UPCYCLING AND WASTE MANAGEMENT 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

NOTE TO TEACHERS

This is a sample Innovation Challenge course syllabus and rubric that has been developed for the Civics 2a. Project. Each Innovation Challenge will be adapted and modified depending on the overarching topic. The Innovation Challenge project is property of The New York Academy of Sciences' Junior Academy.

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 Junior Academy Innovation Challenges require 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 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

In today's world, we are experiencing a growing waste problem largely driven by the production and disposal of short-lived products. The current "use-and-dispose" culture provides convenience and, to some, a sense of sanitariness, but results in enormous waste, which places a heavy burden on the environment. Manufacturing new products consumes significant resources such as raw

materials, water, and energy while generating greenhouse gasses, chemical emissions, and other pollutants. When these products are discarded, even if they are recycled, the environmental costs remain high due to the energy and processes needed for collection, sorting, and recycling.

Waste prevention is the most effective way to reduce environmental impact (Understanding the role of Waste Prevention). By extending the lifespan of products, we can *slow down* the pace of production, reduce resource consumption, and lessen the strain on waste management systems. For instance, using textiles for twice as long without buying new ones could cut environmental impacts, such as greenhouse gas emissions (Parameters Affecting Upcycling of Waste Cotton and PS/CO Textiles). In contrast, simply recycling those textiles might only reduce impacts by about 5%. Therefore, the key is to focus on using and maintaining products for as long as possible before considering recycling.

In this challenge, you will rethink how individuals and communities interact with products and design innovative solutions that will help prevent waste at its source.

Student Challenge: **To design a solution to reduce waste generation by encouraging long-term product use and shifting away from the "use-and-dispose" culture. You will design an end-to-end/overall solution that takes into account product design, business model, and societal behavioral and mindset reset needed to make changes possible.**

Students will work collaboratively to consider the following when designing their teams' solution:

- Your solution should focus on one specific product category, such as electronics, clothing, food containers, household items, and more.
- Durable Product Design: How can products be made more durable and repairable to ensure long-term use?
- Behavioral Change: What educational or incentive-based approaches could encourage people to adopt waste prevention habits?
- Sharing Economy: Could a platform be created to facilitate product sharing, renting, or second-hand exchanges within a community?
- Repair and Maintenance: How can repair services be made more accessible and affordable to extend product life?
- Data Tracking: How can technology monitor product usage and encourage responsible disposal only when necessary?
- Business Model: How can sustainable practices be integrated into profitable business models that encourage long-term product use and reduce waste?

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	• Engage in Launchpad Discussions • Engage/Meet with your Team • Complete Required Weekly Reading	Individual Collaborative

	• Refining & re-test your prototype		
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 and are organized by week.

Week 1

Launchpad Platform, Launchpad

Junior Academy Orientation, Launchpad

Week 2

Upcycling and Waste Management Innovation Challenge Background, Launchpad

What is a circular economy?, Ellen MacArthur Foundation

Zacho, Kristina O, and Mette A. Mosgaard, Understanding the role of Waste Prevention, *Waste Management & Research: The Journal for Sustainable Circular Economy*, V 34, Issue 10, 2016

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

What is the linear economy?, Ellen McArthur Foundation

Planned Obsolescence vs Perceived Obsolescence, Intentionally Sustainable

The Story of Stuff Project

Victoire, Akimanizanye , Nsanzumukiza Vincent Martin, Maniragaba Abias, Uwayo Pacifique, and Mucyo Jean Claude Solid Waste Management Challenges and Its Impacts on People's Livelihood, Case of Kinyinya in Kigali City, *Journal of Geoscience and Environment Protection*, V 8, No 6, 2020.

Abubakar, Ismaila Rimi , Khandoker M. Maniruzzaman, Umar Lawal Dano, Faez S. AlShihri, Maher S. AlShammari, Sayed Mohammed S. Ahmed, Wadee Ahmed Ghanem Al-Gehlani, and Tareq I. Alrawaf Environmental Sustainability Impacts of Solid Waste Management Practices in the Global South, *Int J Environ Res Public Health*, V 19, 2022.

Beyond an Age of Waste- Global Waste Management Outlook 2024 UN Environment Programme, United Nations

C40Cities Sustainable Waste Systems Network, C40 Cities

The World Has a Waste Problem. Here's How to Fix It, International Finance Corporation, World Bank Group

Pantamera Express Swedish system for recycling

New EU rules to reduce, reuse and recycle packaging, European Parliament

EU packaging waste generation with record increase, Eurostat, European Union

What is upcycling, Habitat for Humanity

Upcycling Defined: A Creative Approach to Sustainable Living, Plastic Reimagined

Paguro: Materials (upcycled fashion)

How We Turn Scraps into New Gear, Patagonia

Sustainability In Africa: How Rwanda's Young Innovators Are Building A Circular Economy, Forbes

10 Examples of Circular Economy Solutions, State of Green

Circular supply chains: the role of supply chain professionals in creating a circular economy, Ellen McArthur Foundation

How to Build a Circular Economy, World Resources Institute

Sustainability and Circularity in the Textile Value Chain - A Global Roadmap, United Nations

What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050, World Bank
What is Sustainable Waste Management?, Recycle Track Systems
Waste to Resources: Improving Municipal Solid Waste (MSW) & Hazardous Waste Management in Rwanda, GGGIMedia (video)
Assessing waste management services in Kigali, International Growth Center
Van Genuchten, Dr. Erlign What Makes Environmental Education Effective?, Medium, 2012.
Monroe, Martha C., Richard R. Plate, Annie Oxarart, Alison Bowers & Willandia A. Chaves Identifying effective climate change education strategies: a systematic review of the research, *Environmental Education Research*, V 25, Issue 6, p 791-812, 2017.
Rwanda Environmental Education for Sustainable Development Strategy : A Strategy and Action Plan for 2010-2015, Rwanda Environment Management Authority (REMA).

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