

## Welcome to the Design & Pitch Challenges in STEM: Merging Entrepreneurship and Mathematics Learning!

Whether you are a classroom educator, after-school provider, summer camp instructor, or another educational facilitator, we are excited to have you join the team of innovative practitioners bringing entrepreneurship and career readiness to the forefront of STEM.

The Design & Pitch (D&P) Challenges in STEM is a curricular framework that situates rich STEM learning, especially mathematics, within justice-oriented entrepreneurial pitch competitions. Combining features of design-based learning, project-based learning, and entrepreneurial-based learning, the framework challenges students to use their STEM knowledge and skills to invent viable and user-focused solutions to real-world problems that seek to address a range of community-based justice issues, including social, environmental, and spatial. In doing so, students develop essential STEM skills as they craft persuasive arguments, collaborate with teammates, find their unique advantages, and leverage entrepreneurship to make their solutions actionable and sustainable.

Created by instructional experts from the Exploring Mathematics Curricula Creatively (EMC<sup>2</sup>) team at North Carolina State University and JASON Learning, with funding from the National Science Foundation, Design & Pitch provides districts with a program that provides explicit guidelines and digital resources to support:

- **Math (STEM) Literacy:** Deepen students' understanding and ability to apply key math (STEM) concepts in a variety of contexts.
- **Entrepreneurial Mindset:** Develop and celebrate the entrepreneurial mindset of students, educators, district leadership, and community members
- **Community Involvement:** Leverage productive community engagement while building support for schools.
- **Engagement:** Engage a wide range of educators (multidisciplinary) and students (9 -12) by providing challenges that reflect a variety of contexts and career fields.

# DESIGN & PITCH CHALLENGE

## MODEL OVERVIEW

- **Empathy:** Build intellectual and emotional capacity of educators and students to embrace the opportunity to identify and solve local justice-oriented community challenges while developing 21st-century skills.
- **Implementation:** *Design and Pitch Challenges in STEM **does not** require districts to purchase specialized equipment.* Professional development is available from JASON Learning and by the NCSU EMC<sup>2</sup> research team.

Below, we have included several resources that will help you implement the Design & Pitch Challenges in STEM with your students. These resources include: 1) a list of Teacher Tips for preparing to implement a challenge; 2) an overview of the mathematics standards and topics covered by each challenge; and 3) a sample 6-day pacing guide.

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](mailto:design_pitch@ncsu.edu). We are here to help you in whatever way we can!

### Teacher Tips for Preparing to Implement a Challenge

#### 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
- 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. \*Note: If your students do not have internet access, consider printing the PDF versions of the materials available on our website.
- ***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*. Allow for question-and-answers so all are on the same page.
- ***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?

# DESIGN & PITCH CHALLENGE

## TIPS FOR TEACHERS

### Tips from Other Teachers:

- **Use the Challenges to teach 21<sup>st</sup> 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 21<sup>st</sup> 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! Email us with any questions at [design\\_pitch@ncsu.edu](mailto:design_pitch@ncsu.edu).

### 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 covered within each one.

More detailed standards alignment information for each challenge can be found in the teacher resources for the specific challenge, where we list the standards that we intend for students to encounter as well as additional standards that 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.

### Ways to Use Design & Pitch:

Design and Pitch Challenges can be implemented as a single-classroom activity, in out-of-school settings (e.g., after-school clubs or summer camps), or as a learning experience that involves a broader community. 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

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## TIPS FOR TEACHERS

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**

Regardless of the implementation model, the D&P challenges are 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.

# DESIGN & PITCH CHALLENGE

## CHALLENGE OVERVIEWS

### Design and Pitch Challenges in STEM

Explore all nine of the Design and Pitch Challenges in STEM! In the table below, we include a description of each challenge and its math focus. We also include the primary justice focus for each challenge. However, each challenge opens the space for students to invent solutions to issues that they find relevant.

Challenge Title	Challenge:	Math Integration (STEM):
<a href="#">Reduce, Reuse, Repurpose</a>	Your challenge is to create a product for a customer using existing waste items in a different way from their original purpose.	In designing their solutions, students build composite 3D figures and consider cross sections. In quantifying the environmental impact of their solutions, students consider the volume of 3D composite figures.
<b>Primary justice focus:</b> Environmental		
<a href="#">Negate Noise</a>	Your challenge is to invent a product that harnesses noise cancelling technology to reduce noise pollution and make the world more accessible.	Students write trigonometric functions to model sound waves and create graphs of trigonometric functions to demonstrate how their solutions cancel noises.
<b>Primary justice focus:</b> Social		
<a href="#">Routes Reimagined</a>	Your challenge is to design a navigation app that allows users to plan routes based on criteria they value and predict their estimated travel time and distance.	Students use linear functions (and potentially piecewise functions) to program their apps to estimate travel times, travel distances, and arrival times.
<b>Multiple justice focuses:</b> Social, Environmental, or Spatial		

Challenge Title	Challenge:	Math Integration (STEM):
<a href="#">Gaming for Change</a>	Your challenge is to design a video game that helps improve people's well-being by leveraging projectile motion while connecting with others or practicing healthy habits.	Students will use quadratic equations to plan and model the projectile motion included in their game.
<b>Primary justice focus:</b> Social		
<a href="#">Goal Tracker</a>	Your challenge is to design a business that helps users change unwanted behaviors or develop new healthy habits through tracking and visualizing their progress.	Students will build, evaluate, and interpret functions that map changes in performance onto changes in a visualization. The challenge was left open to allow students to explore contexts (and categories of justice) that they find relevant and worth addressing.
<b>Multiple justice focuses:</b> Social, Environmental, or Spatial		
<a href="#">Backed by Data</a>	Your challenge is to design a business that publishes stories, news, or content that use statistical investigations to retell overlooked or misunderstood stories.	Students will use statistical analysis to combine multiple data sources to create one new quantitative variable which can be represented in a meaningful way to retell a story.
<b>Multiple justice focuses:</b> Social, Environmental, Healthcare, Education, Hunger		
Challenge 7	Machine Learning	Conditional Probability
Challenge 8	Networks	Graph Theory and Networks
Challenge 9	TBD	

### Challenge Pacing Guide

As you and your students become more familiar with the D&P Challenges, you might find that you can spend less time on certain activities that are common to all of the challenges, like reviewing the various Business Models or the How to Build a Pitch document, though these resources are available in each challenge for you and your students to review as needed. Specific educator facilitation notes are embedded in all articles and activities. For a description of each phase of a challenge, see the attached Student Instructions article.

Session	Brief Description	Related Resources
0	<p>If it is your first time using Design &amp; Pitch Materials, a day introducing the ideas may be advisable. Introduce the idea of D&amp;P, what it means to be an entrepreneur, and what a pitch competition is.</p> <p>Students discuss the Entrepreneurial Wheel and the Designing Solutions document. Briefly discuss the components of the D&amp;P Challenges (e.g., Challenge Statement, Key Business Proposition, Tech Brief, Pitch)</p>	<ul style="list-style-type: none"> <li>• Entrepreneurial Role Model Videos</li> <li>• Entrepreneurial Wheel</li> <li>• D&amp;P Student Instructions</li> </ul>
1	<p><b>Launch:</b> Introduce Challenge (video and Challenge Statement); form teams of 3-4 students. Review with students what they will need to submit by the end of the challenge (prototype solution, Key Business Proposition, Technical Brief, and pitch deck).</p> <p><b>Design - Research and Prototype:</b> Students begin exploring the context and possible solutions. In their teams, students should engage with the Helpful Resources and begin brainstorming ideas and sketching their initial solutions.</p>	<ul style="list-style-type: none"> <li>• Video: Setting the Stage with Your Challenge Champion</li> <li>• Article: Challenge Statement</li> <li>• Article: Designing Solutions</li> <li>• Activity: Think About It</li> </ul>
2	<p><b>Design - Research and Prototype:</b> Students continue researching and designing their solutions. Either in their teams or as a class, students can watch the Challenge Background videos.</p> <p><b>Design - Justify and Prototype:</b> Students review the</p>	<ul style="list-style-type: none"> <li>• Videos: Challenge Background and Champion</li> <li>• Activity: Helpful Digital Resources</li> <li>• Article: Business</li> </ul>

Session	Brief Description	Related Resources
	Business Model Types document and begin working on the Key Business Proposition (KBP). Students discuss initial thoughts about their business model and what their customers and/or users want in a solution. Students revise their solutions in light of their business model and KBP.	<p>Models</p> <ul style="list-style-type: none"> <li>● Activity: Key Business Proposition</li> <li>● Activity: Think About It</li> </ul>
3	<b>Design - Prototype &amp; Justify:</b> Students begin working to justify their solutions using the Technical Brief and the by consulting the Technical Brief Grading Rubric. As students work on their Technical Brief, they should continue building and refining their prototype solutions.	<ul style="list-style-type: none"> <li>● Article: Tech Tools</li> <li>● Activity: Think About It</li> <li>● Activity: Technical Brief</li> <li>● Article: Technical Brief Rubric</li> </ul>
4	<b>Design - Prototype &amp; Justify:</b> Using the How to Build a Pitch document and the Pitch Judging Resources, students begin to build their pitches. As students work on their pitches, they continue to build, test, and refine their prototype solutions and complete their KBPs and Technical Briefs.	<ul style="list-style-type: none"> <li>● Tech Tools</li> <li>● Think About It</li> <li>● Technical Brief</li> <li>● Technical Brief Rubric</li> </ul>
5	<b>Pitch - The Practice Pitch:</b> Students practice their final pitches with practice judges (not the final judges) for feedback. Students analyze feedback and revise their pitches, solutions, KBPs, and Technical Briefs.	<ul style="list-style-type: none"> <li>● How to Build a Pitch</li> <li>● Pitch Deck</li> <li>● Example Pitches</li> </ul>
6	<b>Pitch - The Final Pitch:</b> Students pitch their solutions to a panel of judges (potential investors). Judges announce the winners. After completing their pitches, teams complete and submit their Technical Briefs, KBPs, and prototype solutions.	<ul style="list-style-type: none"> <li>● Evaluate Your Pitch</li> <li>● Think About It</li> </ul>