

## **LIVING IN THE EXTREMES 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 Living in the Extremes 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 problems of living in extreme environments as 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**

One of the hallmarks of humans in our species' long history is our incredible ability to adapt to survive in a wide variety of environments – each with its own benefits and challenges. Fire, human-made structures, clothing, architectural techniques, air-conditioning and indoor plumbing, among other technologies, have helped us to meet those challenges. Today, humans can be found living successfully around the globe. None-the-less, a growing world population threatens to push humans beyond our current limits to look for livable options in increasingly extreme environments such as space, high mountain tops or even on or in the sea. At the same time, rapid climate change is making environments more extreme through desertification, increasing temperatures, rising sea levels, and more extreme weather with its related disasters. What might it take for modern humans to continue our adaptation story so that we can live – and

even thrive – in the extremes. In this challenge, you will identify one “extreme environment” and propose a comprehensive solution to sustain life there. What are the physical and social challenges you will need to overcome to provide healthy and fulfilling lives for those who live there? How will you make sure that your solution is sustainable and ethical so that humans can truly prosper in the extreme?

**Student Challenge: To design a livable shelter, home or small community living environment for humans in a specific extreme environment.** Students will work collaboratively to consider the following when designing their teams’ solution:

- What could be considered an extreme environment? What are the causes of these extreme environments?
- What are the environmental challenges and risks of the extreme environment you have chosen?
- How would your shelter, home, living environment address the issues that the extreme environment poses? Would your solution help address issues related to climate change? World population growth? Food deserts? Etc.
- How can you integrate Community Co-Design into your solution?

## LEARNING OBJECTIVES

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**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	<ul style="list-style-type: none"> <li>• Getting Started w/Junior Academy</li> <li>• Onboarding</li> </ul>	<ul style="list-style-type: none"> <li>• Join <a href="#">Launchpad Platform</a></li> <li>• Review <a href="#">Junior Academy Orientation</a></li> <li>• Attend Virtual Kick Off Week</li> <li>• Complete Course Pre-Survey</li> </ul>	Individual
<b>PHASE 1</b> Challenge Team Formation			
Week 2	Challenge introduction <ul style="list-style-type: none"> <li>• Background on your Challenge</li> <li>• Finding Mentors &amp; Experts</li> <li>• Reaching out to experts</li> </ul>	<ul style="list-style-type: none"> <li>• Complete Required Weekly Reading</li> <li>• Engage in Launchpad Discussions</li> <li>• Complete activities found in resource library</li> </ul>	Collaborative
Week 3	Team Building <ul style="list-style-type: none"> <li>• Forming Your Team</li> <li>• Holding a Virtual Team Building</li> <li>• Creating a Team Comm's Plan</li> </ul>	<ul style="list-style-type: none"> <li>• Engage in Launchpad Discussions</li> <li>• Hold 1st Team Meeting</li> <li>• Complete Required Weekly Reading</li> <li>• Due Milestone #1: <a href="#">Team Dynamics</a></li> </ul>	Collaborative
<b>PHASE 2</b> Research, Brainstorm & Plan			
Week 4	Researching <ul style="list-style-type: none"> <li>• Gathering relevant and diverse materials, articles, books, and sources</li> <li>• Developing research questions and interviewing</li> </ul>	<ul style="list-style-type: none"> <li>• Engage in Launchpad Discussions</li> <li>• Engage/Meet with your Team</li> <li>• Complete Required Weekly Reading</li> </ul>	Individual Collaborative
Week 5	Brainstorming <ul style="list-style-type: none"> <li>• Team Concept Brainstorm</li> <li>• Develop How "Might We" Ideas</li> <li>• Building Team Empathy</li> </ul>	<ul style="list-style-type: none"> <li>• Engage in Launchpad Discussions</li> <li>• Engage/Meet with your Team</li> <li>• Complete Required Weekly Reading</li> </ul>	Collaborative

Week 6	<b>Design &amp; Plan</b> <ul style="list-style-type: none"> <li>• Categorizing &amp; Bundling Ideas</li> <li>• Deciding &amp; creating your concept</li> <li>• Developing a user testing plan</li> </ul>	<ul style="list-style-type: none"> <li>• Engage in Launchpad Discussions</li> <li>• Engage/Meet with your Team</li> <li>• Complete Required Weekly Reading</li> <li>• Due: Milestone #2: <a href="#">Design &amp; Test Plan</a></li> </ul>	Individual Collaborative
<b>PHASE 3 Build, Test &amp; Analyze</b>			
Week 7	<b>Build</b> <ul style="list-style-type: none"> <li>• Creating a Prototype</li> <li>• Build storyboard &amp; journey map</li> <li>• Identifying your variables</li> <li>• Rapid Prototyping</li> </ul>	<ul style="list-style-type: none"> <li>• Engage in Launchpad Discussions</li> <li>• Engage/Meet with your Team</li> <li>• Complete Required Weekly Reading</li> </ul>	Collaborative
Week 8	<b>Test &amp; Analyze</b> <ul style="list-style-type: none"> <li>• Conducting User Testing</li> <li>• Getting User Feedback</li> <li>• Analyzing your data Results</li> </ul>	<ul style="list-style-type: none"> <li>• Engage in Launchpad Discussions</li> <li>• Engage/Meet with your Team</li> <li>• Complete Required Weekly Reading</li> <li>• Due: Milestone #3 <a href="#">Analyze Results</a></li> </ul>	Collaborative
<b>PHASE 4 Iterate &amp; Develop Final Projects</b>			
Week 9	<b>Iterate</b> <ul style="list-style-type: none"> <li>• Modifying your concept design based on your results</li> <li>• Refining &amp; re-test your prototype</li> </ul>	<ul style="list-style-type: none"> <li>• Engage in Launchpad Discussions</li> <li>• Engage/Meet with your Team</li> <li>• Complete Required Weekly Reading</li> </ul>	Individual Collaborative
Week 10	<b>Develop Final Project</b> <ul style="list-style-type: none"> <li>• Creating draft of Final Project</li> <li>• Project Feedback &amp; revision</li> <li>• Submitting Final Project</li> <li>• Complete Course Post-Survey</li> </ul>	<ul style="list-style-type: none"> <li>• Due: <a href="#">Executive Summary</a></li> <li>• Due: <a href="#">Final Team Presentation</a></li> <li>• Due: <a href="#">Personal Reflection</a></li> <li>• Complete Course Post-Survey</li> </ul>	Individual Collaborative
New York Academy Challenge Final Project Review & Grading			

<b>COURSE ASSIGNMENTS</b>	<b>% of FINAL GRADE</b>
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 <a href="#">Final Presentation Rubric</a>	50%
(100%) <b>Final Grade</b>	

## 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 and are organized by week.

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

Living in the Extremes Innovation Challenge Background, Launchpad

[What are the Effects of Climate Change?](#), NRDC

[Life in Extreme Environments](#), National Space Society

### 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

[Extreme Weather and Climate Change](#), NASA

[Flooding and Climate Change: Everything You Need to Know](#), NRDC

[Planning for flood hazards](#), Department of Ecology, State of Washington

[Landslides and Mudslides and Your Safety](#), Centers for Disease Control and Prevention

[Climate change: Land degradation and desertification](#), World Health Organization

[What is desertification and why is it important to understand](#), We Forum

[How We Can Adapt to Live with Extreme Heat](#), Scientific American  
[Living with Extreme Heat: Our Shared Future](#), University of Pennsylvania  
[Hurricanes and Climate Change](#), Center for Climate and Energy Solutions  
[A Force of Nature: Hurricanes in a Changing Climate](#), NASA  
[Living in Space](#), NASA  
[Living in Space](#), ESA  
[Why We'll Never Live in Space](#), Scientific American  
[Advantages & Disadvantages of Deserts](#), Sciencing  
[Can You Live Underwater?](#), Wonderopolis  
[Could We Live Under the Sea](#), Gizmodo  
 Pan, Chengwei, Yuzhi Zhang, Jinxiao Yan, Yidan Zhou, Sijie Wang, Xiru Liu, Pan Zhang, Hui Yang [Extreme environments and human health: From the immune microenvironments to immune cells](#), Environmental Research, V236 Part 1, 2023.  
[Biomimicry Institute](#)  
[Four Ways People and Communities Can Adapt to Hurricanes](#), Global Center on Adaptation  
[How can we adapt our infrastructure to climate change?](#), Global Center on Adaptation  
[DEEP Research Labs](#)  
[Ocean Spiral](#)  
[The floating homes of Lake Titicaca](#), BBC  
[The extraordinary benefits of a house made of mud](#), National Geographic  
[10 things you need to live in the Arctic](#), The British Museum  
[Human adaptation to extreme environmental conditions](#), NIH  
[Architecture and Extreme Environments](#), Royal Danish Academy  
[Architecture in Extreme Environments](#), Architecture Competitions  
[Space Exploration Architecture](#)  
[Space Architecture - University of Houston](#) (or Faculty page <https://sicsa.egr.uh.edu/welcome/faculty>)  
[Designing for extreme environments](#), Rethinking the Future  
[Architecture & Extreme Environments: the Atacama Desert](#) (Video), Architecture and Extreme Environments  
[How Can Architecture Combat Flooding?](#), Arch Daily  
[Introduction to community-led co-design](#), Community Led Co-Design Kit  
[Guide to co-design](#), Sunlight Foundation  
[Co-Design Case Studies](#), Community Led Co-Design Kit  
[Seismic Building Codes](#), FEMA  
[Tornadoes Are Deadly. These New Building Codes Will Save Lives](#), National Institute of Standards and Technology  
[Floodplain Management Regulations](#), Cypress Environment & Infrastructure  
[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