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Introduction

Welcome to NIIMBL bioLOGIC™

About

NIIMBL bioLOGIC[™] is a project-based learning program developed by The National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL). The program focuses on three pillars: engagement with advanced technologies, familiarization with the principals of entrepreneurship, and exposure to the education and career pathways that lead into the advanced manufacturing sector. These focus areas are wrapped around a student-led, design-thinking approach that allows participants to concentrate on a problem area that holds real meaning for them, and apply what they learn about technology and entrepreneurship to a real world challenge.

During the program, students will work in teams of 4-6 to:

Identify a real-world problem

Conceptualize an advanced product solution

Create a business model around the product

Build a pitch deck and 3-4 minute pitch they will deliver to a panel of representatives in a professional style setting

The program is deliberately light on instruction and prescription: the goal is for students to learn how to solve open-ended, complex problems in new and creative ways. This lack of prescription results in what we refer to as a "low floor, high ceiling". Some students will excel in this agile environment and dig deeply into the program; others will struggle a bit. Both results are acceptable, and students will learn something no matter where they fall on this spectrum. Far better to learn the stresses of being unprepared at age 15 than at age 25.



One of the most valuable aspects of the program is its ability to connect students with a wide variety of people they would not normally have the chance to interact with. Over the course of these engagements, students may receive contradictory feedback about their projects. This is a normal part of product and business development; it is the job of the team to carefully consider all feedback, and decide which to implement and which to ignore.

NIIMBL bioLOGIC's goal is to help students become comfortable without direction, confident in their ability to solve complex and open-ended problems, and experienced in leading their own research and work. The program will not provide each student with a cookie cutter experience that dictates exactly how to approach the project, but instead offer the diverse range of experiences, skills, tools, and opportunities they need to visualize and pursue careers they find fulfilling and rewarding.



Embedded Learning Objectives

Through the research and work associated with the program, students learn how to approach and solve complex problems and communicate their findings to an audience. Field trips to industry and higher education help students learn how to interact with industry advisors, provide perspective on the professional opportunities available in the advanced manufacturing and technology sectors, and increase awareness of the education pathways required to work in these fields. Along the way, NIIMBL bioLOGIC helps educators achieve a broad range of learning objectives including:

College Readiness

Career Readiness

Career Technical Education

Direct Industry Engagement

Project Management

Argument Development

Creative Reasoning

Critical Thinking

Problem Solving

Judgment

Adaptability

Leadership

Teamwork

Professional Communication

Public Presentation

Your Role

As the classroom instructor, you do not need to know anything about biopharmaceuticals or entrepreneurship to run the program, and you won't be required to teach your students any NIIMBL bioLOGIC-specific material. You will act as more of a Program Manager, ensuring your students conduct the research, critical thinking, and creative reasoning they will need to accomplish all the project's milestones.

Your biggest job is to ensure your students use the Student Workbook and myriad research resources available to them to teach themselves, just as they will when they enter the workforce. Please review their work on a regular basis and help them achieve the following:

Logical argument development

Solid research, to include both statistical data and anecdotal data from reputable sources

Inclusion of all elements on the Scoring Sheet

Well designed and formatted slide decks

Rehearsed pitches

Understanding how a technology-oriented program fits into a non-technical class can seem a little confusing, but the answer lies in the fact that the program rests on logic, not technical expertise. The Student Workbook will guide students through the process of building out the logic chain behind the technology concept, without worrying about the true viability. As the Student Workbook stipulates, the technology concepts do not need to be in existence today, but teams must be able to explain how they could be developed. The Student Workbook helps teams accomplish this by distilling the technological components of a product down and taking a high-level, logic-based approach to understanding how biopharmaceutical medicines are made in layman's terms.

Similarly, you will not need any knowledge about business or finance to help students create their business models—the goal is for students to come out of the program with an appreciation of the complex considerations that go into building a business model, and solid logic underpinning their financial model. Your role will not be to teach them either of these things, but instead to provide feedback on their work by identifying areas that are not supported by a logical assumption or solution.



Integrating Your Learning Objectives

NIIMBL bioLOGIC's course-agnostic approach means that it can be easily overlaid on any class. Successful iterations have been run in subject areas including robotics, engineering, biology, economics, government & policy, English, and English Language Development (ELD) for English as a Second Language (ESL) students.

The program is designed to accommodate a wide variety of learning objectives, both technical and non-technical. Although the steps and touchpoints associated with the program are mandatory, the focus of each area can be tailored to the intersection of problem research, product development, business model development, and/or pitch creation with the subject area of the class. Don't be afraid to get creative as you tailor the program to your subject area, although you do not have to do so.

Below are some ways NIIMBL bioLOGIC instructors have inserted their learning objectives into the program's framework:

English

Aristotle's Triangle of Rhetoric, focusing on Speaker, Audience, and Message to help students craft their arguments and Final Pitch messaging.

English Language Development

Iterating through this program requires students to focus on reading comprehension, argument development, and oral presentation.

Government & Policy

Embedding an assignment (i.e. a slide in the final pitch deck or mini report) on the role government and policy plays in industry and the development of advanced manufacturing and technologies is one option. The focus might include the role of government in technology development, manufacturing, and/or trade, etc.

Another option would be to research what existing or proposed legislation currently impacts the development, creation, use, or sale of each team's product ideas.

Economics

Economic assessment of the product sector.

Biology

Development of medicines related to concepts learned about human health

Robotics

Allow students to incorporate robotics and automation into their manufacturing plans

Engineering

Allow students more time to dive into engineering decisions, process optimization, or process equipment design



About The National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL)

The mission of the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL) is to accelerate biopharmaceutical manufacturing innovation, support the development of standards that enable more efficient and rapid manufacturing capabilities, and educate and train a world-leading biopharmaceutical manufacturing workforce, fundamentally advancing U.S. competitiveness in this industry. NIIMBL is part of Manufacturing USA®, a network of federally sponsored manufacturing innovation institutes, and is funded through a cooperative agreement with the National Institute of Standards and Technology (NIST) in the U.S. Department of Commerce with additional support from its members. Together with partners from industry, academia, non-profits, and government agencies, NIIMBL collaborates on innovative manufacturing technologies to bring lifesaving medicines to market faster and at reduced cost, while maintaining safety and efficacy. In addition, NIIMBL strives to cultivate a world-leading biopharmaceutical workforce through novel training and education programs.

NIIMBL bioLOGIC[™] was designed to introduce students to the transformative potential of biopharmaceutical manufacturing. The program aims to build awareness about the diversity of opportunities available.



infectious agent or cancer cell and train the body's immune system to fight

Cell and gene therapies cure diseases. Cell and gene therapies are newer classes of biopharmaceuticals. Gene therapy replaces or edits defective genes, while cell therapy engineers cells to fight or cure diseases such

the pathogen or pathogenic cells.

as cancer.

Timeline

CAREER READINESS WORKSHOP

The Career Readiness (C.R.) Workshop takes place prior to Kick-Off and teaches students about business communication and etiquette and many other topics that will help them in this program and beyond.

PHASE 1 PROBLEM IDENTIFICATION

KICK-OFF

The Kick-Off (K.O.) is where students are introduced to the program and begin brainstorming problems to address.

PHASE 2 PRODUCT DEVELOPMENT

INDUSTRY DAY

FACILITY TOUR

On Industry Day (I.D.), students tour the Industry Partner's facility, learn about careers and meet people working in the field, and become familiar with products and processes in advanced manufacturing.

PRODUCT DEVELOPMENT WORKSHOP

During the Product Development (P.D.) Workshop, student teams work on their problem and product concept and give a one-minute practice pitch. The Program Manager, High School Instructor, and Industry Advisor provide guidance and feedback throughout.

PHASE 3 – BUSINESS MODEL CREATION

COLLEGE DAY

CAMPUS TOUR

On College Day (C.D.), students experience a higher education campus first hand and what it is like to be a student there.

BUSINESS MODEL WORKSHOP

During the Business Model (B.M.) Workshop, student teams work on creating the business model for their product concept. The Program Manager provides guidance and feedback.

SLIDE DECK WORKSHOP

The Slide Deck Workshop is a working period for teams to create their pitch decks. The Program Manager and High School Instructor will offer feedback on slide content and layout.

PHASE 4 FINALIZE PITCH AND REHEARSE

FINAL REHEARSAL

The Final Rehearsal is a scheduled class period for each team to run through their final presentations.

FINAL PITCH

The Final Pitch (F.P.) is the culminating event of NIIMBL bioLOGIC, where student teams pitch their final presentations to Panelists and a general audience. Following presentations, Panelists offer feedback and guidance to the students.



Instructions

Overview

Documents

SD STUDENTS

All student documents that should be provided to students right before or during Kick-Off.

SD.1Student LetterSD.3Media Release FormSD.2Parent LetterSD.4Student Workbook

ID H.S. INSTRUCTOR

These documents provide an overview of the H.S. Instructor's responsibilities, the program schedule, program implementation documents, and other general information. All instructor documents can be found in the appendix at the end of the guide.

ID.2 Program Calendar

ID.3 H.S. Instructor Action Items

ID.4 I.D. Map

ID.5 I.D. Transportation Form

ID.6 I.D. Itinerary

ID.7 C.D. Map

ID.8 C.D. Transportation Form

ID.9 C.D. Itinerary

ID.10 H.S. Instructor F.P. Checklist



Program Prep

.1 ABOUT

At this point, you have been onboarded by the <u>Program Manager (PM)</u> and set the schedule for the program events. In the next few weeks, you'll receive the NIIMBL bioLOGIC program collateral from the <u>PM</u>. While you wait, there are a few things you can do immediately.

1.2 **EXECUTE**

Send a student roster and a list of student teams to the PM. Include the following:

├ : Name and Grade

: Start reaching out to potential Chaperones for I.D. and C.D.



Career Readiness Workshop

1.3 **ABOUT**

The C.R. Workshop takes place in the H.S. classroom prior to Kick-Off and teaches students about business communication and etiquette, how to become marketable, and how to build a professional network.

1.4 **PREP**

The C.R. Workshop requires about 30 minutes of class time. Brief students on what to expect and confirm the following:

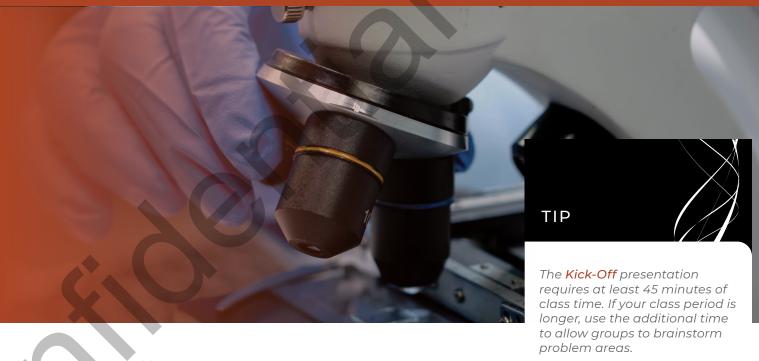


1.5 **EXECUTE**

Welcome the PM.

Attend the C.R. Workshop.





Kick-Off

ABOUT

The Kick-Off presentation is delivered by the Program Manager, and takes about 45 minutes. In this presentation, students are introduced to the program and given information on biopharmaceuticals and entrepreneurship.

1.7 **PREP**

Divide students into teams of 4-5.

Review the Program Calendar (ID.2) and share it with students.

Confirm the following:



A/V functionality

Student Documents (SD) have been printed

1.8 **EXECUTE**

Welcome the PM.

Facilitate Kick-Off.



Attend the K.O. Presentation

Break students into their teams and have them brainstorm their product concept using their Student Workbooks (SD.4)

You and the PM should offer feedback and guidance

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Industry Day

1.9 **ABOUT**

On I.D., students tour the Industry Partner's facility. Next, they attend the P.D. Workshop where they work in teams on their projects, give a one-minute practice pitch on their problem and product concept, and receive guidance and feedback from Industry Advisors. Please note that the P.D. Workshop can be executed after the tour or on a different day.

1.10 **PREP**

Review the I.D. Itinerary (ID.6).

Arrange transportation using the I.D. Transportation Form (ID.5).

Arrange Chaperones.

NIIMBL bioLOGIC staff can never be in a supervisory or disciplinary position with students

Check with the PM to see how many Chaperones you'll need (this is based on the number of groups the Industry Advisor will break students into)

: Arrange lunch for the students.

Either the High School provides lunches, or students should be reminded to bring their own

: Confirm the following with the PM:

Bus departure time

Roster of students attending

Chaperones have been arranged

Lunch has been arranged

Print the following for the bus driver:

iD.4 I.D. Map

A few days before the event, review the I.D. Itinerary (ID.6) with students and remind them to bring their Student Workbooks (SD.4).



1.11 **EXECUTE**

Contact the $\ensuremath{\mathsf{PM}}$ to confirm bus departure or changes to the schedule.

Attend I.D.

: Tour the Industry Partner's facility

: Attend the P.D. Workshop.



Students should break into teams and mock-up their product concept

Each team should give a one-minute practice pitch

PM and Industry Advisors should offer feedback and guidance

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College Day

1.12 **ABOUT**

On C.D., students tour the college and attend an admissions overview. They will also participate in the B.M. Workshop, where they will receive some entrepreneurship instruction and have the chance to create a business model for their product concepts. Please note that the B.M. Workshop can be executed after the College Tour, or on a different day.

1.13 **PREP**

Review the C.D. Itinerary (ID.9).

Arrange transportation using the C.D. Transportation Form (ID.8).

Arrange Chaperones.

NIIMBL bioLOGIC staff can never be in a supervisory or disciplinary position with students

: Arrange lunch for the students.

\+ : Either the High School provides lunches, or students should be reminded to bring their own

: Confirm the following with the PM:

/ :

Bus departure time

Roster of students attending

Chaperones have been arranged

Lunch has been arranged

Print the following for the bus driver:



ID.7 C.D. Map

A few days before the event, review the C.D. Itinerary (ID.9) with students and remind them to bring their Student Workbooks (SD.4).



1.14 **EXECUTE**

Contact the PM to confirm bus departure or changes to the schedule.

Attend C.D.

Attend the B.M. Workshop.

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Prep for Final Pitch

1.15 **ABOUT**

Work with the PM to finalize details for the F.P., including venue, documents, and key invitees.

1.16 **PREP**

Review the H.S. Instructor F.P. Checklist (ID.10) and Student F.P. Checklist in the Student Workbook.

1.17 **EXECUTE**

Book a venue for the F.P.

The space should be big enough to accommodate the entire class,Panelists, and guests

Look for venues that will encourage interaction between the student teams and the panel. Venues like stages can make it hard for the panel to engage naturally with students

Lecture halls and libraries are a good choice

Attend H.S. Instructor Meeting 2.

This meeting can be conducted any time after C.D. Consider scheduling it before or after the Slide Deck Workshop, or before or after the Final Rehearsal. Ideally, this meeting is held in the final pitch venue so you can look at room layout, A/V equipment, etc.

1.18 **FOLLOW UP**

Send the following to the PM:

Address, directions, and map of F.P. venue

Names, titles, email addresses of key invitees

Future NIIMBL bioLOGIC instructors benefit greatly from seeing a Final Pitch before they run the program, so try inviting other H.S. Instructors from the school.





Slide Deck Workshop

1.19 **ABOUT**

The Slide Deck Workshop is a working period where you work with the PM to offer feedback as student teams collaborate on their projects.

1.20 **PREP**

Remind students to bring their Student Workbooks (SD.4).

Confirm the following:

✓

: A/V functionality

1.21 **EXECUTE**

Attend the Slide Deck Workshop.



Students should break into teams and mock-up their product concept

Offer feedback and guidance

Each team should give a one-minute practice pitch

Final Rehearsal

1.22 **ABOUT**

The Final Rehearsal is a scheduled class period for each team to run through their final presentations. The PM, Instructor, and class should provide feedback to each team. The PM will document this feedback in the Final Pitch Feedback Form and provide to each team after their practice pitch.

1.23 **PREP**

Review the Student F.P. Checklist and the F.P. Scoring Rubric with students.

1.24 **EXECUTE**

Attend Final Rehearsal, offer students feedback and guidance.

REMINDER

Go over presentation details with students, including slide composition, presentation of data, and tips for clearly presenting to the panel.

Final Pitch

1.25 **ABOUT**

The F.P. is the culminating event of the NIIMBL bioLOGIC program, where student teams pitch their final presentations to Panelists and a general audience, including school faculty, administration, and peers. Following the presentations, Panelists offer feedback and guidance to the students.

1.26 **PREP**

Confirm the following with the PM:

: Ven

A/V functionality

Schedule, roles, and responsibilities for F.P.

Invite list

F.P. Collateral is prepared

Student Certificates of Completion have been prepared

1.27 **EXECUTE**

Meet the PM at the F.P. venue early to ensure everything is ready for the students.

Facilitate the F.P. with the PM.



Welcome everyone and kick off the F.P.

Briefly introduce the class and subject

Give an overview of NIIMBL bioLOGIC

Thank attendees and partners

Student teams present their product concepts

Panelists offer feedback

Brief closing



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