- Leadership Education And Development Presentation Abstracts

<https://digitalcommons.imsa.edu/slx/2019/>

UN SDGs at IMSA

Service

- Connect personal and collective community service with progress toward the UN SDGs)
 - 30 volunteers/over 4,812 service hours
 - InnerView (Organization):

https://innerview.org/award/members?schoolyear=2018&school_id=1269

- [Service Hours for IMSA](#)

UN SDGs at IMSA

Student Research

- Partnership with Northern Illinois University in research
 - Partnership

Thank you for your attention!