AIR QUALITY & HEALTH INNOVATION CHALLENGE
COURSE SYLLABUS

Create Innovative Solutions to Society's Complex Challenges

Instructor: Program Lead: New York Academy of Sciences
Course Time & Format: 10 weeks; approximately 2-4 hours weekly
Format: Blended; Online
Age Level: 13 - 17 years old

COURSE DESCRIPTION & OBJECTIVES

Innovation Challenges are an introduction to foundational concepts of design thinking with an emphasis on developing and testing new solutions to society's greatest challenges. The Air Quality & Health Innovation Challenge requires students to work in self-selected, distributed teams, requiring cross-cultural communication, dynamic problem solving, deep critical thinking related to society, leadership and project management skills.

Students must first identify their project team and then work together with a mentor to apply design thinking processes to approach the real-world health problems of air pollution in an innovation challenge with the Junior Academy. While each student must identify their own role within the team, together they will learn how to identify and map out a real problem and ways to build and test solutions quickly through an iterative, scientific approach. This course requires extensive student collaboration and regular engagement through The Academy's Junior Academy and its online platform, Launchpad.

THE CHALLENGE

Air pollution has become one of the leading causes of illness and death around the globe. Key pollutants include gases, as well as liquid and solid particulates, emitted from industrial processes as well as the burning of fossil fuels and wood. Dust and chemicals formed by reactions in the atmosphere account for other pollutants. While environmental policy has made some impact in recent decades, the World Health Organization (WHO) estimates that air pollution is responsible for around 7 million deaths annually. In fact, the WHO cites air pollution as the second-leading cause of deaths from non-communicable diseases (NCDs), including heart disease, lung disease, and lung cancer. Emerging scientific evidence has begun to connect air pollution to diabetes and neurological issues, as well. These statistics, along with the clear connection between air pollution

and climate change, point to a critical opportunity and need to design innovative technological solutions that address this public health crisis.

Air is a shared resource. Naturally, efforts to reduce air pollution must also be shared. In addition to policy, technical solutions will need to address the issue at the community or industrial levels. A focus on community and industrial solutions can also ensure that improvements in air quality are equitable and impact the most people. Areas for intervention could include energy sources, transportation, urban planning, agriculture, and residential life such as cooking, heating and waste management.

Student Challenge: **To identify or target a specific source of pollution and design a technical solution that would reduce or eliminate air pollutants while also reducing the impacts of one or more non-communicable diseases.**
Students will work collaboratively to consider the following when designing their teams' solution:

- What pollution source will you address?
    - Fossil fuel combustion? Which fossil fuel?
    - Wildfires?
    - Industry (Food, Agriculture, Fashion?
    - Something else?
- What air pollutants will your solution minimize? Smog? Ozone? Carbon dioxide? Soot? Ammonia? Something else?
- How will you approach the problem? Will you take a community approach or an industry approach? What industry or industries will you tackle?
- How can your solution address equity issues in air quality and/or public health?
    - How might you integrate community co-design into your solution?
    - How might your solution be scaled to impact other regions or other countries?
- How can you keep the cost of your solution low enough to encourage implementation?
- How sustainable is your solution?
- What region or community might your solution impact the most?
- What public policy might be needed to support or implement your solution?

LEARNING OBJECTIVES

INNOVATION CHALLENGE LEARNING OBJECTIVES *At the end of this course, students will be able to*:

- Develop critical thinking and problem-solving skills through brainstorming techniques to develop ideas and design a solution to a complex problem.
- Develop their own arguments and analyze competing perspectives to a complex problem with supporting evidence.
- Develop a deeper, personal civic identity and clearly identify their role in their community.
- Develop a solution that could play a part in transforming a specific societal need regarding a larger issue that is transferable to a specific community and larger global community.
- Use data and insights of an inquiry to answer a research question using scientific terms in charts, tables, or graphs.
- Utilize a social justice lens when applicable to interpret the data and critically think about which groups are not represented around decision making.
- Effectively communicate ideas, data and insights using various forms of media.
- Effectively collaborate with team members with empathy and mutual respect, and develop an expanded perspective about how people from other countries see the world.
- Effectively communicate challenge specific variables that impact the environment, society, and economy including examples of the effect on local communities.
- Understand how to apply Design Thinking methods to understand what users need, and how to develop solutions to meet those needs.
- Learn how to actively listen, work through any disagreements, and solicit input from people in creative ways to generate new ideas.
- Learn how to test ideas and develop rapid prototypes.
- Identify corresponding careers connected to Innovation Challenge.

COURSE OUTLINE

TIME	TOPIC	ASSIGNMENTS	FORMAT
Week 1	• Getting Started w/Junior Academy • Onboarding	• Join Launchpad Platform • Review Junior Academy Orientation • Attend Virtual Kick Off Week • Complete Course Pre-Survey	Individual
PHASE 1 Challenge Team Formation			
Week 2	Challenge introduction • Background on your Challenge • Finding Mentors & Experts • Reaching out to experts	• Complete Required Weekly Reading • Engage in Launchpad Discussions • Complete activities found in resource library	Collaborative

Week 3	Team Building • Forming Your Team • Holding a Virtual Team Building • Creating a Team Comm's Plan	• Engage in Launchpad Discussions • Hold 1st Team Meeting • Complete Required Weekly Reading • Due Milestone #1: Team Dynamics	Collaborative
PHASE 2 Research, Brainstorm & Plan			
Week 4	Researching • Gathering relevant and diverse materials, articles, books, and sources • Developing research questions and interviewing	• Engage in Launchpad Discussions • Engage/Meet with your Team • Complete Required Weekly Reading	Individual Collaborative
Week 5	Brainstorming • Team Concept Brainstorm • Develop How "Might We" Ideas • Building Team Empathy	• Engage in Launchpad Discussions • Engage/Meet with your Team • Complete Required Weekly Reading	Collaborative
Week 6	Design & Plan • Categorizing & Bundling Ideas • Deciding & creating your concept • Developing a user testing plan	• Engage in Launchpad Discussions • Engage/Meet with your Team • Complete Required Weekly Reading • Due: Milestone #2: Design & Test Plan	Individual Collaborative
PHASE 3 Build, Test & Analyze			
Week 7	Build • Creating a Prototype • Build storyboard & journey map • Identifying your variables • Rapid Prototyping	• Engage in Launchpad Discussions • Engage/Meet with your Team • Complete Required Weekly Reading	Collaborative
Week 8	Test & Analyze • Conducting User Testing • Getting User Feedback • Analyzing your data Results	• Engage in Launchpad Discussions • Engage/Meet with your Team • Complete Required Weekly Reading • Due: Milestone #3 Analyze Results	Collaborative
PHASE 4 Iterate & Develop Final Projects			
Week 9	Iterate • Modifying your concept design based on your results • Refining & re-test your prototype	• Engage in Launchpad Discussions • Engage/Meet with your Team • Complete Required Weekly Reading	Individual Collaborative
Week 10	Develop Final Project • Creating draft of Final Project • Project Feedback & revision • Submitting Final Project • Complete Course Post-Survey	• Due: Executive Summary • Due: Final Team Presentation • Due: Personal Reflection • Complete Course Post-Survey	Individual Collaborative

New York Academy Challenge Final Project Review & Grading

COURSE ASSIGNMENTS	% of FINAL GRADE
Milestone #1: Team Dynamics: This assignment is focused on team building and planning for how students will work together.	10%
Milestone #2: Design & Test Plan: This assignment is focused on the Team's proposed solution, hypothesis and test plan.	10%
Milestone #3: Build, Test & Analyze: This assignment is focused on building, testing and analyzing data related to your solution.	10%
Team Collaboration & Online Engagement throughout course	20%
Final Presentation, Executive Summary & Personal Reflection Final Presentation Rubric	50%
	(100%) **Final Grade**

GRADING POLICY

Late-work policy: Milestones 1-3 are allowed to be submitted late for point deduction. Late submissions of the Final Solution Presentation for this course will not be accepted after the due date unless previously arranged with **the Academy** for extenuating circumstances. It is important to stay up-to-date on assignments since much of the work builds on previous assignments and will impact students' ability to be effective in providing solutions for their teams' projects.

Re-grade policy: If a student thinks there has been a technical error in the grading of an assignment, they should email program administration at the Academy within one week of receiving the graded assignment, otherwise the assignment will not be regraded. Feedback is provided upon request.

REQUIRED READING LIST

Students are expected to read and refer to a wide variety of texts throughout this course; all of which can be found in the Launchpad Resource Library.

Please see a sample reading list from the Spring 2024 Innovation Challenge titled, "Circular Textiles".

Week 1

Launchpad Platform, Launchpad

Junior Academy Orientation, Launchpad

Week 2

Air Quality & Health Innovation Challenge Background, Launchpad

Air Pollution, World Health Organization (WHO)

Air Pollution: Everything You Need to Know, NRDC

Week 3

What is Human Centered Design?, Video Design Kit, Innovation, Design, Engineering & Organization (IDEO)

Design Thinking for Problem Solving, Video Design Kit, Innovation, Design, Engineering & Organization (IDEO)

Week 4

Air quality, energy and health, WHO

Air quality and health, Minnesota Pollution Control Agency

Air Pollutant: Fine Particles, Minnesota Pollution Control Agency

Primary Vs Secondary Pollutants, University of California Riverside

Soot Pollution 101, Center for American Progress

The Particulars of PM 2.5, NRDC

Particulate pollution comes in the top 5 threats to human health globally., University of Chicago

What are volatile organic compounds (VOCs)?, EPA

What is Ozone?, EPA

What You Need to Know About Climate Change and Air Pollution, World Bank

Why Wildfire Smoke is a Health Concern, EPA

Climate Change and Health: Air Quality, NRDC

Health Impacts of Power Plant Emissions, American Lung Association

Generating Power, United Nations

Industrial Agricultural Pollution 101, NRDC

Smog, Soot, and Other Air Pollution from Transportation, EPA

Industrial Air Pollution, Clean Air Council

How industrial pollution affects air quality, IQAir

Volatile Organic Compounds' Impact on Indoor Air Quality, EPA

Radon, WHO

Harmful Chemicals in Tobacco Products, American Cancer Society

Noncommunicable Diseases, WHO

Health Impact of Air Pollution, American Lung Association

How air pollution affects our health, European Environmental Agency

Campbell-Lendrum D, Prüss-Ustün A. Climate change, air pollution and noncommunicable diseases. *Bull World Health Organ*. 97(2),160-161. (2019).

Ambient air pollution: A global assessment of exposure and burden of disease, WHO

Rentschler, J., Leonova, N. Global air pollution exposure and poverty. *Nat Commun* 14, 4432 (2023).

Interviewing Experts, Design Kit, Innovation, Design, Engineering & Organization (IDEO)

Interviewing Individuals, Design Kit, Innovation, Design, Engineering & Organization (IDEO)

Interviewing Groups, Design Kit, Innovation, Design, Engineering & Organization (IDEO)

Week 5

How Might We, Design Kit, Innovation, Design, Engineering & Organization (IDEO)

Brainstorming Rules, Design Kit, Innovation, Design, Engineering & Organization (IDEO)

How to Facilitate a Brainstorm, Stanford D School, 2020

Week 6

Bunding Ideas, Design Kit, Innovation, Design, Engineering & Organization (IDEO)

Doing a Gut Check, Design Kit, Innovation, Design, Engineering & Organization (IDEO)

Creating a Concept, Design Kit, Innovation, Design, Engineering & Organization (IDEO)

Week 7

Determine What to Prototype, Design Kit, Innovation, Design, Engineering & Organization (IDEO)
Rapid Prototyping, Design Kit, Innovation, Design, Engineering & Organization (IDEO)
Prototype to Test, Design Kit, Innovation, Design, Engineering & Organization (IDEO)
Identify a Variable, Design Kit, Innovation, Design, Engineering & Organization (IDEO)
Storyboards & Journey Maps, Design Kit, Innovation, Design, Engineering & Organization (IDEO)

Week 8

Get Feedback, Design Kit, Innovation, Design, Engineering & Organization (IDEO)

Testing with Users, Design Kit, Innovation, Design, Engineering & Organization (IDEO)

Research Methods, Launchpad

Week 9 - Week 10

Integrate Feedback & Iterate, Design Kit, Innovation, Design, Engineering & Organization (IDEO)

How to Create a Presentation, Launchpad

How to Create Video Presentations, Movavi
Presentation Guidelines, Launchpad