

Design & Pitch Challenges in STEM



Teacher's Guide - Pollution Solution

Welcome to the Design & Pitch Challenges in STEM!

Whether this is your first time implementing a Design & Pitch Challenge or your ninth, we are excited to have you on our team of innovative practitioners who are bringing entrepreneurship and career readiness to the forefront of STEM.

In this document, you will find a variety of resources that will help you implement the Design & Pitch challenges with your students. These resources include:

1. an overview of the Design & Pitch (D&P) Process;
2. a list of Teacher Tips from the D&P team and other teachers who have used the challenges in their own classrooms.
3. a “Where’s the Math?” document that outlines the standards and topics covered by the challenge;
4. a table of Implementation Models that outline what various timelines might look like for completing the challenges; and
5. a breakdown of each major step in the process in the context of the Pollution Solution challenge.

This guide is specifically designed around Pollution Solution, which is one of the nine D&P challenges designed for middle grades. Pollution Solution encourages students to tackle the issue of plastic waste by developing a product that serves as an eco-friendly replacement for plastic water bottles or other liquid containers. While completing this challenge, students will encounter and develop understanding of mathematical topics like surface area and volume of 3D figures while engaging in an effort to help save our planet from the harmful effects of plastic waste.

Our free materials can be accessed online at <https://sites.ced.ncsu.edu/design-and-pitch/>. If at any time you have a question about the materials or would like to discuss them in greater detail, feel free to reach out to the D&P team at design_pitch@ncsu.edu. We are here to help you in whatever way we can!

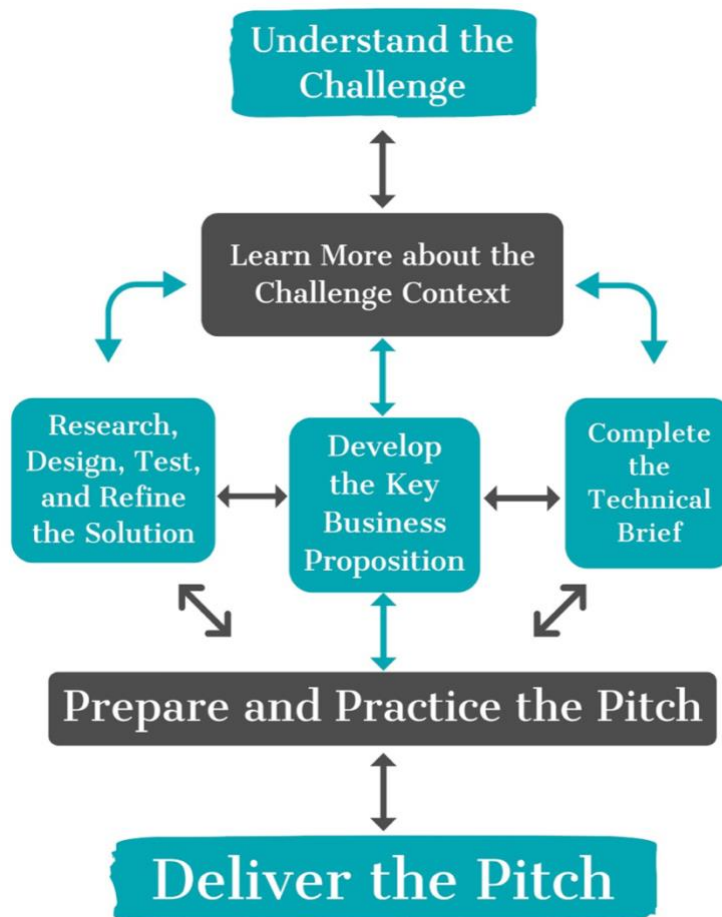
Thank you for your interest in the Design & Pitch Challenges in STEM!
The Design & Pitch Team

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The Design & Pitch Process can be thought of as a flowchart, where the process begins at the top and flows bidirectionally from one step to the next. It flows bidirectionally because students are encouraged to work through the Challenges iteratively, meaning they should be revisiting previous parts of the process as they work toward their solution and the delivery of their pitch.

Throughout this Teacher's Guide, we will break down the steps of the D&P Process in the context of the Pollution Solution Challenge. The pages that directly relate to one of the steps in the process will begin with headers that include 'THE PROCESS' and the name of the specific step. You can also find these pages labeled on the Table of Contents for your convenient navigation.



General Suggested Materials: The following list is meant to serve as a helpful starting point. There may be items specific to each challenge in addition to those outlined below.

- Computers with internet access
 - The D&P Website: <https://sites.ced.ncsu.edu/design-and-pitch/>
- Presentation tools like PowerPoint, cameras, movie-making programs
- 2-3 judges (for the culminating event)

General Teacher Preparation:

- **Become familiar with the challenge** – Be sure you have walked yourself through the challenge, reading over the materials and the resources available to students.
- **Collect materials** – You might limit this to supplies you already have in the classroom or allow students to bring in materials from home to encourage creativity. After students brief themselves about the challenge, you might have students help describe the list of possible materials they might need, given any possible constraints like costs, size, etc.
- **Confirm online access for students** – Research is a primary component to the D&P Challenges, so students will need to have access to the internet. This can also be helpful in sharing documents and materials.
- **Set a date for the “judging”** – Be sure all of your judges can attend the competition!
- **Prep your judges** – Be sure to schedule a meeting with your judges ahead of time. During this meeting, have the judges watch the *Setting the Stage with Your Challenge Champion Video* and review the *Pitch Judging Sheet*.
- **Consider what format the culminating activity will take** – Will this be a district-wide or school-wide competition, or will this be implemented in a classroom?

Tips from Other Teachers:

- **Use the Challenges to teach 21st century skills** – So many soft skills are built into the D&P Challenge Process, so be sure to use the process as a chance to teach presentation, organization, teamwork, and many other skills that students need to have to be successful in the 21st century
- **Bring other teachers on board** – Depending on the challenge you and your students choose to tackle, you might consider working with another content teacher to cover more standards and increase the levels of engagement and learning

Questions?

The D&P Team is here to help! If you have questions, email us at design_pitch@ncsu.edu.

What is Pollution Solution all about?

The world is becoming overwhelmed by plastic waste, especially single-use plastic containers that hold consumer products. Can you imagine a solution to replace plastics that does not cause as much harm to the environment?

This is the question posed to students in the Pollution Solution challenge. In the [Launch](#), students are introduced to Challenge Champion Clifford Okoth Owino, a chemist and entrepreneur who decided to tackle the issue of plastic waste in his community. This champion explains that plastic products are an issue for the planet and challenges savvy, social entrepreneurs to develop an alternative to single-use plastic liquid containers.

Along the way, Okoth Owino offers tips and suggestions for the students as they research their possible solutions and begin developing their businesses. [Several resources](#) are provided to aid in students' research, but they are encouraged to reach beyond these resources to find the information they need.

Why might my students find this challenge interesting?

Pollution Solution was designed to encourage creativity and personalization for students. This challenge requires students to explore alternative packaging for liquid products, but they may choose to package any product they like, including, but certainly not limited to, water, juice, soap, and laundry detergent. We have even seen teams tackle food items, such as honey! The mathematical goal for this challenge is to get students to consider critical aspects of 3D figures, including surface area and volume. As such, any product idea that allows them to think creatively about packaging will work.












DESIGN & PITCH CHALLENGE

WHERE'S THE MATH?

Each challenge has been carefully designed to align to the Common Core State Standards for Mathematics (CCSS-M). To make your job easier, we have compiled a brief overview of each challenge, including a summary of mathematical topics and a list of CCSS-M standards covered within each one. We categorize each standard as either a standard we intend for students to encounter or an additional standard students might encounter. The **standards we intend for students to encounter** are standards we anticipate will be covered by solutions that meet the requirements of the challenge. The **additional standards that students might encounter** are standards that students could uncover as they are digging into their solutions but are not the focus of the challenge.

Our team has created several overview documents to help you get a quick glance at all nine challenges. The [Challenge Matrix](#), pictured below, provides you with a one-page reference sheet that includes the Challenge Image, Title, Description, Champion, and Mathematical Topics. The [Standards Alignment](#) document enumerates the concepts most likely to come out during the challenge for each of the D&P challenges. These documents are all available on the Teacher Resources page of the D&P website.

Design and Pitch: Challenges in STEM				
Overview of Challenges				
Challenge Image	Challenge Title	Description	Challenge Champion	Mathematical Topics
	Operation Lifeline	During natural disasters, delivering essential supplies like water, food, and medicine becomes a race against time. This challenge becomes even harder when the supplies have to be kept cold the whole time so that they don't spoil. In this Design & Pitch Challenge, you will find a workable solution for this important problem.	Kris Ludwig Scientist at the United States Geological Survey	3-D Figures; Proportional Reasoning
	Power Me Up	Gas-powered vehicles release harmful greenhouse gases and rely on a natural resource that will someday be gone. As a result, more and more people are buying electric vehicles. More electric vehicles means there is a need for more electric vehicle charging stations. This is an opportunity for savvy entrepreneurs. In this Design & Pitch Challenge, you will plan design a company that builds charging stations for electric vehicles.	Kristin Vicari Senior Chemical Engineer at Tesla	Analyzing Data; Proportional Reasoning
	Keep It Real	Smartphones are everywhere. They make so many things easier. We can get a ride, order a pizza, and connect with people across the world with a single tap of the screen. But what happens when smartphones get in the way of communication? In this Design & Pitch Challenge, you will design a way to help people put down their phones and connect, face-to-face.	Cardell Patillo Executive Director of Mile High Kids	Collecting, Analyzing, and Representing Data
	Building Algorithms	In today's internet world, data on people's opinions are highly prized. One way to understand those opinions is to ask people to complete surveys. Researchers then create formulas, or algorithms, that analyze their survey responses in an automated process. Many successful businesses are built around algorithms. Your challenge is to build an algorithm that uses people's opinions to rate or rank something you care about and that can be the start of a successful business.	Cathy Yee CEO & Founder of Includic	Equations and Inequalities; Percentages
	Prototype to Profit	Being an entrepreneur is about finding problems and turning them into opportunities. It's about inventing new solutions that create value for customers and using those solutions to make money, because even the best ideas need funding to succeed. At the heart of making money is finding the right business model type. The right business model type can be the difference between success and failure for an idea. And, sometimes, the business model type itself is the solution.	Tyler Maloney Materials Science Engineer & Entrepreneur	Representing and Solving Linear Functions
	Erase Food Waste	The way food looks is one indicator of whether it is safe to eat. But in the United States, we take this idea too far. Most grocery stores and restaurants won't offer produce to their customers that isn't perfectly shaped and colored, even if it is perfectly safe to eat. This results in a lot of food waste. In this Design & Pitch Challenge, you will design a food-related business that uses a sliding price scale to reduce food waste.	Oscar Ekponimo Founder & CEO of Chowberry	Percentages; Data Collection and Analysis
	Fix It: Design for Community Impact	In every community, there are problems that need solving or things that need improving. The most effective solutions are ones that meet the needs and desires of the community. If you pay attention and ask questions, you will notice what people want and what they need. Entrepreneurs don't wait on the sidelines for others to do the work. They jump in and use their energy and passion to make change happen. What can you fix in your community?	Gitanjali Rao Inventor & STEM Promoter	Proportions; Transformations; 3-D Figures
	Flashy Fashion	Technology can now be integrated into clothes, bags, and wearable devices for both self-expression and health & safety applications. Designers' creativity is shining in fashion shows, and tools like LEDs are now accessible enough that anyone can learn to make wearable technology. How will your design light up the world?	Kelley Dominick Designer & CEO of DiDomenico Design	Coordinate Plane; Transformations; Domain and Range
	Pollution Solution	Plastic is a big environmental problem. The world is becoming overwhelmed by plastic waste, especially plastic containers that hold consumer products. Can you imagine a solution to replace plastics that does not cause as much harm to the environment?	Clifford Okoth Owino Founder & CEO of Chemolex	3-D Figures; Data Collection and Analysis

Summary

In Pollution Solution, students will be expected to calculate and justify the **volume** and **surface area** of 3-D figures. Students will use existing or novel alternatives to plastic to package and sell a liquid product. They will need to research plastic alternatives, determine the liquid product, decide how much of the product will fit in the package, and figure out how to package the product for shipping.

Standards

In building their solutions, students are likely to engage with the following mathematical standards.

Standards We Intend for Students to Encounter

- Geometry
 - Measuring Characteristics of 3-D Figures [7.G.B.6](#), [8.G.C.9](#)
 - Apply the formula for surface area to determine how much material to use when considering the size and shape of your product.
 - Apply the formula for surface area to determine the optimal shipping container.
 - Apply the formula for volume to determine the size/capacity of the product.
 - Apply the formula for volume to determine the optimal shipping container.

Additional Standards Students Might Encounter

- Geometry
 - Measuring Characteristics of 3-D Figures [6.G.A.1](#), [6.G.A.4](#)

Opportunities for Math in the Challenge

After deciding on their product material, students will need to apply the concepts of **surface area** and **volume** to compare possible sizes and shapes of their container. Students should keep **cost** in mind to ensure that they are creating a product that will be profitable and a reasonable option to replace the plastic containers that are already in use. To understand the cost, students may want to research current **average sales** of their liquid consumable product.

Once students have determined the optimal material, size, and shape of their product, they will need to determine the best shipping container for their product. They will again apply the concepts of **surface area** and **volume** and should compare the prices of different materials.

Math Resources - Workshops

One way to help students achieve the intended math goals for a challenge is to have small group workshops with your students. These workshops allow you to instruct and remediate on targeted math concepts as needed. You can run workshops with select students, a single team, multiple teams, or the whole class depending on the needs of your students. For example, in Pollution Solution, you may find that you need to help your students brush up on calculating surface area. This is a topic that can be addressed using a workshop model. By pulling a small group of students together for a workshop on surface area, you will be able to address individual needs and misconceptions while situating the math in the context of students' specific solutions.

Tech Tools

Each of the D&P Challenges includes a Tech Tool that is designed to help students develop a deeper understanding of the mathematical content embedded in the Challenge. For Pollution Solution, if you choose to have your students use it, the Tech Tool is TinkerCAD, an online drafting program that allows students to design almost anything they can imagine. We chose TinkerCAD because it is a popular web-based platform that also incorporates tools for mathematical understanding, including a series of measuring tools that will be useful for students as they calculate the surface areas and volumes of their solutions. You can access TinkerCAD through a few places on our website. There are links at the bottom of the [Prepare](#) page, and it is also featured on the [Tech Tools](#) section of the website.



Ways to Use D&P

Design & Pitch challenges can be used in a variety of ways - as core or supplemental materials and in both in-school and out-of-school settings (e.g., after-school clubs, summer camps, Boys & Girls Clubs). There is no “right” way to implement the challenges. Instead, we encourage you to think about how D&P can best fit into your classroom. The D&P team offers professional development opportunities to help teachers dive into the materials in a fun, collaborative setting, and we are happy to meet one-on-one with any teacher who is interested in using the challenges.

Classroom Implementation

For your pacing purposes, we have broken the D&P Process into 6 sessions, which can be found on the next page. You will also find a “Session 0” that can be helpful for those teachers and students experiencing Design & Pitch for the first time. Each of these sessions assumes students will have a 45-minute class period in which to work. For longer or shorter class periods, consider adapting the sessions to meet your needs.

In the past, we have seen teachers complete multiple challenges in a semester, implementing some challenges over consecutive days and completing others a couple days per week for a couple months. The goal is to fit D&P into your schedule rather than try to squeeze the diverse needs of your students into a regimented box.

Including the Community

D&P challenges are also well positioned to provide opportunities for schools to connect with and engage family members, community members, local businesses, and/or town governments. Local STEM professionals or other members of the community with expertise in areas relevant to each challenge can serve as mentors throughout the design process, offering feedback on prototypes and business plans, and may be recruited to judge final projects.



Session 0

If it is your first time using Design & Pitch Materials, a day introducing the ideas may be advisable. Introduce the idea of D&P, what it means to be an entrepreneur, and what a pitch competition is.

Students discuss the Entrepreneurial Wheel and the D&P Process flowchart (see p. 4).

Briefly discuss the various aspects of the D&P Challenges (e.g., Challenge Statement, Key Business Proposition, Tech Brief, Pitch).

Session 1

Launch: Introduce Challenge (video and Challenge Statement); form teams of 3-4 students.

Prepare: Students begin exploring and researching, including Helpful Resources on the Prepare page of the website. Students brainstorm ideas and sketch initial solution.

Engage: Review things students should submit by the end of the Challenge (which can be found on the Engage page) at this time.

Session 2

Engage: Students review Business Models and begin working on Key Business Proposition (KBP).

Students discuss initial thoughts about their business model and what their customers and/or users want.

Students revise product in light of business model and KBP.

Session 3

Engage: Introduce Technical Brief and Technical Brief Grading Rubric.

Students conduct further research and design prototype.

Session 4

Engage/Persuade: Students review How to Build a Pitch and Pitch Judging resources.

Students build initial pitch deck.

If able, students conduct tests on their prototypes and make final revisions.

Teams continue working on Technical Briefs.

Session 5

Engage: Students discuss and finalize KBP.

Engage/Persuade: Students present pitch to practice judges for feedback. Students analyze feedback and revise their pitches, solutions, and business propositions.

Teams revise and complete Technical Brief and Pitch.

Session 6

Students pitch their solutions to a panel of judges (possible investors).

Students hand in Technical Briefs.

Winner(s) announced.

Optional: Awards / Celebration

Launch

Once you have selected and prepared for a challenge, it is time to [launch](#) the challenge with your students. Each challenge includes a Challenge Statement video, in which the Challenge Champion (each challenge has a unique Champion to guide the students through the Launch and Prepare sections) establishes the context or problem and formally issues the challenge. In the video for Pollution Solution, chemist and renewable energy entrepreneur Clifford Okoth Owino briefly explains why plastics are a threat to the environment and introduces the components of the challenge.

Summary and Scenario

Following the Challenge Statement video is a Summary and Scenario section, where the challenge is briefly summarized for the students. This section also begins to explore the significance of the issue so as to convince students that this problem deserves their attention. In the Pollution Solution challenge, for example, students are presented with the fact that in February 2019, a whale was found washed up on a California beach with over 80 pounds of plastic in its stomach! This shocking fact plays to the emotional side of students who care about animals and the environment, though this is just one angle to convince students of the need for plastic alternatives.

As you launch the challenge with your students, you might consider showing them additional videos that emphasize the issue in your specific challenge or facilitating a discussion in which you encourage them to reflect on their experiences with the issue. For Pollution Solution, for example, you might show news stories that highlight pollution or images that show the harmful effects plastics can have on wildlife. The goal here is to tailor this section of the challenge to your students' interests and grab their attention; this is the time to bring out your teacher 'hook!'

Challenge Statement

The final piece of the Launch is the [Challenge Statement](#) itself. This document outlines the challenge and describes the areas that should be addressed by the students' products/solutions and businesses. While the students are encouraged to be innovative in their solutions, the following criteria are laid out to get students to interact with the targeted math topics. The Challenge Statement for Pollution Solution explains that the students are to **propose a business around producing and selling a liquid consumer product that is packaged in a dissolvable or edible plastic container** and that their business should include:

1. A description of the liquid consumer product your business will sell and its purpose.
2. A justification of the most appropriate shape and size for your product, given its purpose.

3. A detailed plan, with justification, for how you will package and ship your product.*

* Your plan for how you will package and ship your product must include a description of the size, shape, surface area, and volume of the optimal shipping container, including the ratio of surface area to volume. Demonstrate how those choices will protect your product and be cost-effective. Be sure to justify your choices in your Technical Brief.

Brainstorming

As you introduce the challenge to your students, it is important to allow them to brainstorm along the way. They might be thinking about issues they find important or possible solutions. They might be thinking of business strategies or about the final pitch. They might be thinking about questions they have or things they will need to know along the way. As such, they might need help organizing their thoughts, and brainstorming as a class or small group can help them do this. If students have already been organized into groups, you can have them record their brainstorming somewhere that will be accessible for all group members; if you are brainstorming as a class, you might consider recording ideas on a poster board or bulletin board so the class can refer back to their original thoughts later.



Prepare

In this part of the challenge, students will conduct the research necessary to design and market their product. In order to facilitate this part of the challenge, we have included several tools on the [Prepare](#) section of the website.

Tips From Your Challenge Champion

At the top of the [Prepare](#) page, you will find a brief biography of the Challenge Champion, followed by a Background video from this expert. In Pollution Solution, Clifford Okoth Owino takes students on a deeper dive into his background and the steps he took to turn the issue of an invasive water-based plant into an opportunity to give back to his community by turning that plant into a bioplastic.

Helpful Resources on Pollution and Sustainability

Below the Background video, we have included several resources that students might find helpful as they learn more about pollution and existing solutions. These resources include articles, websites, videos, and much more. Students are encouraged to peruse these resources and go beyond those listed on the website to learn as much as they can about the issues surrounding plastics and pollution before they begin designing their product and as they continue to test and refine their solutions.



Prototyping

Once students are familiar with the requirements and context of the challenge, it is time for them to begin working on their solution. This is a great opportunity to check in with students as they work. Ask them to explain their entrepreneurial solution and follow up with questions that drive back at the challenge criteria. For example, if students are designing edible water pods, ask them how much water each pod will hold and how they know. Explain that judges will want to know the specifics of the solution.

Research

Depending on the ideas your students develop, they may need to go beyond the resources provided to understand what their solution might require. For example, your students might want to design a packaging material other than the ones they learned about on the Prepare page of the D&P website. That is wonderful, and we encourage students to be as inventive as possible! It might require them to do some additional digging, though, and this is where they can begin that research.

Design

Once students understand what their solution will require, they are ready to begin designing their solution. This might involve sketches or 3D models; for Pollution Solution, we recommend students use [TinkerCAD](#) to design their 3D model. To help students become familiar with this tool, we provide several resources, including a [How To Use TinkerCAD Guide](#) and TinkerCAD-created tutorials for specific skills. These resources can all be found on the [Tech Tools](#) page of the D&P website.

Test and Refine

The brilliance of entrepreneurship is that designs that don't work are viewed as learning opportunities. As students test their initial designs, they might find that something went wrong. Maybe their first sketch is too small to hold their liquid. Maybe the shape is too strange to be packaged efficiently. For our young entrepreneurs, this is a chance to take a step back, re-evaluate, and refine their design. This is a good time to encourage your students to revisit (or take a first look at) the helpful resources on the Launch page. It might take several attempts before they find something that works, and that is okay.

As a teacher, you have a lot of flexibility in how you run this part of the challenge. Some teachers have groups pair up to share their ideas and give feedback. Other teachers have done this as a whole class discussion. This is a great time to practice informal presentation skills and giving constructive feedback.

Developing a Business

The Design & Pitch Challenges are a great way to get students to think creatively about real-world issues, but they are also about building a viable business. As such, one part of the D&P Challenges that students must consider is the Key Business Proposition.

Business Models

One of the first questions students must answer about their business is how their solution is going to create value, which includes identifying a business model so that you can reach your target customers. We have provided a [list of common business models](#) for students to consider. This list is not comprehensive; students are welcome to research and select a business model that is not on this list.

Key Business Proposition

Once students have decided on the model for their business, they can begin working on the [Key Business Proposition](#). This document is designed to get students thinking about a variety of business-related questions, including the following:

- Who are your customers and/or users? What do they want out of a solution?
- Why do they need your design more than someone else's?
- How does your solution enhance what customers like about their situation and fix what they dislike?

We find that students often lose sight of the customer through the process of designing their solution, and the Key Business Proposition can be used to remind them of the ultimate goal: design a product *to help* someone or some community. This is another opportunity to drive the students back to the targeted math goals. Asking questions like “How did you decide the amount of liquid your product will hold?” and “What aspects of your product will make customers want to buy it?” is a great way for students to think about both the math and the needs of their customers. You might also encourage students to think about their own experiences with similar products as they begin to justify what customers want or need.



Technical Brief

The [Technical Brief, or “Tech Brief.”](#) gives students the opportunity to reflect on the D&P process and their solutions and connects directly to the targeted math concepts. As such, it can be completed along the way or after the final pitch and provides you the opportunity for small group instruction as needed. Some of the questions ask students to identify strengths they noticed and challenges they overcame along the way, so you might want to encourage students to be thinking about these items as they are working on their solution.

There are seven parts to the Tech Brief, which are outlined below. The first six parts are common to all nine D&P Challenges, though Part 1 often asks students how their solution works within the context of the specific challenge. Part 7, however, is challenge specific and drives students to think about the math behind their solutions.

- Part 1.** Briefly describe your solution and how it decreases the negative impact of single-use plastics on the environment.
- Part 2.** Describe the mathematics, science, and engineering you researched to design your product. Include links to websites or other resources you used.
- Part 3.** Describe the decisions you made to choose your design and the challenge you had to overcome.
- Part 4.** How did developing your Key Business Proposition and related Business Models Type affect your process?
- Part 5.** Your final solution probably looked different from your original idea. Describe the process for how you developed your idea from start to finish.
- Part 6.** How well do you think your solution will work under real-world conditions? Explain your reasoning.
- Part 7.** Fully describe your Pollution Solution based on the questions below.
 - 1. What liquid consumer product did you choose to repackage?
 - 2. How will you package your liquid product?
 - 3. How will you ship your product?
 - 4. How will your product help the environment?

Grading Rubric

Teachers often ask us how they can assign a grade to the D&P Challenges. While there are many ways you might choose to assign a numeric or letter grade to your students’ work, we provide [a rubric](#) for the Tech Brief to help you assess the mathematical content behind each solution. Each rubric is designed to align to Part 7 of the Tech Brief and is unique for each challenge. In keeping with the entrepreneurial spirit, criteria are rated as “Getting Started,” “Improving,” “Good,” or “Excellent” in order to encourage students to keep working hard.

Prepare and Practice the Pitch

Once your students have designed and refined their solutions, it is time for them to pitch their ideas to the investors. As students begin to build their pitch deck (i.e., the slides they will use to present their solutions to the judges), it will be useful for them to review two resources that can be found on the Engage and Persuade pages of the website: [How to Build a Pitch](#), which walks students through the components of a successful business pitch; and the [Pitch Judging Sheet](#) – a score sheet that judges will use to evaluate each of the solutions and choose a winning team.

On the [Persuade](#) page, students also have access to three example pitch decks from existing companies (Air BnB, YouTube, and Podozi). These are meant to serve as idea-generating examples, not templates, for the students to use to understand what a pitch *can* look like and how important elements can be incorporated into a winning pitch. Once students have developed their initial pitch decks, they should practice the pitch before delivering it to investors. This can take a variety of forms, including having teams pitch to one another, to the whole class, or to a single individual (e.g., teacher, administrator, or community member). This is a time for the students to receive critical feedback so they can develop their ideas more completely before the final pitch.

Deliver the Pitch

Presenting the pitch is one of the most exciting parts of the competition for students (and teachers). All of the hard work each student has put in up to this point culminates in this persuasive presentation. As a standard rule, students only have five minutes to pitch their solution to the panel of judges (more on the judges below), though you, as a teacher, have control over how long students have to present. The suggested five minutes encourages students to be succinct and helps them to become effective communicators. In addition to overall winners, we encourage you to assign superlatives to all teams, such as awarding Best Business Design, Most Creative Solution, Best Pitch or Most Engaging Pitch, Overall Best Solution.

Preparing a Panel of Judges

Students love the opportunity to share their work with people external to the classroom. In the past, we have seen panels of principals, parents, community members, college professors, and other experts from the field. For Pollution Solution, you might consider members of your community who have experience working as chemical engineers or in other environmental roles. To help your judges prepare for their role, provide them with some background info, such as a link to the challenge website, and the [Pitch Judging Sheet](#) ahead of time so that they can understand what they are going to be judging. As for grading the pitch, some teachers use the Pitch Judging Sheet to assign a grade, some develop their own method for scoring the pitch, and still others choose not to assign a grade to this part of the Challenge. We encourage you to think about what works best for your classroom and assessment practices.

This teacher’s guide was created by the Design & Pitch team, a group of mathematics education researchers in the Department of STEM Education at North Carolina State University. The D&P materials were created in partnership with Scaling Up Digital Design Studies (SUDDS), Exploring Mathematics Curricula Creatively (EMC²), and JASON Learning.

