



Believe in Ohio

Getting Started with Believe in Ohio

	Page
1. 4 Ways to Get Started	2
2. STEM Commercialization Plans	
a. STEM Commercialization Implementation Guide	3
b. Science Standards	14
c. Science Sample Unit	25
3. STEM Business Plans	
a. STEM Business Implementation Guide	32
b. Business Standards	43
c. Business Sample Unit	61





Believe in Ohio

4 Ways to Get Started with Believe in Ohio!

2

Teach the Design Thinking/Ideation Mini-Course.

You could plan to spend a week on this unit. Start with Quick Look Video Describing this course for you, the Teacher. Then follow the Design Thinking Lesson Plan. It is color-coded to include Virtual Alternate Activities, Teacher-Led Activities, Video Narration, etc. It is very comprehensive!

Find the course links here: <https://mk0believeinohioil21qn.kinstacdn.com/wp-content/uploads/2020/09/Teacher-Resource-Draft-STEM-Commercialization-Plan-Final3.pdf>

Recommended Design Thinking / Ideation Mini-Course:

- Quick Look – Recommended Design Thinking / Ideation Mini-Course

o Link – <https://youtu.be/a4iF8lbYVgY>

- Design Thinking Lesson Plan

o Link - <https://believeinohio.org/wp-content/uploads/2020/08/Design-Thinking-Lesson-Plans.docx>

Part 1

Believe in Ohio Welcome – Are You Ready for Your Future?
Introduction to Design Thinking
IDEO Shopping Cart
Design Thinking Exercise

Part 2

Empathize & Define (Part 1)
Empathize & Define (Empathy Video)
Empathize & Define (Part 2)

Part 3

Student Discovery – STEM Innovation & Entrepreneurship at Ohio Colleges & Universities
Student Discovery – Emerging Technologies That Are Changing the World

Part 4

Introduction to Brainstorming – Ideation

1

Believe in Ohio Professional Development Course

Explore the resources available through our Google Classroom in this course which is available in two ways. <https://believeinohio.org/pd/>

- 7 FREE contact hours – follow the syllabus guiding you through the Google Classroom and respond with reflections on the provided form
- 1 graduate credit through Ashland University or Kent State – same as the previous version with an additional assignment for full Graduate credit. (Tuition reimbursed!)

3

Future of Work and Idea Generation

Introduce the idea of technology rapidly changing the world and the need to be life-long learners by showing the video, **Are You Ready for the Future?** <https://www.youtube.com/watch?v=zznfNwFe8X4&feature=youtu.be>

Follow that by having students look at the document **Technologies Changing the World** <https://believeinohio.org/wp-content/uploads/2020/08/Technologies-Changing-the-World.pdf> and have them choose at least one and write a 1-2 paragraph discussion about why the technology development interests them and how they might apply it to develop a new product or service to solve a problem or pain point solution.

4

Practice using the Believe in Ohio Roadmap in a Class Period

Put students in groups or work alone. Ask students to brainstorm a problem they have or are concerned about which can be solved by creating a product or a service. Have them describe the science or engineering design concepts that they are using to build or design their product. This is the underlying enabling STEM concepts that would make their idea work.

These are the first three Mileposts in our Roadmap process. Print the Roadmap Worksheet for students/groups to use in their brainstorming and the Printable Milepost 1-8 for them to assess what each step entails.

They can move to subsequent Mileposts if they have time. After about 30 minutes, have the groups/students present their pitch for their product in front of their peers describing each Milepost in 3 minutes. They must be succinct.

Roadmap Worksheet <https://believeinohio.org/wp-content/uploads/2019/10/Roadmap-milepost-1-8-worksheet.pdf>

Printable Mileposts 1-8 <https://believeinohio.org/wp-content/uploads/2020/08/How-to-Navigate-Mileposts-1-8.pdf>

IMPLEMENTATION GUIDE FOR BELIEVE IN OHIO STEM COMMERCIALIZATION PLANS

Believe in Ohio provides a wide array of resources for teachers to use in their classrooms to guide students in creating quality STEM Plans. Use as many, or as few, as you choose in your lesson plans.

This Implementation Guide is designed to give teachers suggestions about which resources to use as starting points to guide students in this process. We also suggest assignments that will allow students to begin the research and writing process for each Milepost.

Each Part can be completed in 1—3 weeks depending on the amount of class time a teacher can devote to the process. The entire STEM Plan can be completed in 4—12 weeks using this schedule. The key is flexibility! Some teachers spread the assignment out within a semester, some throughout the school year, and others devote 3—4 weeks exclusively to developing Believe in Ohio STEM Plans.

This Implementation Guide is divided into 4 Parts:

Part 1: Introduction to Believe in Ohio and the Entrepreneurial Mindset Mileposts 0—3

Part 2: Assessing the Commercial Feasibility of the Idea Mileposts 4—8

Part 3: Developing and Writing the STEM Plan Mileposts 9—12

Part 4: Reviewing, Reassessing, and Finalizing the STEM Plan

Included in each of the 4 Parts are additional resources teachers may include if they have extra time to devote to Believe in Ohio. Using these resources may increase the quality of the Plans making them more competitive for Local, Regional, and State Awards. These and other in-depth exploration resources can be found at the end of this guide.

Additional Resources for Creating Exceptional STEM Plans:

Option 1: Dan Hess Additional Milepost STEM/Entrepreneurship Video Series

Option 2: Design Thinking/Ideation Mini-Course

Option 3: Emerging Technologies Deep-Dive

Option 4: Exploring Patents

Blue Boxes contain minimum resources to introduce students to each of the 4 Parts.

Red Boxes are Homework or Class Assignments designed to extend student research and begin the writing process for the STEM Plan at each Milepost.

Gray Boxes contain additional highly recommended resources or activities for teachers who have more time available or need to provide more explanation to their students about entrepreneurship.

PART 1:

INTRODUCTION TO BELIEVE IN OHIO & THE ENTREPRENEURIAL MINDSET MILEPOSTS 0 - 3

Assign in Google Classroom or use links

INTRODUCTION TO BELIEVE IN OHIO

1. The What and Why of Believe in Ohio

- ◆ Show students [“Are You Ready”](#) video (5:43) and/or [Milepost 0 Video 1 The Challenge of the Future](#) (10:00)
- ◆ Share Believe in Ohio STEM Commercialization & STEM Business Plan process and project incentives and expectations.
- ◆ Provide [STEM Commercialization Plan Judging Card](#) & discuss judging rubric
- ◆ Show students Key Videos for Students
 - ◆ [Video 1: Why Students are Asked to do a STEM Plan](#) (2:39)
 - ◆ [Video 2: What, Specifically, Students are Asked to do to Develop Their STEM Plan](#) (4:59)

MILEPOST 0

2. Knowledge of STEM + Entrepreneurial Mindset = INNOVATION!

- ◆ Show [Milepost 0 Video 2: Intro to Entrepreneurship](#) (7:00)
- ◆ Show [Milepost 0 Video 3: Think, Innovate, Change](#) (8:00)

Homework or Class Research Assignment: Students select 1 or more emerging technologies that interest them from [Technologies Changing the World](#) and React/Respond.

Homework or Class Option: Show 1 or more Entrepreneurship Videos: Select from *Videos that explain Entrepreneurship & the American Free Market System* in the Google Classroom to introduce students to the Importance of Entrepreneurship in creating jobs, (4:33 – 12:44) e.g. [Kaufman Foundation Video Sketchbook Series #1](#) (12:44) and/or [Kaufman Foundation Video Sketchbook Series #2](#) (7:42)

PART 1:

INTRODUCTION TO BELIEVE IN OHIO & THE ENTREPRENEURIAL MINDSET MILEPOSTS 0 - 3

(continued)

3. Independent Exploration/Research of Students' Problems and Pain Points

Homework or Class Research Assignment:

- ◆ Students read [Student Step by Step Instructions for Determining the Commercial Feasibility of Your Plan & Developing the Plan Itself](#) use throughout all Mileposts.
- ◆ Students watch additional videos from [Videos to Inspire Students to Think About Their Futures](#) (5:08 – 17:40)

MILEPOSTS 1–3

Continue Independent Exploration/Research of Students' Problems and Pain Points

- ◆ Show [Key Video 3: Working Through Mileposts 1-3](#) (2:39)
- ◆ Introduce the Believe in Ohio Roadmap Worksheet. Using [BiO Roadmap Worksheet](#) and [BiO Navigation Instruction Mileposts 1-8](#) students brainstorm their ideas at each Milepost.
- ◆ Conduct additional on-line and personal research to further develop Mileposts 1–3. Students select 1 or more additional emerging technologies that interest them from [Technologies Changing the World](#)

Note: Students can use the Worksheet to jot down their ideas for each Milepost. Use post it notes if working in-person or share the Worksheet to a Padlet or other on-line collaborative software for students to interactively add their ideas to the Worksheet in a collaborative shared space.

Homework Research Assignment: Ask parents, family, friends, classmates, teachers, or coaches about problems or market opportunities they have encountered. Create a list of these ideas to consider for Milepost 1.

Homework or Class Writing Assignment: Describe and briefly summarize Mileposts 1-3. Consider a deadline for students to briefly summarize their pain point and come up with an idea!

Homework or Class Option: Recommended Videos if time allows:

- ◆ Show [Milepost 1 Video 4: Finding Problems, Seeing Opportunity](#) (9:00)
- ◆ Show [Milepost 2 Video 5: Proposing Solutions](#) (9:00)
- ◆ Show [Milepost 3 Video 6: Using Technology to Execute a Solution](#) (11:00)

PART 2:

ASSESSING THE COMMERCIAL FEASIBILITY OF THE IDEA MILEPOSTS 4—8

Assign in Google Classroom or use links

MILEPOSTS 4—6

- ◆ Show [Key Video 4: Working Through Mileposts 4-8](#) (11:38)
- ◆ Students continue brainstorming and developing their ideas at Milepost 4 –6 using [BiO Roadmap Worksheet](#) and [BiO Navigation Instruction Mileposts 1-8](#)
- ◆ Conduct additional on-line & personal research to further develop Mileposts 4–6.
- ◆ Using [BiO Roadmap Worksheet](#) and [BiO Navigation Instruction Mileposts 1-8](#) students brainstorm their ideas at each Milepost.

Homework or Class Writing Assignment: Discuss your ideas with parents, friends, classmates, coaches, and teachers. Make any changes you find appropriate and summarize Mileposts 4-6. Consider a deadline for students to briefly summarize their customers and competitors.

Homework or Class Assignment:

Recommended Videos & Response Sheets (Google Classroom only):

- ◆ Milepost 4 Video 7: [Who Can Benefit From Your Solution?](#) (8:00)
- ◆ Milepost 5 Video 8: [Who Are Your Competitors?](#) (7:00)
- ◆ Milepost 6 Video 9: [What Value Do You Bring to the Market?](#) (7:00)

PART 2:

ASSESSING THE COMMERCIAL FEASIBILITY OF THE IDEA MILEPOSTS 4—8

(continued)

MILEPOSTS 7—8

- ◆ Students continue brainstorming and developing their ideas at Milepost 7 –8 using [BiO Roadmap Worksheet](#) and [BiO Navigation Instruction Mileposts 1-8](#)
- ◆ Conduct additional on-line and personal research to further develop Mileposts 7 –8.

Homework Research Assignment: Ask parents, family, friends, classmates, teachers, coaches, or local business owners about some of the revenue streams and costs they are aware of that students should consider while developing their Plan. Include some of these ideas in Milepost 7-8 if relevant.

Homework or Class Writing Assignment: Summarize the revenue possibilities and key costs relative to their idea for Mileposts 7-8.

Homework or Class Assignment:

Recommended Videos & Response Sheets (Google Classroom only):

- ◆ Milepost 7 Video 10: [Will Your Idea Generate Revenue?](#) (9:00)
- ◆ Milepost 8 Video 11: [What Will It Cost to Get Started?](#) (7:00)
- ◆ Milepost 8 Video 12: [What Are the Operating Costs?](#) (7:00)
- ◆ Traffic Light – [Does Your Idea Get a Green Light?](#) (7:00)

PART 3:

DEVELOPING AND WRITING THE STEM PLAN MILEPOSTS 9—12

Assign in Google Classroom or use links

MILEPOSTS 9—12

- ◆ Show [Key Video Working Through Milepost 9 -12 \(STEM Commercialization\)](#) (5:00)
- ◆ Assign [How to Navigate the Believe in Ohio STEM Plan Instructional Roadmap – Mileposts 9-12](#) instructions for students to begin expanding, developing, then writing their Plans. **Use Milepost 11A!**

This section provides an assessment of the science and technology concepts and principles underlying the plan and provides a science and technology proof of concept of the feasibility of the idea. **This part should be the core of the Commercialization Plan.** It will likely need to be several pages long to adequately cover all the required information in the points:

- ◆ Review and assessment of the scientific literature:
- ◆ Discussion of your findings with relevant cited references:
- ◆ Statement of a single, clear and compelling (1) testable hypothesis or (2) engineering design:
- ◆ Inquiry or design-based discussion:
- ◆ Data tables, graphs, charts, sketches, engineering drawings or photos of prototypes or models, and cited references:

- ◆ Provide STEM Commercialization Plan Templates for precise formatting and writing guidelines. [Word \(Google Docs Template in Google Classroom only\)](#)
- ◆ Ask students to review [Examples of past 'highly rated' STEM Plans for student review](#) for examples of writing styles, discussion length, and use of figures, etc.

Homework or Class Research & Writing Assignment: Students conduct additional research as needed to develop their idea and write Mileposts 9 -12. Review summary comments from the Mileposts 1-8 and use as a basis for completing the initial draft of the STEM Commercialization Plan. Use the provided STEM Commercialization Plan Template to complete the Draft Plan.

PART 4:

REVIEWING, REASSESSING, AND FINALIZING THE STEM PLAN

Once students have a Draft STEM Plan, they should **REVIEW** their Plan!

Does the idea make sense? Or does it need further investigation?

They should **REASSESS** their idea based on this analysis.

If it does NOT make SENSE as designed and envisioned they must **PIVOT!** This means they might have to change their design, material, target customers, or general business model. They may need to do additional research or adapt their idea based on a competitors' product.

If **PIVOTING**, they will return to previous Mileposts where their idea is weak or not feasible.

They may have to conduct additional research, redesign their product, or their business approach through each successive Milepost based on the point of the necessary **PIVOT**.

Finally, they will **REWRITE** their STEM Plan based on this new information.

Parts of the STEM Plan may need to be revised and rewritten multiple times to produce a well-thought-out, competitive STEM Plan.

Students review the Judging Rubric [STEM Commercialization Plan Judging Card](#) and use it to assess Plans.

- ◆ Students review their own Plans and rewrite as needed to maximize score.
- ◆ Teachers/mentors give Plan feedback before FINAL submission.

Optional Peer Feedback Opportunities!

- ◆ Students present their Plans to their classmates and receive peer feedback.
- ◆ Students are paired, exchange Plans, and give feedback to each other.

Teachers will grade **FINAL STEM Plans** then submit them to their judges for the Local School Competition.

- ◆ Consult the Believe in Ohio Timeline or MoU for submission deadlines of Local School Competition winners and paperwork.
- ◆ Consult your Regional STEM Advocate for your Final Report Check Sheet to submit your winners and cover sheets to release student awards and teacher support grant funds.

OPTIONAL RESOURCES FOR CREATING EXCEPTIONAL STEM PLANS!

Option 1: Dan Hess Additional Milepost STEM/Entrepreneurship Video Series

Option 2: Design Thinking/Ideation Mini-Course

Option 3: Emerging Technologies Deep-Dive

Option 4: Exploring Patents

OPTION 1: DAN HESS ADDITIONAL MILEPOST STEM/ENTREPRENEURSHIP VIDEO SERIES

Assign in Google Classroom or use links

This video series explores the idea of **STEM Knowledge + Entrepreneurial Mindset = INNOVATION** by following 6 relatable young entrepreneurs as they take their ideas through the Mileposts. The Milepost 0 videos illustrate this equation and are considered important explanatory videos in Part 1 of the Implementation Guide. Showing students the entire series will further engage them in the process and allow them to see how the Mileposts are used to assess very different ideas and business models.

However, use as many or as few as you would like with your class!

- ◆ Milepost 0 Video 1: [The Challenge of the Future](#) (10:00)
- ◆ Milepost 0 Video 2: [Intro to Entrepreneurship](#) (7:00)
- ◆ Milepost 0 Video 3: [Think, Innovate, Change](#) (8:00)
- ◆ Milepost 1 Video 4: [Finding Problems, Seeing Opportunity](#) (9:00)
- ◆ Milepost 2 Video 5: [Proposing Solutions](#) (9:00)
- ◆ Milepost 3 Video 6: [Using Technology to Execute a Solution](#) (11:00)
- ◆ Milepost 4 Video 7: [Who Can Benefit From Your Solution?](#) (8:00)
- ◆ Milepost 5 Video 8: [Who Are Your Competitors?](#) (7:00)
- ◆ Milepost 6 Video 9: [What Value Do You Bring to the Market?](#) (7:00)
- ◆ Milepost 7 Video 10: [Will Your Idea Generate Revenue?](#) (9:00)
- ◆ Milepost 8 Video 11: [What Will It Cost to Get Started?](#) (7:00)
- ◆ Milepost 8 Video 12: [What Are the Operating Costs?](#) (7:00)
- ◆ Traffic Light – [Does Your Idea Get a Green Light?](#) (7:00)

Homework or Class Writing Assignment: Fill out Student Support Sheet for each video.

OPTION 2: DESIGN THINKING /IDEATION MINI-COURSE

Assign in Google Classroom or use links

OVERVIEW

We highly recommend incorporating this mini-course into the Believe in Ohio process!

Plan to spend 1 week or maybe 2 weeks if necessary depending on the numbers of class sessions per week you have available. View the *Quick Look* video then follow the Lesson Plan to guide your students through Parts 1 – 4.

Alternatively, you can select individual resources or sections of this mini-course to share with your students.

[Quick Look – Recommended Design Thinking / Ideation Mini-Course](#) (1:00)

[Design Thinking Lesson Plan](#) by Dr. Heather Braun, Associate Professor of English, University of Akron

Part 1: Introduction to Design Thinking- (Total Time: 40 minutes with Welcome video)

- Part 1 - [Believe in Ohio Welcome – Are You Ready for Your Future?](#)
- Part 1 – [Introduction to Design Thinking](#)
- Part 1 – [IDEO Shopping Cart](#)
- Part 1 – [Design Thinking Exercise](#)

Part 2: Empathize & Define (Total Time: 35 minutes)

- Part 2 – [Empathize & Define \(Part 1\)](#)
- Part 2 – [Empathize & Define \(Empathy Video\)](#)
- Part 2 – [Empathize & Define \(Part 2\)](#)

Part 3: Student Discovery Activity (Total Time: 30 minutes)

- Part 3 – [Student Discovery – STEM Innovation & Entrepreneurship at Ohio Colleges & Universities](#)
- Part 3 – [Student Discovery – Emerging Technologies That Are Changing the World](#)

Part 4: Introduction to Ideation (Total Time: 35 minutes)

- Part 4 – [Introduction to Brainstorming – Ideation](#)

OPTION 3: EMERGING TECHNOLOGIES DEEP-DIVE

Assign in Google Classroom or use links

STEM Knowledge + Entrepreneurial Mindset = INNOVATION

Our nation's prosperity is the result of generations of innovators and entrepreneurs who developed the products, services, businesses, and industries that have made the United States economy the largest in the world. Today, we are living in an Innovation Age in which technology advancements and global competition point to a future where continuous innovation will cause every product, service, and aspect of life to be transformed and reinvented during the lifetimes of today's students who will be our country's next generation of innovators and entrepreneurs.

To create these new jobs and future prosperity, we must inspire students' interest in STEM where many of the jobs and careers of the future will be. We must also plant in students the seed of entrepreneurship and help them develop the problem solving, critical thinking, collaboration and the other 21st Century skills they will need to be successful in the future.

The **Emerging Technologies Deep-Dive** will help students connect the content of their STEM classes to real-world practical applications they discover in the resources. These examples should help students find topics of interest that they can adapt and develop in their STEM Plans.

- ◆ Students investigate additional emerging technologies that interest them from [Technologies Changing the World](#) & **React/Respond to them.**
- ◆ Students select 1 or more Emerging Technologies TED talks to watch [8 TED Talks on emerging technologies to watch](#) by Carla Rudder (Editorial Team) | July 22, 2019 **React/Respond to them.**
- ◆ [Solving Global Problems Using Emerging Technologies | Zaynah Bhanji | TEDxTheWoodlandsSchool](#) Feb 14, 2020 (12:00) People worldwide are impacted by a lack of access to food, technology, education, housing, sanitation, and a host of other challenges. What if we used Artificial Intelligence to find solutions to these problems? Zaynah Bhanji is a 16-year-old machine learning and virtual & augmented reality developer. She began her journey developed neural networks at 13-years-old and has been supported by companies like Google, CIBC, TD, Deloitte, Microsoft, and more.

OPTION 4: EXPLORING PATENTS

Assign in Google Classroom or use links

While developing Believe in Ohio STEM Plans some students and their parents have questions about patenting their idea. Also, some teachers like to include patent searches into the process to highlight that aspect of the engineering design or business process.

We have included some information about patents to assist these students and teachers and to introduce the concept of patents and intellectual property for those who have the time and inclination to include them. Also, we include a discussion of patents as it applies to entry into the Believe in Ohio competition in the [Roadmap to Future Jobs and Prosperity Instruction Booklet](#) on page 4.

- ◆ Students learn about [Patent & Intellectual Property Discussion & Videos](#)
 - ◆ Patents & Intellectual Property 101 – Video Part 1 – "IP² = profits" (15:00)
 - ◆ Patents & Intellectual Property 101 –Video Part 2 – "The invention of the ice cream cone (22:00)
 - ◆ Patents & Intellectual Property 101 – Video Part 3 – The America Invents Act and its implications for entrepreneurs (10:00)
 - ◆ How to get a patent from a Research Scientist Perspective (A video by Senior Research Scientist Dr. Bilal Bomani) (13:00)

- ◆ Students research their idea to see if someone has already patented a similar product [How to Conduct a Preliminary U.S. Patent Search: A Step by Step Strategy](#)

The *Believe in Ohio* program is pleased to provide the *Ohio Learning Standards and Model Curriculum for Science “Visions into Practice”* connections to teachers so that they can assess how the *Believe in Ohio* program can help them meet those standards.



Hint: One teaching practice for working with your students might include using one of these Visions into Practice Classroom Designing technological/engineering solutions from your discipline to model and work through the Believe in Ohio process with your students helping them fully understand the mileposts in the program.

Project and Technology Connections in Science for Believe in Ohio from Ohio's Learning Standards and Model Curriculum for Science (adopted 2018-2019)
<http://education.ohio.gov/getattachment/Topics/Learning-in-Ohio/Science>

GUIDING PRINCIPLES Ohio’s Learning Standards and Model Curriculum for Science has been informed by international and national studies, education stakeholders and academic content experts. The guiding principles include:

- Definition of Science
- Scientific and Engineering Practices
- 21st Century Skills
- The *Nature of Science* distinguishes science as a discipline and describes how scientific knowledge is advanced. This section includes guidelines that contribute to the development of scientific literacy for all students. It is a knowledge of the constructs and values that are intrinsic to science.
- Technological Design: Technological design is a problem or project-based way of applying creativity, science, engineering and mathematics to meet a human need or want. Modern science is an integrated endeavor. Technological design integrates learning by using science, technology, engineering and mathematics and fosters 21st Century Skills.
- Technology and Engineering: Technology modifies the natural world through innovative processes, systems, structures and devices to extend human abilities. Engineering is design under constraint that develops and applies technology to satisfy human needs and wants. Technology and engineering, coupled with the knowledge and methods derived from science and mathematics, profoundly influence the quality of life.

Table of Contents

PHYSICAL SCIENCE 2

BIOLOGY 3

CHEMISTRY 5

ENVIRONMENTAL SCIENCE 6

PHYSICAL GEOLOGY..... 8

PHYSICS 9

HUMAN ANATOMY & PHYSIOLOGY 10

Physical Science - Designing technological/engineering solutions using science concepts:

Model Curriculum pg.	Area	<i>Visions into Practice Classroom</i> Designing technological/engineering solutions using science concepts <i>from Science Standards 2018</i>
219	PS.EW.2: Transfer and transformation of energy (including work)	<ul style="list-style-type: none"> Design and build a roller coaster with at least two loops and one hill. Use the roller coaster to calculate kinetic and potential energy and identify the quantity of energy transferred out of the system during the ride. Then engineer a new design that would decrease the energy loss from the system.
220	PS.EW.4: Thermal Energy	<ul style="list-style-type: none"> Use thermal conductivity concepts to improve a cooler design to keep beverages cold. Improve the design of the cooler to further reduce the transfer of thermal energy.
221	PS.EW.5 - Electricity	<ul style="list-style-type: none"> Design an alarm system that uses a change in a circuit to indicate that the alarm has been triggered, (e.g., a short circuit changing current flow through a branch, a branch of a circuit opening to cease current flow).
225	PS.FM.1: Motion	<ul style="list-style-type: none"> Speed detection device: Build a model of a device that could be used to determine the speed of a car travelling down the street.
226	PS.FM.1: Motion	<ul style="list-style-type: none"> Motion of two objects: Investigate how knowledge of the intersection point for two moving objects is used for controlling traffic patterns (e.g., air traffic control, trains).
228	PS.FM.3: Dynamics how forces affect motion)	<ul style="list-style-type: none"> Protective Packaging: Design and test methods that decrease the force on an object (e.g., egg, cell phone) so that it will survive being dropped from a given height. The focus should be on reducing the magnitude of the forces that the object will experience. Redesign/retest the methods based on initial testing.
231	PS.U.1: History of the universe	<ul style="list-style-type: none"> Create or improve a device to collect data from a portion of the universe, understanding that there are situations where we cannot directly observe or measure something in a straightforward way.

Biology - Designing technological/engineering solutions using science concepts:

Model Curriculum pg.	Area	Visions into Practice Classroom Designing technological/engineering solutions using science concepts <i>from Science Standards 2018</i>
239	B.H.5: Modern genetics Biology/Heredit	<ul style="list-style-type: none"> Using knowledge of genetic technology, create a proposal for the design of a product to solve a current world problem (e.g., golden rice, oil-eating bacteria, insulin-producing bacteria, pigs for producing human organs).
237	B.H.1: Cellular genetics Biology/Heredit	<ul style="list-style-type: none"> Discuss ways that human genetic information can be used (e.g., ancestry, health) and the ethical implications of using this information.
241	B.E.1: Mechanisms Genetic Drift Biology/Evolution	<ul style="list-style-type: none"> Consider an organic farming operation growing a heritage variety of sweet corn. The operation borders a large, industrial farm producing genetically modified corn. The organic farm's success is threatened by both gene flow from the corporate GMO (genetically modified organism) farm and genetic drift. Propose a solution to minimize the effect of these factors on the organic farm. Design a solution to lessen the impact of genetic drift (e.g., increasing genetic variation in populations of cheetahs or lowland gorillas housed in zoos around the world).
242	B.E.1: Mechanisms Biology/Evolution Modeling Hardy Weinberg	<ul style="list-style-type: none"> Critique a real-world solution to the arrival of an invasive species and how it changed native populations and/or the invasive population with respect to Hardy-Weinberg assumptions (e.g., Ohio examples: Japanese honeysuckle, zebra and quagga mussels, Emerald Ash Borers, purple loosestrife, white-nose syndrome in bats). Design an engineering or technical solution to keep out or remove an invasive species from a local habitat (e.g., invasive fish out of Lake Michigan, garlic mustard, Zebras mussels, invasive lampreys from Great Lakes tributaries). Construct a program to remove all descendants of invasive species in a habitat (e.g. rats on small Pacific island). Design an engineering/technical solution to help return native species following the intentional removal of all invasive species (e.g. rats on small Pacific islands). Design and construct a habitat that maintains the gene pool of a transplanted population at equilibrium
243	B.E.2: Speciation Natural selection Biology/Evolution	<ul style="list-style-type: none"> Design a medical protocol to discourage the persistence (spread) of antibiotic resistance through natural selection in populations of bacteria. Design an agricultural solution/procedure to discourage the persistence (spread) of herbicide resistance in crop plants or pesticide resistance in insects through natural selection
243	B.E.2: Speciation Biology/Evolution Variance within and between populations	<ul style="list-style-type: none"> Observe and measure traits within several groups of local species. Propose an engineering solution to block or allow interbreeding between neighboring populations (e.g., tassel-eared squirrels).
244	B.E.2: Speciation Biology/Evolution Evolutionary relatedness	<ul style="list-style-type: none"> Design a technological solution to determine identification in species where visual cues alone cannot determine the identity (e.g., bird species that can only be identified by their song or mating behaviors).
247	B.DI.1: Biodiversity Genetic Diversity Biology/ Diversity and Interdependence of Life	<ul style="list-style-type: none"> Investigate a species of extremely low abundance (e.g., Vaquita porpoise, Sumatran/Javan rhinos or native bees) and propose monitoring or management methods to increase the genetic diversity.

Model Curriculum pg.	Area	<i>Visions into Practice Classroom</i> Designing technological/engineering solutions using science concepts <i>from Science Standards 2018</i>
248	B.DI.1: Species diversity and Interdependence of Life	<ul style="list-style-type: none"> Design, evaluate, and refine a solution to reduce the impacts of human activities on the environment and biodiversity.
249	B.DI.2: Ecosystems Equilibrium and disequilibrium Diversity and Interdependence of Life	<ul style="list-style-type: none"> Devise a plan to address the ecological and economic impacts of an invasive species. The plan should address lessening the species' impacts.
250	B.DI.2: Ecosystems Population Studies Biology/ Diversity and Interdependence of Life	<ul style="list-style-type: none"> Design a tracking method to estimate population size and carrying capacity for an organism.
251	B.DI.3: Loss of diversity Climate Change Biology/ Diversity and Interdependence of Life	<ul style="list-style-type: none"> Plan a project utilizing real-time/authentic data (e.g., community planners, ODNR, interviews with local farmers) to explain strategies (e.g., pest control, water supply, crop rotations, stormwater management) used to adapt to changes in climate.
252	B.DI.3: Loss of diversity Anthropocene effects Biology/ Diversity and Interdependence of Life	<ul style="list-style-type: none"> Design, evaluate, or refine a solution for reducing the impacts of human activities (e.g., urbanization, building dams, introduction of invasive species, sinking ships to rebuild coral reefs, creating manmade lakes) on the environment and biodiversity.
252	B.DI.3: Loss of diversity Extinction Diversity and Interdependence of Life	<ul style="list-style-type: none"> Investigate a species of extremely low abundance (e.g., Vaquita porpoise, Sumatran/Javan rhinos) and propose monitoring or management methods to improve the genetic diversity. Research the possibility of bringing back extinct species. Examine species restoration methods and techniques. Explore the possibility of de-extinction of a species, its ecological impacts, moral implications and economic values.
253	B.DI.3: Loss of diversity Invasive Species Biology/ Diversity and Interdependence of Life	<ul style="list-style-type: none"> Research an invasive species in Ohio, analyze its ecological and economic impacts on biological and human communities. Identify factors that contribute to the species' success and propose solutions to reduce the ecological and economic impacts of the species.
256	B.C.1: Cell Structure and Function Homeostasis and Feedback Loop	<ul style="list-style-type: none"> Research the cause and effect of various homeostatic diseases (e.g., Type 2 diabetes, high blood pressure, gout) and develop solutions to achieve homeostatic balance for patients that suffer from this disease. Suggest an explanation for the increased incidence of diabetes worldwide.
256	B.C.2: Cellular Processes Fermentation	<ul style="list-style-type: none"> Refine a product such as yogurt so that it better addresses dietary concerns, restraints and restrictions (e.g. diabetics, infants, bodybuilders)
257	B.C.2: Cellular Processes Biosynthesis of macromolecules	<ul style="list-style-type: none"> Plan and design an investigation using algae, fungi or other microorganisms to biosynthesize a natural product that has commercial applications.
258	B.C.2: Cellular Processes Photosynthesis and respiration	<ul style="list-style-type: none"> Promote awareness of photosynthetic processes as a component of the Earth's CO₂ recycling system. Design a "green" environment (e.g., school, house, microenvironment) that demonstrates sustainable environmental practices, such as vegetated green roof systems to improve air quality. The design should encompass the efficient use of fuel resources and building materials to lower carbon footprint and reduce greenhouse gas emissions. Generate an argument and present data justifying how the design improves sustainability.

Chemistry - Designing technological/engineering solutions using science concepts:

Model Curriculum pg.	Area	<i>Visions into Practice Classroom</i> Designing technological/engineering solutions using science concepts <i>from Science Standards 2018</i>
262	C.P.M 1 Atomic structure Chemistry/Structure and Properties of Matter	<ul style="list-style-type: none"> Design a toy that is based on the idea of excited electrons.
264	C.P.M.2 Periodic Table Chemistry/Structure and Properties of Matter	<ul style="list-style-type: none"> Develop a proposal for the construction of an outdoor art installation in various environments/climates. Determine which metal(s) would have the optimal properties for your project
266	C.P.M.3 Chemical Bonding Chemistry/Structure and Properties of Matter Polar covalent bonds	<ul style="list-style-type: none"> Design a theoretical pharmaceutical with an appropriate shape to interact with a provided enzyme or receptor designed by the teacher. The designed molecule would need to contact the enzyme or receptor in three different loci. Propose a method to evaluate the ability of plastics to be recycled based on the understanding of the plastic's polarity.
272	C.P.M. 5 Quantifying matter Chemistry/Structure and Properties of Matter	<ul style="list-style-type: none"> Devise a method to indirectly determine the value of a measurement that common laboratory tools cannot provide (e.g. thickness of aluminum foil, number of sand particles, moles of chalk used to write name, drop from a pipet).
274	C.P.M. 6 Intermolecular forces of attraction Chemistry/Structure and Properties of Matter	<ul style="list-style-type: none"> Make a soap and evaluate its effectiveness on hard water. Compare the effectiveness of various soaps. Evaluate the composition of shampoo samples using properties (e.g., viscosity, pH) to determine their effectiveness.
277	C.I.M.1 Chemical Reactions Chemistry/Interactions of Matter	<ul style="list-style-type: none"> Evaluate oxidation and reduction reactions occurring in real-world settings (e.g., rusting, electroplating) that cause engineering/manufacturing challenges and propose a solution. Critique the effects of a catalyst on everyday chemical reactions. Redesign a process which is more cost effective and/or environmentally friendly. Design a better (e.g., less expensive, more environmentally friendly) safe hand warmer using ionic substances. Conduct an experiment to determine what type of roof materials would be appropriate in area with high acid rain. Evaluate and critique why lakes with limestone or calcium carbonate experience less adverse effects from acid rain than lakes with granite beds. Then invent a product or process to minimize these effects.
282	C.I.M.2 Gas Laws Chemistry/Interactions of Matter	<ul style="list-style-type: none"> Design a device that measures tire pressure under changing temperature conditions. Design a toy that is an application of a gas law.
284	C.I.M. 3 Stoichiometry Chemistry/Interactions of Matter	<ul style="list-style-type: none"> Evaluate the efficiency, cost, and environmental impacts of multiple possible chemical processes to determine which process would be best to use. Sustainability and green chemistry should be considered. Evaluate an environmental problem through the lens of limiting reagents (e.g., algae growths impacted by available phosphates and nitrates).

Environmental Science - Designing technological/engineering solutions using science concepts:

Model Curriculum pg.	Area	<i>Visions into Practice Classroom</i> Designing technological/engineering solutions using science concepts <i>from Science Standards 2018</i>
290	ENV.ES.1 Biosphere Environmental Science Earth Systems/Interconnected Spheres of Earth	<ul style="list-style-type: none"> Identify an instance of biomagnification and bioaccumulation within a specific ecosystem and propose possible solutions Evaluate and critique current trends in reclaiming former industrial sites. Taking economics, government regulations and current technology into consideration, design a new method to reclaim a former brownfield in the Great Lakes Region. Research an endangered species and develop a conservation plan for the species taking into account the interests of all stakeholders. List the advantages and disadvantages of conservation.
293	ENV.ES.4 Hydrosphere Environmental Science Earth Systems/ Interconnected Spheres of Earth	<ul style="list-style-type: none"> Construct a functioning shower using only four gallons of water and household materials, which would allow someone to wash the body and hair effectively and capture the gray water produced. The shower construction should be tested to assure it meets design criteria and that it will adequately allow for a person to wash. Investigate various methods to clean up an oil spill using a model to evaluate their effectiveness. At the completion of the clean-up process, each team will assess the effectiveness, including environmental impact of the clean-up process, and make suggestions for improvement. Design methods to transport potable water to arid areas. Consider availability of materials, cost, and efficiency.
294	ENV.ES.5 Movement of matter and energy through the hydrosphere, lithosphere, atmosphere and biosphere Environmental Science Earth Systems/Interconnected Spheres of the Earth	<ul style="list-style-type: none"> Use quantifiable data and evidence to investigate the relationship between deforestation and changing weather or, in some cases, climate at a specific location (e.g., the Amazon region in South America). Analyze the data and draw a conclusion based upon the analysis.
297	ENV.ER.1 Energy Resources Environmental Science Earth's Resources	<ul style="list-style-type: none"> Using existing energy technologies (e.g., tidal power plants, solar panels, scrubbers) as an example, generate an alternative way to collect energy or improve an existing energy technology. Test your design.
297	ENV.ER.2 Air and Air Pollution Environmental Science Earth's Resources	<ul style="list-style-type: none"> Design a "city makeover" for a city near you. Your new city must promote clean air practices. Consider mass transit, industry, infrastructure, homes, education and technology.
298	ENV.ER. 3 Water and Water Pollution Environmental Science Earth's Resources	<ul style="list-style-type: none"> Design and build a water filter with commonly available materials for either wastewater or drinking water, taking into account cost and efficiency. Test the water filter, analyze the data collected and brainstorm ideas on how to improve the design.
299	ENV.ER.4 Soil and Land Environmental Science Earth's Resources	<ul style="list-style-type: none"> Create a plan to revitalize a brownfield site in one of the Great Lake States. Be sure to include an explanation of how it became a brownfield.
299	ENV.ER.5 Wildlife and Wilderness Environmental Science Earth's Resources	<ul style="list-style-type: none"> Design a plan to preserve/conservate a wilderness or waterway in Ohio. Be specific and defend your rationale with data. Include biological and ecological relationships within the system.

Model Curriculum pg.	Area	Visions into Practice Classroom Designing technological/engineering solutions using science concepts <i>from Science Standards 2018</i>
301	ENV.GP.2 Potable Water Quality, Use and Availability Environmental Science Global Environmental Problems and Issues	<ul style="list-style-type: none"> ▪ Design a water treatment system or process that can be implemented at a low cost and without the need for electricity to be used in areas that do not have access to potable water. ▪ Design and build an irrigation system that will move water at a specific rate.
303	ENV.GP.4 Sustainability Environmental Science Global Environmental Problems and Issues	<ul style="list-style-type: none"> ▪ Research and design a sustainable lifestyle in regard to energy efficient living space and mindfully used resources, alternative transportation, dietary sources and outdoor space.
305	ENV.GP.6 Air Quality Environmental Science Global Environmental Problems and Issues	<ul style="list-style-type: none"> ▪ Design and construct a scrubber for cleaning the sulfur emissions from burning coal. Assess how well the scrubber works by collecting calcium sulfate or sulfite to compare against a control.
305	ENV.GP.7 Food Production and Availability Environmental Science Global Environmental Problems and Issues	<ul style="list-style-type: none"> ▪ Identify the locations of food deserts in your community or surrounding areas. Write a proposal to the local government to provide that community with better food resources.
307	ENV.GP.9 Waste Management (solid and hazardous) Environmental Science Global Environmental Problems and Issues	<ul style="list-style-type: none"> ▪ Research composting techniques. Analyze the wastes produced by the school and design an appropriate composting system to process the biodegradable waste produced. ▪ Construct and maintain a composting site on school grounds.

Physical Geology - Designing technological/engineering solutions using science concepts:

Model Curriculum pg.	Area	<i>Visions into Practice Classroom</i> Designing technological/engineering solutions using science concepts <i>from Science Standards 2018</i>
312	PG.M.4 Criteria of a Mineral Physical Geology Minerals	<ul style="list-style-type: none"> Design a method to use GIS to target mineral exploration or evaluate mining conditions and extraction methods. Then, construct a model of a site which has minimal environmental impact.
316	PG.IMS. 4 Oceans Physical Geology Igneous, Metamorphic, and Sedimentary Rocks	<ul style="list-style-type: none"> Design and engineer a method to use ocean waves, tides, or currents to produce energy.
320	PG.PT. 1 Internal Earth Physical Geology	<ul style="list-style-type: none"> Design model buildings to withstand earthquakes. Use shake tables to test the models. Refine designs based on the test results. Compare designs within the class to evaluate to most effective design techniques.
324	PG.ER.1 Energy Resources Physical Geology Earth's Resources	<ul style="list-style-type: none"> Design and build (virtual, blueprint or 3-D model) an Eco-House that uses green technology and allows the house to be off-grid. Select a specific location and evaluate the different options that would be efficient and effective for the area.
324	PG.ER.2 Air Physical Geology Earth's Resources	<ul style="list-style-type: none"> Design a technology to remove either particulate or chemical pollutants from air.
325	PG.ER.4 Water Physical Geology Earth's Resources	<ul style="list-style-type: none"> Investigate different methods (e.g., aeration, filtration) for removing pollutants from water. Design, build, and test water filters.
325	PG.ER. 4 Soil and Sediment Physical Geology Earth's Resources	<ul style="list-style-type: none"> Build a model construction site and use it to develop techniques to manage storm water runoff and construction mud.

Physics - Designing technological/engineering solutions using science concepts

Model Curriculum pg.	Area	<i>Visions into Practice Classroom</i> Designing technological/engineering solutions using science concepts <i>from Science Standards 2018</i>
340	P.F.3 Elastic Forces Physics Forces, Momentum, and Motion	<ul style="list-style-type: none"> Construct a bungee jump apparatus to safely drop a fragile object (e.g., flour bag) to within a specified distance of the ground from an appropriate height, using calculations alone to determine length and strength of bungee cord required. After construction, test bungees to compare elastic force and gravitational force on the object and use data to critique and modify designs.
343	P.F.7 Momentum, Impulse and conservation of Momentum Physics Forces, Momentum, and Motion	<ul style="list-style-type: none"> Design a system to safely stop a vehicle. Construct a working model that allows a raw egg mounted on the front of a vehicle to remain whole when the vehicle stops before impacting a wall. Test components and systems to collect and analyze data. Use data to refine designs and retest. Use a design portfolio to keep track of trials and revisions to the design throughout the process. Discuss advantages and disadvantages of various braking systems. Research a stretch of road where there are many accidents. Evaluate potential causes related to laws of motion and propose a design change to the road to reduce the number of accidents
345	P.E.1 Gravitational Potential Energy Physics Energy	<ul style="list-style-type: none"> Design a gravity-fed water system, connecting concepts of rise/fall to gravitational potential energy. Evaluate the system's real-world function compared to predicted performance, considering factors affecting performance (e.g., effects of pipe diameter) Use the data to critique designs and propose changes for reconstruction.
347	P.E.4 Conservation of Energy Physics Energy	<ul style="list-style-type: none"> Investigate a system that transforms mechanical energy to determine the average force of friction on the system and refine the system to improve its efficiency of the system before and after student refinements.
348	P.E.5 Nuclear Energy/ Energy Transformation System Physics Energy	<ul style="list-style-type: none"> Design a system to complete a task such as raising a mass a certain distance or compressing a spring or a spring-loaded lever. Use the smallest amount of initial energy to complete the task. Test and refine the design to minimize energy transferred out of the system.
348	P.E.5 Nuclear Energy/ Nuclear Power Plant Physics Energy	<ul style="list-style-type: none"> Research consequences of using nuclear energy as a source of electrical energy production in a particular area. Choose to support or oppose the construction of a nuclear power plant in that area. Identify design changes that could be incorporated to a nuclear power plant that would make it more suitable for use in the area.
350	P.W.1 Wave Properties Physics Waves	<ul style="list-style-type: none"> Design a parabolic cooker using principles of ray reflection to design the apparatus. After construction and testing, evaluate the success of the design and examine where performance departs from plan.
351	P.W.2 Light Phenomena Physics Waves Laser maze	<ul style="list-style-type: none"> Design a laser maze. Present mazes and challenge students to solve them.
355	P.EM.2 Charging Objects Electricity and Magnetism	<ul style="list-style-type: none"> Investigate alternative solutions to reduce static electricity in clothing tossed in a dryer.
357	P.EM.6 Electromagnetic Interactions Physics Electricity and Magnetism	<ul style="list-style-type: none"> Design and build a generator that will convert mechanical energy into electrical energy and light three flashlight bulbs. Draw a labeled design plan and write a paper explaining in detail, and in terms of electromagnetic induction, how the details of the design allow the generator to work. Test the generator in an electric circuit. If it cannot supply the electrical energy to light three flashlight bulbs in a series, redesign the generator. Design an electromagnetic motor with a limitation on the amount of materials used in construction. Test the design and redesign the motor based on the findings from the testing process.

Human Anatomy & Physiology - Designing technological/engineering solutions using science concepts:

Model Curriculum pg.	Area	<i>Visions into Practice Classroom</i> Designing technological/engineering solutions using science concepts <i>from Science Standards 2018</i>
361	AP.LO: LEVELS OF ORGANIZATION AP.LO.2: Types of Tissues	<ul style="list-style-type: none"> Simulate tissue engineering using a variety of materials (e.g., gelatin, agar, yeast). Critique the characteristics of each tissue simulation to rate its possible use in tissue grafting.
361	AP.LO: LEVELS OF ORGANIZATION AP.LO.3: Homeostasis	<ul style="list-style-type: none"> Design or critique a device used to maintain or monitor homeostasis for a human body process (e.g., heart rate, glucose, oxygen level).
365	AP.SM: SUPPORT AND MOTION AP.SM.1: Integumentary system Skin cancer-UV connection	<ul style="list-style-type: none"> Design a sunscreen that does not kill aquatic wildlife (e.g. corals).
365	AP.SM: SUPPORT AND MOTION AP.SM.2: Skeletal system Structure	<ul style="list-style-type: none"> Design and create a model of a prosthetic limb that can perform a task (e.g., lift or carry an object). Design a bone model with cardstock and tape to meet specific parameters (e.g., strength). Test how well the model meets the parameters.
366	AP.SM.2: Skeletal system Bones AP.SM: SUPPORT AND MOTION	<ul style="list-style-type: none"> Design a better cast for fractures, identifying the materials, type of fixation, etc.
366	AP.SM.3: Muscular system Muscles AP.SM: SUPPORT AND MOTION	<ul style="list-style-type: none"> Design and construct an artificial hand from common household items where the fingers flex and extend to perform a task.
371	AP.IC: INTEGRATION AND COORDINATION AP.IC.1: Nervous system Brain structure/function	<ul style="list-style-type: none"> High school athletes are reported to be more susceptible to brain damage than their peers. Use scientific evidence to support or refute this claim. If this claim is accurate, suggest a possible way to reduce Chronic Traumatic Encephalopathy (CTE) injuries in high school athletes. Use correlations of symptoms caused by brain injuries to critique personal protective equipment (e.g., bicycle helmet, hard hats) and suggest modifications to improve their design.
372	AP.IC.1: Nervous system Processes AP.IC: INTEGRATION AND COORDINATION	<ul style="list-style-type: none"> Design a prototype of a new medical device for an amputee, including the transfer of electrical impulses to neurons
372	AP.IC.2: Special senses Sight AP.IC: INTEGRATION AND COORDINATION	<ul style="list-style-type: none"> Choose a disease causing a homeostatic imbalance to vision. Use a picture as a control and modify the picture to show how the picture would be seen by an individual with the chosen visual disease. Design a possible medical device that could alleviate the symptom
373	AP.IC.2: Special senses Hearing/balance AP.IC: INTEGRATION AND COORDINATION	<ul style="list-style-type: none"> Choose a disease causing a homeostatic imbalance to the sense of hearing. Modify a sound file to illustrate the effects of the damage and suggest possible medical devices that could alleviate the symptoms. Design a device to direct whales from areas of danger (e.g. the site of a major underwater oil well failure). Use the mechanism by which bats capture prey in darkness to design an assistive technology for visual impairment.
374	AP.IC.3: Endocrine system Processes AP.IC: INTEGRATION AND COORDINATION	<ul style="list-style-type: none"> Critique the medical devices used by diabetics to monitor and treat blood sugar and propose solutions to address any identified flaws.

Model Curriculum pg.	Area	<i>Visions into Practice Classroom</i> Designing technological/engineering solutions using science concepts <i>from Science Standards 2018</i>
374	AP.IC: INTEGRATION AND AP.IC.3: Endocrine system Environmental Impacts COORDINATION	<ul style="list-style-type: none"> Propose one or more technological or engineering solution(s) to control broad-leaved “weeds” without using potential environmental endocrine disruptors.
377	AP.T.1: Blood Blood typing AP.T: TRANSPORT	<ul style="list-style-type: none"> Critique available artificial blood products. Design artificial blood products.
378	AP.T.2: Cardiovascular system Gross anatomy AP.T: TRANSPORT	<ul style="list-style-type: none"> Critique available artificial heart and valve products.
379	AP.T.2: Cardiovascular system Cardiac output and imbalances AP.T: TRANSPORT	<ul style="list-style-type: none"> Analyze data to explain why long-term exposure to microgravity can be dangerous to the cardiovascular system. Propose countermeasures to minimize effects of microgravity. Design a device to clear an occluded artery.
383	AP.AE: ABSORPTION AND EXCRETION AP.AE.1: Digestive system	Propose a redesign of an alimentary canal segment and/or accessory digestive organ. Propose a procedure as a potential cure for cirrhosis or ulcers using tissue engineering techniques.
384	AP.AE.2: Respiratory system Respiratory health and the environment AP.AE: ABSORPTION AND EXCRETION	<ul style="list-style-type: none"> Design an action plan to improve the air quality in an area with low air quality (e.g., construction dust in a building). Determine the design specifications of a face mask to filter fine particulate matter (PM 2.5 particles) resulting from the combustion of fossil fuels.
384	AP.AE.2: Respiratory system Exercise and respiration AP.AE: ABSORPTION AND EXCRETION	<ul style="list-style-type: none"> Design a device to improve the respiratory function in athletes.

Believe in Ohio *a sample* Science Unit plan

Believe in Ohio allows teachers as much flexibility as is needed to implement the Believe in Ohio program into the existing requirements of your curriculum.

Believe in Ohio has created a multitude of online resources to guide your students through this process, both video and written. Your advocate can help you determine what might best fit your situation.

Developing a Product or Service Using Cutting Edge Technology and Research

This lesson plan has been adapted from an experience science teacher who has used Believe in Ohio many times with science students with great success. It is one approach which outlines time allotted, resources available, assignments and objectives and written guidance developed to help students successfully write their papers.

FYI: Newly developed resources have been listed in addition to those the teacher has previously used.

Lesson Objectives: *(Common Core included)*

1. To explore the role of science and technology to meet ever evolving consumer needs and wants
2. To develop research skills *RST.11-12.2 RST.11-12.7*
3. To explore cutting edge technology and research *RST.11-12.7*
4. To analyze future consumer trends in order to understand future workforce needs *RST.11-12.10*
5. To read, write and communicate effectively in science *RST.11-12.2 RST.11-12.9 WHST.11-12.1-9*

Time allotment:

- 4 - 50 min classes Mileposts 0-6
- (2 consecutive days to introduce followed by independent student work. Then allow 2 additional days for in class work with teacher oversight available.)
- 6 - 50 min classes researching and to develop the **scientific proof of concept ELA teacher help
- 5 - 50 min classes during 3rd Quarter - leading up to the day of competition (see teacher tips)

Materials, Resources and Links:

- Video - Are You Ready for the Future? (5:43) *find in google classroom*
- Video 1-Why students are asked to do a STEM Plan (2:39) John Klipfell, Believe in Ohio Co-Director *find in google classroom*
- Video 2 - What, specifically, students are asked to do to develop their STEM Plan 4:59 John Klipfell, Believe in Ohio Co-Director *find in google classroom*
- 10 Consumer Trends That Will Spark Innovation in 2020
<https://www.forbes.com/sites/saradeshpande/2020/01/16/10-consumer-trends-that-will-spark-innovation-in-2020/#272f82dd1011>
- Student resources for rubrics, instructions for writing, plan templates

Additional curriculum materials not integrated into this lesson plan--find in google classroom

- Dan Hess, Entrepreneurship teacher, Roadmap videos for students with student guides:
Find in the google classroom under the Mileposts 13 videos
 - Milepost 0 - *The Challenge of the Future*
 - Milepost 0 - *Introduction to Entrepreneurship*
 - Milepost 0 - *Think, Innovate, Change*
 - Milepost 1 - *Finding Problems, Seeing Opportunity*
 - Milepost 2 - *Proposing Solutions*
 - Milepost 3 - *Using Technology to Execute a Solution*
 - Milepost 4 - *Who Can Benefit from Your Solution?*
 - Milepost 5 - *Who Are Your Competitors?*

- Milepost 6 – *What Value do You Bring to the Market?*
- Milepost 7 – *Will Your Idea Generate Revenue?*
- Milepost 8 – *What Will It Take to Get Started?, What Are the Operating Costs?, Does It Get the Green Light?*
- John Klipfell videos for Mileposts 4-8 and Mileposts 9-12 Commercialization plan *find in google classroom under Mileposts*
- Emerging Technologies - PDF -*find in google classroom: Teacher Curriculum Resources*
- STEM Innovation & Entrepreneurship at Ohio colleges and Universities PDF past forum speakers--
find in google classroom: Teacher Curriculum Resources
- Believe in Ohio Roadmap: <https://mk0believeinohio121qn.kinstacdn.com/wp-content/uploads/2019/10/Roadmap-milepost-1-8-worksheet.pdf>
- Design-Thinking Ideation a 4-part workshop -great for Mileposts 1-3 *find in google classroom:*

Procedures:

Class 1-Intro to Believe in Ohio challenge-Milepost 0

1. Explain to class that you will be giving them a great challenge that will help them place their science content in terms of their role in the future workforce and businesses in Ohio.
 - a. They will be asked to develop a product or service that meets a consumer demand and uses cutting edge science and technology. Further explaining this will be a huge challenge for them, you will be with them through the process and at the end, some of them will receive a cash award and go on to compete regionally and perhaps at the state level.”
 - b. *Note to students:* At the regional level, they can win \$1000 in scholarships, and at the state level, they can win even more, perhaps \$5000 or even \$20000.
2. Before watching the *Are you Ready for the Future*, alert them that they will be writing and sharing comments or questions about this 6-minute video.
 - a. After watching students write a comment or a question about the film.
 - b. Have students share with their partner what they wrote and discuss for a few minutes.
 - c. Students summarize their thoughts on a sticky note, or electronic equivalent.
 - d. After posting the stickies, allow time for discussion.
3. Explain the next video is about businesses in their region of Ohio
 - a) Students will write a question or comment, share with partner and post on a sticky note or electronic equivalent.
 - b) Discuss as a class the comments or questions that students have posted. If there is a question, tell them you will look into it and let them know the next class.
STEM Innovation & Entrepreneurship at Ohio colleges and Universities PDF past forum speakers
Believe in Ohio Southwest Ohio: <https://www.youtube.com/watch?v=6u6WvfaVas0>
4. Provide the following website article or PDF for independent student work. Students make a list of as many new ideas as they can think in the remainder of class time. *This may be considered out of class work that is due the next day.*
 - 10 Consumer Trends That Will Spark Innovation in 2020
<https://www.forbes.com/sites/saradeshpande/2020/01/16/10-consumer-trends-that-will-spark-innovation-in-2020/#272f82dd1011>
 - Emerging Technologies - PDF

Class 2 -Milepost 1-5

1. Show Believe in Ohio Video 1 and 2 to help them understand what they are being asked to do and why.
2. Explain to students that you are going to read some ideas generated by their classmates – (specific ideas belong to the individual who posted them).
3. Tell them that they will need to begin to research their ideas and decide which idea they will pursue. These ideas are “pain points” and can lead to innovation and entrepreneurship ideas.
4. When they choose an idea, if there is one, they are not using, please move their sticky note to a poster or wall space labeled: Discarded ideas that others may use.
5. *Highly suggested: Design thinking Activities with Dr. Heather Braun (3-4 class periods extra)*

**Explanation of specifics of the STEM plans for Believe in Ohio competition:
provide copies of Roadmap or a link.**

Note: This teacher has students working independently on the STEM Commercialization Plan with teacher guidance and checkpoints along the path.

6. Walk students through the requirements sharing the roadmap guidelines. The rough draft of their plan must include: Problem, (pain point), solution, STEM concepts, target customers and users, competitors, customer value and competitive advantage. See videos to help students conceptualize what is expected for each of these mileposts.

Optional and highly recommended: Milepost videos by Dan Hess, entrepreneurship teacher. These videos can be used in class or assigned for homework or in a blended learning style.

- a. Provide a due date for the rough draft of their report, with the emphasis being their scientific proof of concept, works cited page, plus their initial annotated research.
- b. Provide a “heads-up” to the presentation to the judges, including their board, their 3-minute elevator pitch and their notebook if a prototype was built or something tested. – due the day of the competition.

Believe in Ohio Roadmap: <https://mk0believeinohio121qn.kinstacdn.com/wp-content/uploads/2019/10/Roadmap-milepost-1-8-worksheet.pdf>

Provide the following printouts:

- Believe in Ohio Class Timeline attached for personal update
- How to put solid scientific evidence into your plan included in this plan
- Format of the Paper *find in Curriculum Resources in google classroom*
- Templates for student plan writing *find in Curriculum Resources in google classroom*

Teacher Tips:

General flow of project:

- Emphasize that the goal of the first assignment is to complete the first page of the report and find solid evidence for the product or service and learn to summarize, quote and annotate that evidence so that it is readily available when it comes time to write the paper.
- Provide small portions of time throughout the process for them to work on this. Whenever this time is due, have some way of assessing how effectively students spend their time.
- Have students submit work on Google classroom so that you can track their progress.
- A day or two before the first work is due, give them time in class to work and meet with each student to provide feedback.

- A week before the competition, give students 2 days to construct temporary project board. On the 3rd day, students present their 3-minute elevator pitch and project board to the class and get 2 minutes of questions and comments. Students do not answer back but make note. This will enable students to get the maximum feedback with the minimum pain. Students that want to excel will adjust due to this feedback.
- The next day students can adjust their boards and elevator pitches. During the first ten minutes, go over what to expect for the next day's competition. The grading is also provided on this sheet. It is a very merciful rubric. Students will appreciate that.
- Tell them how proud you are of how far they have come. They have learned a tremendous amount. Really take a deep breath and appreciate the great job you have done as a teacher and how far you have brought your students.
- The day of the competition, you will need someone to cover your classes because you will be managing the judges, your students and the hospitality. Ask your principal in advance for coverage. Ask another teacher if they will supervise your students. At the end of the day announce the winners.
- The day after the celebration, use at least half a class to discuss what happened and how the students felt. They will be very excited and will have lots of stories. Be sure to tell them again – all of them – how proud you are of their work.

Timeline 2020-2021

Believe in Ohio is a new program sponsored by the Ohio Academy of Science and Entrepreneur Engagement Ohio. The Ohio General Assembly and The Ohio Board of Regents designed to help prepare Ohio high school students for the future workforce by 1) introducing them to the “Innovation Economy of the Future,” 2) inspiring them to pursue a STEM education and 3) encouraging them to be one of the innovators and entrepreneurs Ohio needs to develop new products, services, and jobs of the future.

Milepost	QUESTION /TASK	Weeks	DUE DATE
1	Problem statement/pain point/market opportunity	6 weeks	
2	What is your proposed solution?		
3	What STEM concepts underlie your proposed solution?		
4	Who are your target customers and intended users?		
5	Who are your competitors?		09-30-20
6	Write the first page of your report: What are the problems?What is your solution? What is your customer value proposition & competitive advantage?	2 weeks	
	Write three annotated paragraphs from three sources ofhard-core research you have found on your product or service idea. Provide works cited page.		10-16-20
9	Summarize the STEM concepts & principles underlyingyour solution. (500 words or fewer-based on Step 3). ***	8 weeks ***very important and closely monitored	
10	Summarize in writing your commercialization assessmentof your plan. (Based on steps 1-8). (English corroboration.)		
11B	Write a Scientific proof of concept.		
12	Prepare a front page and an executive summary of yourentire plan. (250 words or fewer).		(prior to Winter break) 12-18-20
	Prepare a presentation board and elevator pitch for product	Usually done 5 days in one week: includes the HS competition day	1-8-21
	Present to class		1-11-21
	Present to judges		1-13-21

This timeline is provided to the student with the dates that fit the school year and the teacher’s agenda.

How to Put Solid Evidence into Your Paper

How to put solid evidence into your paper:

1. Find a good piece of information that helps explain the science of your product or business. Be sure that the backbone of your paper is primary source, university or government research.... not a magazine's summary of that research.) Go first to Google scholar.
 2. Identify the important line. Either identify a quote you want to use or paraphrase what you want to use.
 3. Use citation machine to cite source. Put it in your works cited.
 4. Put the quote or paraphrase in your paper:
 - Start your paragraph with a general statement about why the quote or paraphrase is important.
 - Put the quote or paraphrase in. Use quotation marks for the entire part that is quoted.
 - Place the first part of your citation in parentheses to properly cite your use of this published information. Usually it is the author's name or title of the article or paper.
 - Finish by commenting on why the information is important and relates to your product.
- ✓ Almost everything in your science and technology proof of concept should be cited.
 - ✓ Every citation that is in your paper should be in your works cited.
 - ✓ Everything in your works cited should be cited in your paper.
 - ✓ In other words, there should be a one to one correspondence between your paper and your works cited in terms of sources.

Key Questions to Research

	Were all or some of these questions addressed by sources	Article is highlighted and addresses this. (8 pts)	Source properly cited in references (8pts)
1. What is the problem?	<p>What are the statistics on this problem? What other problems and expenses does this problem cause? What are the statistics on this problem? What other problems and expenses does this problem cause? # of people with this problem worldwide (or at least in the US</p>		
2. What is the market opportunity?	<p>Who will buy this? How can it be sold? What is currently sold and how much does it cost? What will this new product cost? Is there a similar device and can you compare its costs with this one?</p>		
3. What is your proposed solution?	<p>What will its dimensions be? What will it be made of? How will the parts fit together? Can you draw or build a model of this device? How will it be manufactured? Will the materials used be biodegradable or compostable or not either of these?</p>		
4. What STEM concepts underlie your product?	<p>Examples: Biotechnology, nanotechnology, technology, genomics, APPs, Fungi + algae new uses.</p> <p>Can you explain this technology and how does it apply to your new product? What new studies have been done that pertain to some aspect of your idea?</p>		
5. Who are your competitors?	<p>Specifically, who makes the product that your product will replace? How much do they sell a year and at what profit? Who are your secondary competitors?</p>		
6. What testing will need to be done to see if this works?	<p>How is this conducted?</p> <p>Will it need FDA approval? EPA approval, etc? How is that process done? Cost? Timing?</p>		

IMPLEMENTATION GUIDE FOR BELIEVE IN OHIO STEM BUSINESS PLANS

Believe in Ohio provides a wide array of resources for teachers to use in their classrooms to guide students in creating quality STEM Plans. Use as many, or as few, as you choose in your lesson plans.

This Implementation Guide is designed to give teachers suggestions about which resources to use as starting points to guide students in this process. We also suggest assignments that will allow students to begin the research and writing process for each Milepost.

Each Part can be completed in 1–3 weeks depending on the amount of class time a teacher can devote to the process. The entire STEM Plan can be completed in 4–12 weeks using this schedule. The key is flexibility! Some teachers spread the assignment out within a semester, some throughout the school year, and others devote 3–4 weeks exclusively to developing Believe in Ohio STEM Plans.

This Implementation Guide is divided into 4 Parts:

Part 1: Introduction to Believe in Ohio and the Entrepreneurial Mindset Mileposts 0–3

Part 2: Assessing the Commercial Feasibility of the Idea Mileposts 4–8

Part 3: Developing and Writing the STEM Plan Mileposts 9–12

Part 4: Reviewing, Reassessing, and Finalizing the STEM Plan

Included in each of the 4 Parts are additional resources teachers may include if they have extra time to devote to Believe in Ohio. Using these resources may increase the quality of the Plans making them more competitive for Local, Regional, and State Awards. These and other in-depth exploration resources can be found at the end of this guide.

Additional Resources for Creating Exceptional STEM Plans:

Option 1: Dan Hess Additional Milepost STEM/Entrepreneurship Video Series

Option 2: Design Thinking/Ideation Mini-Course

Option 3: Emerging Technologies Deep-Dive

Option 4: Exploring Patents

Blue Boxes contain minimum resources to introduce students to each of the 4 Parts.

Red Boxes are Homework or Class Assignments designed to extend student research and begin the writing process for the STEM Plan at each Milepost.

Gray Boxes contain additional highly recommended resources or activities for teachers who have more time available or need to provide more explanation to their students about entrepreneurship.

PART 1:

INTRODUCTION TO BELIEVE IN OHIO & THE ENTREPRENEURIAL MINDSET MILEPOSTS 0 - 3

Assign in Google Classroom or use links

INTRODUCTION TO BELIEVE IN OHIO

1. The What and Why of Believe in Ohio

- ◆ Show students [“Are You Ready”](#) video (5:43) and/or [Milepost 0 Video 1 The Challenge of the Future](#) (10:00)
- ◆ Share Believe in Ohio STEM Commercialization & STEM Business Plan process and project incentives and expectations.
- ◆ Provide [STEM Business Plan Judging Card](#) & discuss judging rubric
- ◆ Show students Key Videos for Students
 - ◆ [Video 1: Why Students are Asked to do a STEM Plan](#) (2:39)
 - ◆ [Video 2: What, Specifically, Students are Asked to do to Develop Their STEM Plan](#) (4:59)

MILEPOST 0

2. Knowledge of STEM + Entrepreneurial Mindset = INNOVATION!

- ◆ Show [Milepost 0 Video 2: Intro to Entrepreneurship](#) (7:00)
- ◆ Show [Milepost 0 Video 3: Think, Innovate, Change](#) (8:00)

Homework or Class Research Assignment: Students select 1 or more emerging technologies that interest them from [Technologies Changing the World](#) and React/Respond

Homework or Class Option: Show 1 or more Entrepreneurship Videos: Select from *Videos that explain Entrepreneurship & the American Free Market System* in the Google Classroom to introduce students to the Importance of Entrepreneurship in creating jobs, (4:33 – 12:44) e.g. [Kaufman Foundation Video Sketchbook Series #1](#) (12:44) and/or [Kaufman Foundation Video Sketchbook Series #2](#) (7:42)

PART 1:

INTRODUCTION TO BELIEVE IN OHIO & THE ENTREPRENEURIAL MINDSET MILEPOSTS 0 - 3

(continued)

3. Independent Exploration/Research of Students' Problems and Pain Points

Homework or Class Research Assignment:

- ◆ Students read [Student Step by Step Instructions for Determining the Commercial Feasibility of Your Plan & Developing the Plan Itself](#) use throughout all Mileposts.
- ◆ Students watch additional videos from [Videos to Inspire Students to Think About Their Futures](#) (5:08 – 17:40)

MILEPOSTS 1–3

Continue Independent Exploration/Research of Students' Problems and Pain Points

- ◆ Show [Key Video 3: Working Through Mileposts 1-3](#) (2:39)
- ◆ Introduce the Believe in Ohio Roadmap Worksheet. Using [BiO Roadmap Worksheet](#) and [BiO Navigation Instruction Mileposts 1-8](#) students brainstorm their ideas at each Milepost.
- ◆ Conduct additional on-line and personal research to further develop Mileposts 1–3. Students select 1 or more additional emerging technologies that interest them from [Technologies Changing the World](#)

Note: Students can use the Worksheet to jot down their ideas for each Milepost. Use post it notes if working in-person or share the Worksheet to a Padlet or other on-line collaborative software for students to interactively add their ideas to the Worksheet in a collaborative shared space.

Homework Research Assignment: Ask parents, family, friends, classmates, teachers, or coaches about problems or market opportunities they have encountered. Create a list of these ideas to consider for Milepost 1.

Homework or Class Writing Assignment: Describe and briefly summarize Mileposts 1-3. Consider a deadline for students to briefly summarize their pain point and come up with an idea!

Homework or Class Option: Recommended Videos if time allows:

- ◆ Show [Milepost 1 Video 4: Finding Problems, Seeing Opportunity](#) (9:00)
- ◆ Show [Milepost 2 Video 5: Proposing Solutions](#) (9:00)
- ◆ Show [Milepost 3 Video 6: Using Technology to Execute a Solution](#) (11:00)

PART 2:

ASSESSING THE COMMERCIAL FEASIBILITY OF THE IDEA MILEPOSTS 4—8

Assign in Google Classroom or use links

MILEPOSTS 4—6

- ◆ Show [Key Video 4: Working Through Mileposts 4-8](#) (11:38)
- ◆ Students continue brainstorming and developing their ideas at Milepost 4 –6 using [BiO Roadmap Worksheet](#) and [BiO Navigation Instruction Mileposts 1-8](#)
- ◆ Conduct additional on-line & personal research to further develop Mileposts 4–6.
- ◆ Using [BiO Roadmap Worksheet](#) and [BiO Navigation Instruction Mileposts 1-8](#) students brainstorm their ideas at each Milepost.

Homework or Class Writing Assignment: Discuss your ideas with parents, friends, classmates, coaches, and teachers. Make any changes you find appropriate and summarize Mileposts 4-6. Consider a deadline for students to briefly summarize their customers and competitors.

Homework or Class Assignment:

Recommended Videos & Response Sheets (Google Classroom only):

- ◆ Milepost 4 Video 7: [Who Can Benefit From Your Solution?](#) (8:00)
- ◆ Milepost 5 Video 8: [Who Are Your Competitors?](#) (7:00)
- ◆ Milepost 6 Video 9: [What Value Do You Bring to the Market?](#) (7:00)

PART 2:

ASSESSING THE COMMERCIAL FEASIBILITY OF THE IDEA MILEPOSTS 4—8

(continued)

MILEPOSTS 7—8

- ◆ Students continue brainstorming and developing their ideas at Milepost 7 –8 using [BiO Roadmap Worksheet](#) and [BiO Navigation Instruction Mileposts 1-8](#)
- ◆ Conduct additional on-line and personal research to further develop Mileposts 7 –8.

Homework Research Assignment: Ask parents, family, friends, classmates, teachers, coaches, or local business owners about some of the revenue streams and costs they are aware of that students should consider while developing their Plan. Include some of these ideas in Milepost 7-8 if relevant.

Homework or Class Writing Assignment: Summarize the revenue possibilities and key costs relative to their idea for Mileposts 7-8.

Homework or Class Assignment:

Recommended Videos & Response Sheets (Google Classroom only):

- ◆ Milepost 7 Video 10: [Will Your Idea Generate Revenue?](#) (9:00)
- ◆ Milepost 8 Video 11: [What Will It Cost to Get Started?](#) (7:00)
- ◆ Milepost 8 Video 12: [What Are the Operating Costs?](#) (7:00)
- ◆ Traffic Light – [Does Your Idea Get a Green Light?](#) (7:00)

PART 3:

DEVELOPING AND WRITING THE STEM PLAN MILEPOSTS 9—12

Assign in Google Classroom or use links

MILEPOSTS 9—12

- ◆ Show [Key Video Working Through Milepost 9 -12 \(STEM Business\)](#) (5:00)
- ◆ Assign [How to Navigate the Believe in Ohio STEM Plan Instructional Roadmap – Mileposts 9-12](#) instructions for students to begin expanding, developing, then writing their Plans. **Use Milepost 11B!**
- ◆ Assign [Suggestions for Students Developing a STEM Business Plan & Financial Projection](#)
- ◆ Assign [Potential Revenue Models to Consider When Developing STEM Business Plan](#)
- ◆ Assign [Instructions for the 3 Year Financial Worksheet](#)
- ◆ [STEM Business Plan - Preparing a Three-Year Financial Projection \(Downloadable Excel Spreadsheet\)](#)

The purpose of this section is to provide an assessment of the business and financial feasibility of your proposed business venture, which effectively provides a proof of concept for your idea. **This part should be the core of the STEM Business Plan.** It will likely need to be several pages. Your discussion should include:

- ◆ Your proposed marketing, sales and pricing strategies to bring your new product, service or concept idea to market.
 - ◆ How you will operationally develop and make your product, service or other concept idea into a tangible commercial venture.
 - ◆ The most significant risks and uncertainties you expect to face in bringing your new product, service or other concept idea to market.
 - ◆ A discussion about the amount and type of investment you believe will be required to bring your new product, service or concept idea to market.
 - ◆ A three-year financial projection that confirms the financial feasibility of bringing your new product, service or concept idea to market on a sustainable basis.
- ◆ Provide STEM Business Plan Templates for precise formatting and writing guidelines. [Word](#) (*Google Docs Template in Google Classroom only*)
 - ◆ Ask students to review [Examples of past 'highly rated' STEM Plans for student review](#) for examples of writing styles, discussion length, and use of figures, etc.

Homework or Class Research & Writing Assignment: Students conduct additional research as needed to develop their idea and write Mileposts 9 -12 . Review summary comments from the Mileposts 1-8 and use as a basis for completing the initial draft of the STEM Business Plan. Use the provided STEM Business Plan Template to complete the Draft Plan.

PART 4:

REVIEWING, REASSESSING, REVISITING, AND REWRITING THE STEM PLAN

Once students have a Draft STEM Plan, they should **REVIEW** their Plan!

Does the idea make sense? Or does it need further investigation?

They should **REASSESS** their idea based on this analysis.

If it does NOT make SENSE as designed and envisioned they must **PIVOT!** This means they might have to change their design, material, target customers, or general business model. They may need to do additional research or adapt their idea based on a competitors' product.

If **PIVOTING**, they will return to previous Mileposts where their idea is weak or not feasible.

They may have to conduct additional research, redesign their product, or their business approach through each successive Milepost based on the point of the necessary **PIVOT**.

Finally, they will **REWRITE** their STEM Plan based on this new information.

Parts of the STEM Plan may need to be revised and rewritten multiple times to produce a well-thought-out, competitive STEM Plan.

Students review the Judging Rubric [STEM Business Plan Judging Card](#) and use it to assess Plans.

- ◆ Students review their own Plans and rewrite as needed to maximize score.
- ◆ Teachers/mentors give Plan feedback before FINAL submission.

Optional Peer Feedback Opportunities!

- ◆ Students present their Plans to their classmates and receive peer feedback.
- ◆ Students are paired, exchange Plans, and give feedback to each other.

Teachers will grade **FINAL STEM Plans** then submit them to their judges for the Local School Competition.

- ◆ Consult the Believe in Ohio Timeline or MoU for submission deadlines of Local School Competition winners and paperwork.
- ◆ Consult your Regional STEM Advocate for your Final Report Check Sheet to submit your winners and cover sheets to release student awards and teacher support grant funds.

OPTIONAL RESOURCES FOR CREATING EXCEPTIONAL STEM PLANS!

Option 1: Dan Hess Additional Milepost STEM/Entrepreneurship Video Series

Option 2: Design Thinking/Ideation Mini-Course

Option 3: Emerging Technologies Deep-Dive

Option 4: Exploring Patents

OPTION 1: DAN HESS ADDITIONAL MILEPOST STEM/ENTREPRENEURSHIP VIDEO SERIES

Assign in Google Classroom or use links

This video series explores the idea of **STEM Knowledge + Entrepreneurial Mindset = INNOVATION** by following 6 relatable young entrepreneurs as they take their ideas through the Mileposts. The Milepost 0 videos illustrate this equation and are considered important explanatory videos in Part 1 of the Implementation Guide. Showing students the entire series will further engage them in the process and allow them to see how the Mileposts are used to assess very different ideas and business models.

However, use as many or as few as you would like with your class!

- ◆ Milepost 0 Video 1: [The Challenge of the Future](#) (10:00)
- ◆ Milepost 0 Video 2: [Intro to Entrepreneurship](#) (7:00)
- ◆ Milepost 0 Video 3: [Think, Innovate, Change](#) (8:00)
- ◆ Milepost 1 Video 4: [Finding Problems, Seeing Opportunity](#) (9:00)
- ◆ Milepost 2 Video 5: [Proposing Solutions](#) (9:00)
- ◆ Milepost 3 Video 6: [Using Technology to Execute a Solution](#) (11:00)
- ◆ Milepost 4 Video 7: [Who Can Benefit From Your Solution?](#) (8:00)
- ◆ Milepost 5 Video 8: [Who Are Your Competitors?](#) (7:00)
- ◆ Milepost 6 Video 9: [What Value Do You Bring to the Market?](#) (7:00)
- ◆ Milepost 7 Video 10: [Will Your Idea Generate Revenue?](#) (9:00)
- ◆ Milepost 8 Video 11: [What Will It Cost to Get Started?](#) (7:00)
- ◆ Milepost 8 Video 12: [What Are the Operating Costs?](#) (7:00)
- ◆ Traffic Light – [Does Your Idea Get a Green Light?](#) (7:00)

Homework or Class Writing Assignment: Fill out Student Support Sheet for each video.

OPTION 2: DESIGN THINKING /IDEATION MINI-COURSE

Assign in Google Classroom or use links

OVERVIEW

We highly recommend incorporating this mini-course into the Believe in Ohio process!

Plan to spend 1 week or maybe 2 weeks if necessary depending on the numbers of class sessions per week you have available. View the *Quick Look* video then follow the Lesson Plan to guide your students through Parts 1 – 4.

Alternatively, you can select individual resources or sections of this mini-course to share with your students.

[Quick Look – Recommended Design Thinking / Ideation Mini-Course](#) (1:00)

[Design Thinking Lesson Plan](#) by Dr. Heather Braun, Associate Professor of English, University of Akron

Part 1: Introduction to Design Thinking- (Total Time: 40 minutes with Welcome video)

- Part 1 - [Believe in Ohio Welcome – Are You Ready for Your Future?](#)
- Part 1 – [Introduction to Design Thinking](#)
- Part 1 – [IDEO Shopping Cart](#)
- Part 1 – [Design Thinking Exercise](#)

Part 2: Empathize & Define (Total Time: 35 minutes)

- Part 2 – [Empathize & Define \(Part 1\)](#)
- Part 2 – [Empathize & Define \(Empathy Video\)](#)
- Part 2 – [Empathize & Define \(Part 2\)](#)

Part 3: Student Discovery Activity (Total Time: 30 minutes)

- Part 3 – [Student Discovery – STEM Innovation & Entrepreneurship at Ohio Colleges & Universities](#)
- Part 3 – [Student Discovery – Emerging Technologies That Are Changing the World](#)

Part 4: Introduction to Ideation (Total Time: 35 minutes)

- Part 4 – [Introduction to Brainstorming – Ideation](#)

OPTION 3: EMERGING TECHNOLOGIES DEEP-DIVE

Assign in Google Classroom or use links

STEM Knowledge + Entrepreneurial Mindset = INNOVATION

Our nation's prosperity is the result of generations of innovators and entrepreneurs who developed the products, services, businesses, and industries that have made the United States economy the largest in the world. Today, we are living in an Innovation Age in which technology advancements and global competition point to a future where continuous innovation will cause every product, service, and aspect of life to be transformed and reinvented during the lifetimes of today's students who will be our country's next generation of innovators and entrepreneurs.

To create these new jobs and future prosperity, we must inspire students' interest in STEM where many of the jobs and careers of the future will be. We must also plant in students the seed of entrepreneurship and help them develop the problem solving, critical thinking, collaboration and the other 21st Century skills they will need to be successful in the future.

The **Emerging Technologies Deep-Dive** will help students connect the content of their STEM classes to real-world practical applications they discover in the resources. These examples should help students find topics of interest that they can adapt and develop in their STEM Plans.

- ◆ Students investigate additional emerging technologies that interest them from [Technologies Changing the World](#) & **React/Respond to them.**
- ◆ Students select 1 or more Emerging Technologies TED talks to watch [8 TED Talks on emerging technologies to watch](#) by Carla Rudder (Editorial Team) | July 22, 2019 **React/Respond to them.**
- ◆ [Solving Global Problems Using Emerging Technologies | Zaynah Bhanji | TEDxTheWoodlandsSchool](#) Feb 14, 2020 (12:00) People worldwide are impacted by a lack of access to food, technology, education, housing, sanitation, and a host of other challenges. What if we used Artificial Intelligence to find solutions to these problems? Zaynah Bhanji is a 16-year-old machine learning and virtual & augmented reality developer. She began her journey developed neural networks at 13-years-old and has been supported by companies like Google, CIBC, TD, Deloitte, Microsoft, and more.

OPTION 4: EXPLORING PATENTS

Assign in Google Classroom or use links

While developing Believe in Ohio STEM Plans some students and their parents have questions about patenting their idea. Also, some teachers like to include patent searches into the process to highlight that aspect of the engineering design or business process.

We have included some information about patents to assist these students and teachers and to introduce the concept of patents and intellectual property for those who have the time and inclination to include them. Also, we include a discussion of patents as it applies to entry into the Believe in Ohio competition in the [Roadmap to Future Jobs and Prosperity Instruction Booklet](#) on page 4.

- ◆ Students learn about [Patent & Intellectual Property Discussion & Videos](#)
 - ◆ Patents & Intellectual Property 101 – Video Part 1 – "IP² = profits" (15:00)
 - ◆ Patents & Intellectual Property 101 –Video Part 2 – "The invention of the ice cream cone (22:00)
 - ◆ Patents & Intellectual Property 101 – Video Part 3 – The America Invents Act and its implications for entrepreneurs (10:00)
 - ◆ How to get a patent from a Research Scientist Perspective (A video by Senior Research Scientist Dr. Bilal Bomani) (13:00)

- ◆ Students research their idea to see if someone has already patented a similar product [How to Conduct a Preliminary U.S. Patent Search: A Step by Step Strategy](#)

The Believe in Ohio program is pleased to provide the *National Standards for Business Education* (below) to teachers so that they can assess how the *Believe in Ohio* program can help them meet those standards. Of particular relevance are the Standards for Economics (page 6), Entrepreneurship (page 7), and Marketing (page 16).

Project and Technology Connections in Business for Believe in Ohio from

“The National Standards for Business Education: What American Students Should Know and Be Able to Do in Business” (NBEA, 2013) provides a framework for the development of Business plans. Content areas range from Accounting to Marketing. Across these topics, sections were selected that linked most closely with the curriculum and goals of the **Believe in Ohio** program. The selected Performance Expectations included below are intended to provide a representative sample and are adapted from Level 3 (High School) and/or Level 4 (Post-secondary). Retrieved from: https://neapolitanlabs.education/assets/north_linn/files/business_education.pdf

The Learning Experience: Relevant, Authentic, Real-Life

Students are motivated and learn best when they understand the relevance of what they are studying. Perhaps more than any other discipline, business education programs provide rich opportunities for relevant, real-world learning experiences. These experiences, often taught using a project-based learning approach, reinforce high academic standards and at the same time provide authentic contexts in which students can apply what they learn.

By giving students opportunities to apply skills in real-world contexts, teachers pave the way for competency-based mastery learning. Students actively engage in learning experiences that teach them what they should know and be able to do in business, while their teachers, using a variety of instructional strategies, function as facilitators and guides. This not only provides opportunities for learning more than just the immediate project skills, but also provides unique opportunities for building relationships.

A Developmental approach to content mastery The National Standards for Business Education incorporates a developmental approach to content mastery. For example, content at the elementary level introduces young learners to the excitement of studying about business and leads them to progressively higher levels of rigor at each succeeding level. This developmental approach is reflected in the numbering system (levels 1 (K-6), 2 (6-9), 3 (9-12), and 4 (Post-secondary) included in each content area.

Level 3: Secondary (Grades 9–12) Business educators at the secondary level facilitate learning in a student-centered environment, guiding learners as they develop the skills needed to be effective consumers, citizens, workers, and business leaders.

- Learning is customized; students select projects based on personal and career interests.
- Working independently or in teams, students use a wide range of technologies to solve unstructured problems.
- All of these opportunities support students’ desires for independence and creativity, as well as their need for collaboration.
- Learners continue to explore careers, apply work-based skills, gain business experience, and participate in student organizations.

Level 4: Two-Year Postsecondary/Community College or Technical College

Two-year postsecondary/community colleges or technical colleges are ideal places for providing education and training to people who want to broaden their educational experiences, change careers, expand employability options, and/or upgrade technological skills. Certificate and degree programs, when combined with practical work experiences, can smooth the transition from high school to two- and four-year colleges or to the business world. The variety of available learning formats affords students the opportunity to develop advanced technological skills; refine their understanding of economic principles and systems; and enhance their proficiency in communication, critical thinking, management, personal finance, problem solving, team building, and decision making.

Source: National Standards for Business Education (2013), p. xi.

Table of Contents

ACCOUNTING	3
BUSINESS LAW	4
COMMUNICATION	5
ECONOMICS & PERSONAL FINANCE	6
ENTREPRENEURSHIP	7
INFORMATION TECHNOLOGY	9
INTERNATIONAL BUSINESS	11
MANAGEMENT	13
MARKETING	16

ACCOUNTING

Achievement Standard	Performance Expectations
Use an annual report and financial statements to make informed business decision(s).	Develop a financial report; describe the content and purpose for each section.
Use an annual report and financial statements to make informed business decision(s).	Describe different types of business ownership, including the advantages or disadvantages of each, and how each report financial statements.
Assess the financial condition and operating results of a company; analyze and interpret financial statements and information to make informed business decision(s).	Assess profitability by calculating and interpreting financial ratios (gross profit margin, operating profit margin, net profit margin, return on assets, return on operating assets, sales turnover).
	Research industry averages and explain their use in assessing the financial condition, operating results, profitability, liquidity and capital structure.
Identify and describe generally accepted accounting principles (GAAP).	Determine the costs of property, plant and equipment, natural resources and intangible assets.
	Calculate the cost of borrowed funds and determine the impact on financial statements.
	Describe the difference between revenue/gain and expenses/losses.

BUSINESS LAW

Achievement Standard	Performance Expectations
Analyze the relationships between contract law, law of sales, and consumer law.	Describe those statutes that regulate cyber-price shopping, cyber-payment problems, and cyber-contract security issues.
	Distinguish goods from services and real property.
Describe the major types of business organizations, including sole proprietorships, partnerships, corporations, and limited liability companies, operating within the socioeconomic arena of the national and international marketplace.	Explain the legal procedures for forming and running a sole proprietorship, partnership, corporation, or limited liability.
	Explain the advantages and disadvantages of each of these organizational types.
Explain the legal rules that apply to personal property, real property, and intellectual property.	Describe some protections given in copyright and trademark matters by the Patent Cooperation Treaty and the Paris Convention for the Protection of Industrial Property.
	Identify the types of intellectual property e.g. trademark, tradename, trade dress, copyright, patent, trade secret).
Explain how advances in computer technology impact such areas as intellectual property, contract law, criminal law, tort law, and international law.	Determine when a computer program can be protected by a patent or copyright.
Explain the legal rules that apply to environmental law and energy regulation.	Describe the various state statues that impact energy regulation and conservation.

COMMUNICATION

Achievement Standard	Performance Expectations
Listen actively, use the communication process, read and research information, and integrate technology to enhance communication effectiveness.	Adapt appropriate listening strategies for various audiences and contexts.
	Analyze and critically evaluate the intent of messages.
	Synthesize information from multiple sources to solve problems and make decisions.
	Determine whether to organize content directly or indirectly.
	Specify desired outcome of the message.
	Identify primary and secondary audiences.
	Determine audience benefits.
	Adapt the message for the needs of the audience.
	Evaluate the message to ensure it meets the purpose.
	Determine the level of persuasion necessary to produce the desired outcome; incorporate audience benefits.
	Distinguish between literal and inferential Statements.
	Identify technology tools used to communicate information.
	Enhance documents through the use of advanced layout, design, and graphics.
	Enhance documents through the use of advanced layout, design, and graphics.
Prepare clear, complete, concise, correct, and courteous written messages for personal and professional uses.	Identify factors affecting the readability of text; use bias-free language
	Prepare informal and formal reports using professional format and appropriate supporting graphics.

ECONOMICS & PERSONAL FINANCE

Achievement Standard	Performance Expectations
Assess opportunity costs and trade-offs involved in making choices about how to use scarce economic resources.	Explain the concept of marginal benefit vs. marginal cost and how it relates to rational decision making.
Identify the basic features of different economic systems and analyze the major features of the U.S. economic system.	Analyze how economic systems, resources, and culture affect each other.
	Analyze how wages and prices are determined in command or centrally planned and market economies.
Analyze the role of core economic institutions and incentives in the U.S. economy.	Explain how specific financial and nonfinancial incentives influence economic behavior of individuals in different ways.
	Explain the roles of profit and competition in a market-oriented economy.
Analyze the role of markets and prices in the U.S. economy.	Identify determinants of supply and demand.
Analyze the different types of market structures and the effect they have on the price and the quality of the goods and services produced.	Discuss the major barriers to new firms entering a market and how the barriers affect the level of competition in an industry.
Explain the importance of productivity and analyze how specialization, division of labor, investment in physical and human capital, and technological change affect productivity and global trade.	Assess opportunity costs and economic risks involved when investing in physical and human capital to increase productivity.
	Distinguish between fixed, variable, explicit, and implicit costs.
Use a rational decision-making process as it applies to the roles of citizens, workers, and consumers.	Differentiate between types of decisions and identify those for which a formal decision-making process should be used.
	Examine the impact of advertising, peer pressure, and family history on personal financial decisions.
Apply a decision-making model to maximize consumer satisfaction when buying goods and services.	Compare the costs and benefits of purchasing, leasing, and renting.
	Examine the impact of advertising and marketing on consumer demand and decision-making in the global marketplace.
Evaluate services provided by financial deposit institutions to transfer funds.	Evaluate products and services and related costs and fees associated with financial institutions in terms of personal banking needs
Analyze factors that affect the choice of credit, the cost of credit, and the legal aspects of using credit.	Explain how the amount of principal, the period of the loan, and the interest rate affect the amount of interest charged.
	Explain why the interest rate varies with the amount of assumed risk,
	Explain the implications of foreclosure and bankruptcy.

ENTREPRENEURSHIP

Achievement Standard	Performance Expectations
Recognize that entrepreneurs possess unique characteristics and examine the role of innovation in entrepreneurial opportunities.	Identify and appraise the unique contributions of entrepreneurs to the economy of a country.
	Explain the importance of entrepreneurship as a choice in a market economy.
	Develop a portfolio of personal accomplishments demonstrating entrepreneurial characteristics.
	Evaluate the best method of communication for business scenarios.
	Develop a code of ethics for a business venture.
	Compare and contrast the effectiveness of communication methods used in business.
	Analyze the causes of communication failure and evaluate the solutions to such failures.
	Use research tools to identify the consumers' needs and wants.
Recognize trends and social responsibilities can lead to entrepreneurial opportunities.	Identify and create a socially responsible business that aims to generate profit while addressing a societal need.
	Investigate requirements for establishing a certified "green" business.
Apply economic concepts when making decisions for an entrepreneurial venture.	Analyze the effect of different market structures on market price.
	Construct and interpret a demand curve and explain why demand is necessary to the success of an entrepreneurial venture.
	Compare and contrast pricing policies for an entrepreneurial venture.
	Explain the role of the entrepreneur's contribution of time, money, and expertise as it relates to profit.
Develop a marketing vision to introduce a product or service.	Use primary and secondary data sources to locate information about potential target markets; conduct market research to determine target market.
	Construct a plan outlining how social media outlets can be used to identify target markets.
	Analyze the advantages and disadvantages of possible locations for businesses— brick and mortar stores, virtual enterprises, and click and mortar stores.
	Identify ways businesses track customers,
	Conduct a competitive market analysis.
Use the financial concepts and tools needed by the entrepreneur in making business decisions.	Project the total cash needed to start a business (e.g., start-up costs, ongoing operational expenses, and cash reserves).
	Identify the major options of funding for a business.
	Assess the role of government assistance in the growth and development of small businesses.

Recognize that entrepreneurs must establish, maintain, and analyze appropriate records to make business decisions.	Evaluate software, methods, and systems available for maintaining business records.
	Research requirements for retention of accounting records and business documents.
	Evaluate the financial condition of a firm based on business records.
Develop a management plan for an entrepreneurial venture.	Establish short- and long-term goals for an entrepreneurial venture.
	Create a mission statement for an entrepreneurial venture.
	Create an organizational structure for an entrepreneurial venture.
	Describe and give examples of the characteristics of successful teams.
	Explain the leadership skills that a successful entrepreneur would exhibit.
	Determine technological needs for a business.
	Develop a disaster recovery plan for an entrepreneurial venture.
Analyze how forms of business ownership, government regulations, and legal regulations affect entrepreneurial ventures.	Select the most appropriate form of business ownership for an entrepreneurial venture.
	Identify ways of protecting ideas and inventions.
Develop a business plan.	Research business plan resources and information.
	Prepare a timetable for establishing an entrepreneurial venture.

INFORMATION TECHNOLOGY

Achievement Standard	Performance Expectations
Assess the impact of information technology in a global society.	Analyze how developments in information technology affect the supply/ demand characteristics of the job market.
	Illustrate how information technology changes organization structures.
	Evaluate how information technology transforms business processes and relationships.
Gather, evaluate, use, cite, and disseminate information from technology sources.	Synthesize information from data sources to formulate decisions across the curriculum.
Demonstrate respectful, responsible, and ethical behavior in a digital world.	Analyze legal and ethical dilemmas within the framework of current laws and legislation (e.g., virus development, hacking, threats, phishing).
Describe current and emerging devices and components; configure, install, and upgrade equipment; diagnose problems; and repair hardware.	Evaluate and recommend devices to solve specific problems.
Identify, evaluate, select, install, use, upgrade, and customize operating systems. Diagnose and solve problems with various types of operating system utilities.	Compare and contrast the functions, features, and limitations of different operating systems and utilities (e.g., open source, mobile, and proprietary operating systems).
	Identify and use appropriate help resources (e.g., help desks, online help, and manuals) to install, configure, upgrade, diagnose, and repair operating systems and utilities
Use various input technologies to enter and manipulate information appropriately.	Identify and select appropriate input technology for various tasks.
Identify, evaluate, select, install, use, upgrade, troubleshoot, and customize applications.	Use the collaborative features of applications to accomplish organizational tasks.
	Identify, evaluate, and select software specific to an organizational function and/ or industry.
Use and create digital media.	Interpret, analyze, and determine meaning for digital media production.
	Create an original high-end, professional quality media production.
	Analyze and select appropriate digital media formats and properties (e.g., plug-ins, codecs, compression).
Design, develop, test, implement, update, and evaluate web solutions.	Identify client and target audience needs.; create content that is readable, accessible, searchable, and sticky for this audience.
	Research and analyze hosting and domain name solutions.

Use, plan, develop, and maintain database management systems.	Identify the concepts and terminology for enterprise level databases.
	Explain how data mining techniques can be used to extract useful information.
Analyze and design projects and information systems using appropriate management and development tools.	Identify and explain the steps in the systems development life cycle.
	Analyze a current system using structured systems analysis tools.
Design, develop, test, and implement programs and applications.	Identify and explain programming structures.
Develop the skills to design, deploy, and administer networks and telecommunications systems.	Identify network connectivity hardware and related software; identify network architecture and topologies.
Plan the selection and acquisition of information technologies.	Research and identify information technology solutions to meet organizational needs.
	Develop and present a project plan for identifying, evaluating, selecting, purchasing, installing, and supporting an information system.
Design and implement security and risk management policies and procedures for information technology.	Analyze security, privacy, and risk management issues.
	Identify potential risks to enterprise systems from physical or cyber threats.
	Identify risks to personnel, facilities, data, communications systems, and applications.
Develop the technical and interpersonal skills and knowledge to train and support the user community.	Identify, evaluate, and use resources for problem identification and resolution.
Describe the information technology components of business functions and explain the interrelationships.	Identify and examine information systems and their impact on the enterprise (e.g., Enterprise Resource Planning (ERP) systems)
	Identify and explain the major components of marketing and sales information technologies and their interrelationships
	Identify and explain the major components of accounting and finance information technologies and their interrelationships
	Identify and explain the major components of manufacturing and logistics information technologies and the interrelationships.
	Identify and explain the major components of research and development information technologies and the interrelationships.

INTERNATIONAL BUSINESS

Achievement Standard	Performance Expectations
<p>Explain the role of international business and identify its benefits and costs; analyze how it impacts business at all levels, including the local, state, national, and international levels.</p>	Interpret the impact of emerging economies and political changes on international operations, markets, commodity supply, and unemployment rates.
	Explain the different modes that companies use to enter foreign markets (including exporting, turnkey projects, licensing, franchising, joint ventures, and subsidiaries), and identify advantages and disadvantages of each entry mode.
	Determine the impact of geography on international business, including factors such as climate; time zones; distance; topography; and social, economic, and natural resources.
	Compare the application, interview, and hiring practices of various countries.
	Explain factors affecting an international business trip; assess risks involved in international business travel.
<p>Describe the interrelatedness of the social, cultural, political, legal, economic, and technological factors that shape and impact the global business environment.</p>	Define intercultural competence and discuss its importance when working in a global context.
	Analyze how the social, cultural, institutional, and educational environments of a given country might impact a company beginning to do business in that country.
	Evaluate cases where social and cultural factors influenced business outcomes.
	Identify and explain formal and informal trade barriers.
	Describe how political and economic systems of a country differ.
	Describe the differences between the legal systems of various countries and compare them to the codes, statutes, and common laws of the United States.
	Explain the difference between the free market economy and government-controlled economy.
	Analyze competitive situations that companies face in global business markets.
Determine appropriate business strategies for operating in foreign market situations such as pure competition, monopoly, and oligopoly.	
<p>Apply communication strategies necessary and appropriate for effective and mutually beneficial international business relations.</p>	Identify the effect of translators and interpreters on international business communication and relations.
	Explain the usage of names, titles, and ranks in different cultures and countries.
	Assess business consequences which may result when incorrectly speaking, writing, or interpreting another language or culture.

	<p>Compare cultural attitudes about use of time, silence, space, gestures, body language, and body and eye contact to successful international business relationships.</p> <p>Evaluate which telecommunication or electronic methods are most appropriate for given international business situations.</p> <p>Identify how to adapt a company's website to target a specific international market.</p>
Describe the factors that define what is considered ethical and socially responsible business behavior in a global business environment.	Identify current and emerging ethical issues in the global business environment.
	Compare the Corporate Codes of Ethical Conduct adopted by companies from different countries to identify similarities and differences
Identify forms of business ownership and entrepreneurial opportunities available in international business.	Determine an appropriate form of business ownership (e.g., sole proprietorship, partnership, or corporation) for different international business situations.
	Identify risks and rewards related to doing business in a specific country.
	Identify organizations, government agencies, and other resources that a small and/or medium-sized business might use to investigate international business opportunities.
	Identify factors to consider when evaluating and selecting an international business partner.
Apply marketing concepts to international business situations.	Illustrate how social, cultural, technological, geographic, and political factors influence consumer buying behavior in different cultures.
	Compare the pricing strategy for a product sold both domestically and internationally.
	Discuss the factors in determining the appropriate mode of transportation for international shipments (e.g., cost, time, size, perishability).
Explain the concepts, role, and importance of international finance and risk management.	Describe various methods of payments used in international transactions, including Letters of Credit, open account, wire transfer, and draft.
	Identify major foreign exchange and commercial risks associated with international business activities

MANAGEMENT

Achievement Standard	Performance Expectations
Analyze the management functions and their implementation and integration within the business environment.	Discuss the importance of vision, mission, goals, and objectives setting within the context of the business environment.
	Describe how operational, tactical, and strategic planning differ.
	Analyze a business plan and explain the role of innovation and change in the planning process.
	Explain the advantages and disadvantages of centralizing and decentralizing responsibility and authority in organizing a business.
	Evaluate how businesses are organized to achieve desired goals.
	Compare and contrast leadership styles.
	Compare and contrast feedforward, concurrent, and feedback control.
Analyze management theories and their application within the business environment.	Illustrate how past and current management theories are applied in the business environment.
Analyze the organization of a business.	Define and provide examples of the basic forms of business ownership (e.g., sole proprietorship, partnership, and corporation).
	Differentiate between tall and flat organization structures
	Distinguish between functional and matrix organization structures.
	Analyze organizational structures of various organizations.
Develop personal management skills to function effectively and efficiently in a business environment.	Design and implement a time management schedule as a result of a time management analysis.
	Identify stressors in the business environment.
	Evaluate personal emotional intelligence.
	Identify avenues for professional growth (e.g., workshops, seminars/webinars, conferences, courses, professional associations, and journals).
	Create a professional development plan.
	Identify major problems that prevent effective communication in organizations.
	Identify available resources inside and outside the school for making professional contacts (e.g., professional organizations, business schools, alumni, and business leaders).
Examine the role of ethics and social responsibility in decision making.	Examine/evaluate a business code of ethics.
	Identify the impact of unethical behavior on a business.
	Identify ethical considerations resulting from various situations (e.g., technological advances, global competition, employer-employee relationships, and consumer relations).
	Define social responsibility.

Describe human resource functions and their importance to an organization's successful operation.	Define human resource planning.
	Analyze the role of outsourcing or offshoring in Organizations.
	Identify recruitment sources.
	Identify selection tools and explain how they are used (e.g., interviews, tests, and reference checks).
	Explain the purpose of orientation and training in successful employee performance.
	Explain the purpose of employee evaluations.
	Describe policies and procedures used to determine compensation (e.g., company performance, benchmarking, profit sharing, and gain sharing).
	Assess an employee compensation package (e.g., wages/salaries and benefits).
	Define and discuss the concept of rightsizing.
	Describe an employment contract; define "right to work state" and "employment at will."
Describe the role of organized labor and its influence on government and business.	Describe the history of the labor movement and why unions were organized.
Utilize information and technology tools to conduct business effectively and efficiently.	Select the appropriate technology tools for conveying information, solving problems, and expediting business processes.
	Differentiate between e-commerce and e-business.
Analyze a business organization's competitive position within the industry.	Compare and contrast various forms of competition (pure competition, monopolistic competition, oligopoly, and monopoly).
	Describe the process of conducting an industry analysis.
	Analyze various organizations to determine their competitive advantages.
	Evaluate the reliability of internal and external data sources.
Analyze financial data influenced by internal and external factors to make short-term and long-term decisions.	Describe the purpose of financial statements.
	Identify sources of financial information for industries and for publicly held firms.
	Assess the short-term and long-term financial needs of an organization.
	Explain the process of developing a risk management plan.
Apply operations management principles and procedures to the design of an operations plan.	Evaluate a product design process.
	Evaluate the effectiveness and efficiency of a production schedule.
	Identify factors considered when selecting suppliers (e.g., quality, price, and reliable delivery).
	Evaluate a system for maintaining inventory control.
	Explain the concept of quality management and its evolution.

Examine the issues of corporate culture and managing in the global environment.	Identify the legal issues related to managing an organization in the global environment.
	Identify global economic factors that impact business.
	Describe benefits and challenges of managing a diverse workforce.
	Analyze the benefits of global partnering in various countries and industries.
	Analyze business situations to determine opportunities for global partnering.
	Explain how global organizations can meet Corporate Social Responsibility (CSR) in domestic and foreign countries.

MARKETING

Achievement Standard	Performance Expectations
Recognize the customer-oriented nature of marketing and analyze the impact of marketing activities on the individual, business, and society.	Describe the wide scope of marketing— business-to-consumer, business-to-business, consumer-to-consumer, group buying, industrial, non-profit, personal, government, and electronic.
	Discuss marketing practices that violate customer rights and consumer advocacy.
	Analyze the differences between transactional marketing and relationship marketing.
Analyze the characteristics, motivations, and behaviors of consumers.	Describe characteristics of the changing domestic and global populations (e.g., demographics, psychographics, and geographics).
	Describe the impact of consumer differences (e.g., life stages, benefits sought, usage rate, brand loyalty, and socioeconomic characteristics) on buying decisions.
	Differentiate between rational (cognitive) and emotional (affective) buying motives.
	Describe the steps in the consumer buyer decision process.
	Explain ways that segmentation can be used to identify target markets.
	Analyze variables used to identify target markets (e.g., usage level, brand loyalty, and benefits sought).
Analyze the influence of external factors on marketing.	Analyze the effects of marketing regulations/ laws on specific companies and industries.
	Compare and contrast ethical standards in domestic and international markets.
	Compare and contrast legal versus ethical marketing practices (e.g., utilitarianism vs. moral idealism).
	Analyze methods used by marketers to obtain and use personal information.
	Compare and contrast marketing strategies of competitors in a single industry.
	Assess the role of technology in enabling companies to compete effectively.
	Compare and contrast types of stakeholders and their impact on business decisions.
	Identify special interest groups concerned with marketing policy (e.g., shareholders, consumer groups, labor groups, and environmental groups).
	Analyze the implications (e.g., market share, ethical, economic, legal) of favoring one group of stakeholders at the expense of another (e.g., customers vs. employees, shareholders vs. employees).
	Analyze ways in which marketers may respond to the concerns of sociocultural groups.

	Analyze the cost/benefit of different technological approaches to marketing (e.g., digital vs. print media).
Analyze the elements of the marketing mix, the interrelationships, how they are used in the marketing process, and their role in positioning.	Analyze marketing mix strategies for each product classification.
	Describe the process of new product and/or service development (e.g., idea generation, development, and test marketing).
	Describe the management process of new-product development.
	Explain issues of ethics and social responsibility in packaging (e.g., sustainability, false and misleading claims, durability).
	Analyze functionality of packaging options.
	Illustrate package design as a product Feature.
	Compare and contrast brand strengths and weaknesses,
	Explain how brands establish long-term business success.
	Evaluate the rationale behind various brand strategies (e.g., individual branding, family branding, mixed branding, co-branding).
	Describe the parameters of the product mix (e.g., length, width, depth).
	Explain consumer demand.
	Explain the role of product augmentation (e.g., product warranty, technical support, installation, or service contract).
	Describe the stages of a product life cycle.
	Compare and contrast direct and indirect marketing channels for various industries.
	Derive pricing strategies based on corporate objectives (e.g., product line, loss leader, psychological, penetration, and skimming) and positioning.
	Compare and contrast different advertising appeals.
	Develop a campaign strategy (e.g., commercial, Internet ads, print, radio, outdoor).
	Describe the purposes of various types of sales promotion (e.g., encouraging repeat purchases and building traffic).
	Evaluate a current sales promotion campaign for a business.
	Distinguish between advertising and public relations.
Create a public relations campaign.	
Explain the steps involved in the personal selling process.	
Plan and organize a sales presentation (e.g., approaching prospects, asking appropriate questions, relating features and benefits to customer needs).	
Describe the elements, design, and purposes of a marketing plan.	Identify the components of a marketing Plan.
	Evaluate marketing plans peer-to-peer
Analyze the role of marketing research in decision-making.	Compare and contrast marketing research and environmental scanning.

	Differentiate between primary and secondary sources of data.
	Identify the methods for collecting primary data (e.g., surveys, experiments, focus groups, and observations).

A SAMPLE BUSINESS LESSON PLAN

Believe in Ohio allows teachers as much flexibility as is needed to implement the Believe in Ohio program into the existing requirements of your curriculum.



Believe in Ohio has created a multitude of online resources to guide your students through this process, both video and written. Your advocate can help you determine what might best fit your situation.

This lesson plan has been adapted from an experience business teacher who has used Believe in Ohio many times with business students with great success. It is one approach to the introduction of entrepreneurship and the introduction to students for Believe in Ohio.

Lesson title: Who is an entrepreneur?

Milepost 1 Intro to Entrepreneurship, Characteristics of an Entrepreneur

Lesson Objectives/Standards/SLOs:

BIG IDEA: Entrepreneurship is a vital part of the economy and entrepreneurs are the backbone in a successful, capitalist society. It is important to have a big picture appreciation of entrepreneurship before deciding if being an entrepreneur is worth the investment.

After completing this lesson, students will be to:

- Define entrepreneurship
- Identify major entrepreneurship contributions in a historical context
- Identify the 7 common rewards of entrepreneurship
- Identify the 4 common risks of entrepreneurship
- Identify the 12 common characteristics of entrepreneurs
- Identify the 10 ten foundational skills of entrepreneurs

Standard(s):

- Entrepreneurship, I. Entrepreneurs and Entrepreneurial Opportunities
- 1.7 Entrepreneurship/Entrepreneurs: Analyze the environment in which a business operates and the economic factors and opportunities associated with self-employment.
- 1.7.3 Identify the factors that contribute to the success and failure of entrepreneurial ventures.
- 1.7.7 Create a list of personal strengths, weaknesses, skills and abilities needed to be successful as an entrepreneur.
- 1.7.9 Conduct a self-assessment to determine entrepreneurial potential.

Key Vocabulary/Terminology:

- Entrepreneurship
- Entrepreneur
- Customer
- Consumer
- Foundational Skills (see below)

Time allotment: 1 class period

Materials/resources/links

- Slide Deck: <https://docs.google.com/presentation/d/1h-0TqklixJsvaGTC8LR1q49FkihbHNsyuTE4AwVUTA4/edit?usp=sharing>
- Student Notes: <https://docs.google.com/document/d/1RagtVR6MMHDy3yK6bfKcRRVb-DdRrs8oeXGyMzkdH54/edit?usp=sharing>
- Student Survey: <https://s3-us-west-2.amazonaws.com/oerfiles/WMBusiness/Entrepreneur-Self-Assessment-Survey.pdf>
- Articles: <https://www.tsheets.com/blog/small-business-help/risks-and-rewards-of-entrepreneurship>
- Articles: <https://www.lifehack.org/503713/the-risks-and-rewards-going-into-business-for-yourself>
- Articles: <https://www.smallbizgenius.net/by-the-numbers/startup-statistics/#gref>
- Assessment/Extension: https://docs.google.com/document/d/13GrHnLzikymwO6EaQKBYK9BF_gm5ljoljsQ96_C5Dbc/edit?usp=sharing

Procedures:

Hook:

1. Using butcher paper or any type of roll paper, ask volunteer students to create a chalk outline of 2 people. One person will be named “entrepreneur” and the other person will be named “consumer.”
2. Cut out the people and peg them to the wall in your room.
3. Provide students with notecards or small pieces of paper and ask them to write down characteristics of an *entrepreneur*. Students should write down one characteristic per card/paper.
4. Ask students to write down characteristics of *consumers*.
5. Provide students 5 minutes to create as many characteristics as they can.
6. After the 5 minutes, ask students to come up to the entrepreneur and consumer and tape on their qualities.
7. If the students use a term that may be unfamiliar to all the students, be sure to define the term so all students can understand the qualities of these individuals.
8. Keep the entrepreneur and consumer up for the duration of this multi-part lesson.

II. Presentation of Information	
Instructional/Procedural Steps	
1.0 Introduction - Defining Entrepreneurship Metacog Check: What am I thinking... Teacher Led Instruction	Let’s think! Ask students to complete “What in the world am I thinking” questions 1-2 to have them engaged individually into the importance of this lesson. Before students can become entrepreneurs, they must first understand what an entrepreneur is. Launch Google Slides Define Entrepreneur: entrepreneur

an individual who undertakes the creation, organization, and ownership of a business

Define Entrepreneurship: the activity of setting up a business or businesses, taking on financial risks in the hope of profit.

Ask: Many of us know entrepreneurs, please tell the class briefly about an entrepreneur you know. (Remind students that entrepreneurship can take many forms. This does not need to be an owner of a big company.)

2.0 Qualities of Entrepreneurship
 Entrepreneurship Survey
 Teacher Led Instruction
 Think, Pair, Shar (modified)

Before jumping into the basic qualities of entrepreneurs, let's first allow students to discover their entrepreneurial leanings. There are several online options. I like to print the following:

<https://s3-us-west-2.amazonaws.com/oerfiles/WMBusiness/Entrepreneur-Self-Assessment-Survey.pdf>

After taking the quiz, be sure to add the quiz characteristics to the entrepreneur butcher paper person if those characteristics are not already listed.

Google Slides: Although there are many characteristics of an entrepreneur, generally, 12 are agreed upon... these 12 include:

persistent	self-demanding
creative	self-confident
responsible	risk-taking
inquisitive	restless
goal-oriented	action-oriented
independent	enthusiastic

Have students fill in these words on their graphic organizer handout. Working in pairs, have students define the words, provide an example and write the word in a sentence providing them contextual meaning.

It is important that students understand that having one or just a few of these characteristics does not make them an entrepreneur.

3.0 Pros / Cons of Entrepreneurship
Teacher Led Instruction
Reading

So, if people have the characteristics of an entrepreneur, do they always become one?

Ask: Why do people want to become an entrepreneur? Students' answers will likely result in the following: freedom, they are their own boss, make lots of money, like to come up with new ideas.

These are definitely the pros! Have students write their ideas down as well as the other following pros.

- being your own boss
- doing something you enjoy
- being creative
- setting your own schedule
- having job security
- making more money
- being recognized in the community

Ask: So, if it is so great, why isn't everyone an entrepreneur? Students will discuss cons. Their answers are likely to include the following: long hours, inconsistent pay, they might fail. Have students write down their responses along with these ideas:

- working long hours
- having an uncertain income
- being fully responsible
- risking one's investment

Turn the discussion over to a risk versus rewards debate. Is it worth it? Let students discuss for a few minutes.

Working in pairs, have students read the following articles, then once again discuss risk and rewards. To ensure students take time reading, have students write the "big idea" from each article on their note taking sheet.

1. <https://www.tsheets.com/blog/small-business-help/risks-and-rewards-of-entrepreneurship>

2. <https://www.lifehack.org/503713/the-risks-and-rewards-going-into-business-for-yourself>

3. <https://www.smallbizgenius.net/by-the-numbers/startup-statistics/#gref>

4.0 Common skills of entrepreneurs
Metacog Check: What in the world...
Think, Pair, Share
Teacher Led Instruction
Student Reflection

Midpoint metacognition check: Ask students to return to the “What in the world am I thinking?” side. Have students complete questions 3-5.

So, we’ve discussed characteristics, but having the characteristics to be a successful entrepreneur does not make an entrepreneur.

With your partner, create a list of skills you think a successful entrepreneur will need. Give students 3-5 minutes to develop a list on their note sheets. Then, ask individual students to place their number 1 skill and place that skill on a separate notecard. Have students bring those notecards and place them on their entrepreneur butcher paper person.

After students return to their seats, ensure students also have the opportunity to write down the following characteristics:

communication	organizing and planning
math	teamwork
problem-solving	social
technical and computer	adaptability
decision-making	basic business

Again, working in pairs, have students define the term, give an example and use the word in a sentence.

After students complete this activity, ask the students to rank using a scale of 1 - 4 on their current abilities in these areas. 1 = Poor, 4 = Excellent.

Ask students to create a goal for one area they rated as poor on their note taking sheet. Have the students share that goal with their partner. Remind students that goals should be SMART.

	<p>Next, have the student write down a way they'd like to have their instructor support them in achieving that goal.</p> <p>Be sure to stress these skills will be developed throughout the coursework.</p>
<p>III. Formative Check</p>	<p>Ask students to complete questions 6-8 on the "What in the world am I thinking?" sheet.</p>
<p>IV. Summary</p>	
<p>Being an entrepreneur takes more than just having an idea. Entrepreneurs need to be risk takers who have strong entrepreneurial skills. These skills can be developed, but entrepreneurship is not for everyone.</p>	

V. Application

So, who is an entrepreneur? In this application, students return back to the butcher paper person. Right now, the paper is hanging on the wall with all kinds of posted characteristics and skills. But the person lacks any personality or physical features. Have the students each take a turn drawing on a personal element to the paper person. For example, one student could draw on brown eyes because they have brown eyes. Another person could draw on a belt buckle that they own.

After all students have a chance to draw on a personal item, decide as a class what the entrepreneur's name is. Leave up the entrepreneur because additional descriptions will be added to him/her at a later time.

VI. Evaluation

- (a) Define entrepreneur
- (b) What are the 12, common characteristics of an entrepreneur?
- (c) What are the 10, common skills an entrepreneur needs to have?

VII. Assignments - Extension Learning

Have students explore an entrepreneur. This entrepreneur can be famous or someone the student just knows. If it is someone the student knows, have them interview the person. Use the attached rubric to assist in the extension.

https://docs.google.com/document/d/13GrHnLzikymwO6EaQKBYK9BF_gm5ljoljsQ96_C5Dbc/edit?usp=sharing

VIII. Next Lesson

Entrepreneurship Makes the World Go Around / Exploring the Environment of Entrepreneurship

Closure

1. At the completion of the lesson, collect students note sheets for understanding.
2. As students leave the room, have them place their post-it on one of the boards: Yes! I got it.
OR Nope! I need help.
3. Students who place their post-it on the Yes! should write the Big Idea on the post-it. Students who place their post-it Nope! should write down their questions/concerns.

Lesson 1 / Who is an entrepreneur?

Student Notetaking Thinking document

Coursework Objective:

(1) Define entrepreneurship (2) Identify major entrepreneurship contributions in a historical context (3) Identify the 7 common rewards of entrepreneurship (4) Identify the 4 common risks of entrepreneurship (5) Identify the 12 common characteristics of entrepreneurs (5) Identify the 10 ten foundational skills of entrepreneurs



Student Reflection: What in the world am I thinking?

Pre-Instruction:

1. What do I already know about entrepreneurship?

2. Why do I think understanding entrepreneurship is important?

Mid-Instruction:

3. What have I learned so far?

4. What am I wondering about?

5. What do I need help with?

Post-Instruction:

6. What was the big idea of the whole topic?

7. What am I still struggling with?

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8. So what? Why do I care?

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Note Taking

- Define Entrepreneur: an individual who undertakes the _____, organization, and _____ of a business
- Define Entrepreneurship: the activity of setting up a business or businesses, taking on financial _____ in the hope of _____.

Think! Do I know an entrepreneur?

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**Take the entrepreneurial characteristics survey.
Write down the qualities discussed from the quiz:**

Think! What was my score? Am I surprised? Does this mean I should or should not be an entrepreneur?

- What are the 12 additional characteristics of an entrepreneur? Let's list them, define them and use them successfully in a sentence!

persistent	self-demanding
creative	self-confident
responsible	risk-taking
inquisitive	restless
goal-oriented	action-oriented
independent	enthusiastic

Persistent =
Example:
Sentence:
Creative =
Example:
Sentence:
Responsible =
Example:
Sentence: