Inclusive iSTeM
Teacher Starter Guide

How to use this Starter Guide.

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About Inclusive iSTeM

What is Inclusive iSTeM?

Inclusive iSTeM

i – Integrated

S – Science

T – Technology

e – Engineering

M – Mathematics

Inclusive iSTeM education is an interdisciplinary curriculum that exposes students to science, technology, engineering and mathematics through application, critical thinking, and problem based challenges. Through Inclusive iSTeM students are exposed to these distinct disciplines in a cohesive manner, linking their learning and understanding to challenging real world problems.

For more information please visit http://inclusive-istem.com/

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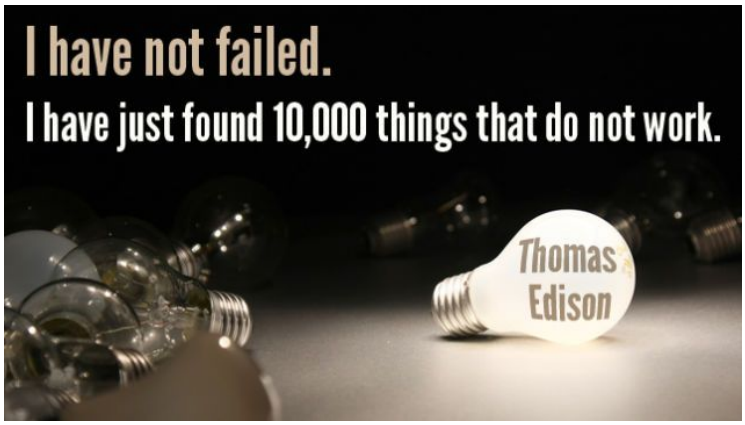
About Inclusive iSTeM

How do I incorporate Inclusive iSTeM into my classroom?

There are many ways to incorporate Inclusive iSTeM education into your classroom. For example, a core component of this curriculum is the use of the Engineering Design Process. This process encourages students to brainstorm various possibilities to a problem, create different sketches and prototypes, and test out multiple solutions. In addition, this process prompts students to continuously reflect throughout the entire learning process. By introducing students to this process teachers are encouraging students to explore while they learn and find new and creative solutions to problems.



Another way to incorporate Inclusive iSTeM into your classroom is by completing a design challenge. In this guide, there is an explanation of two types of design challenges, Mini Challenges and Content Driven Design Challenges. Both of these methods motivate students to complete tasks related to discipline topics and/or the Engineering Design Process. The primary purpose of Inclusive iSTeM education is to provide opportunities for students to collaborate and learn about topics in an interactive and unique way.

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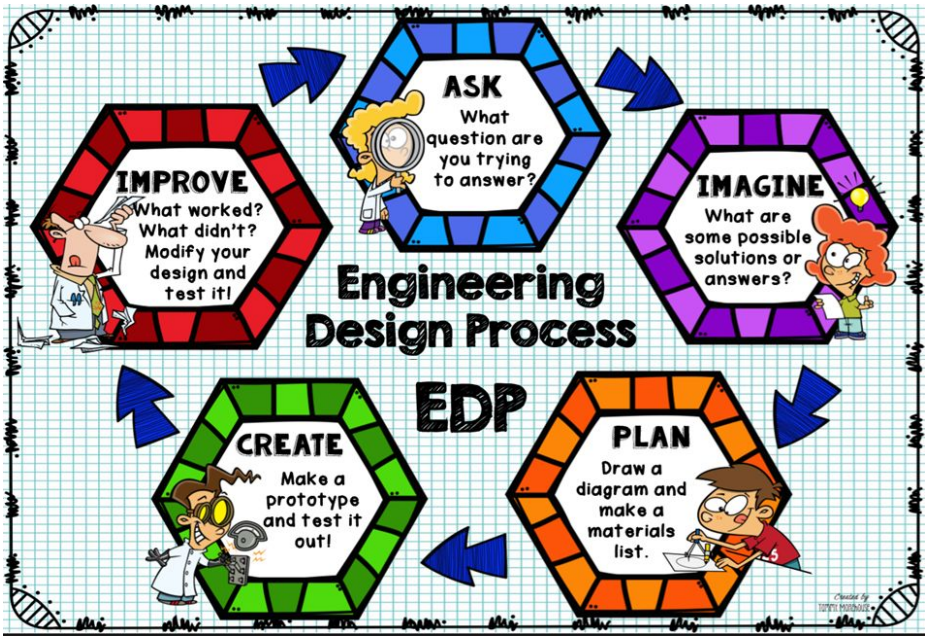
The Engineering Design Process

What are the steps?

The Engineering Design Process is a set of steps that encourages students to work through problems and determine solutions in a systematic and organized manner. There are many variations of the Engineering Design Process, however all these variations include these common steps:



1. ***Ask*** - What question are you trying to answer? What problem do you want to solve?
2. ***Imagine*** - What are some possible solutions to this problem? Brainstorm multiple ideas and possible solutions.
3. ***Plan*** - Develop a drawing, sketch, or diagram of your possible solutions. List out any necessary supplies or materials needed.
4. ***Create*** - Make a prototype or representation of the solution and test it out.
5. ***Improve*** - Reflect on your work. What worked? What did not work? Modify your design and retest your solution.

In the Additional Resources section you will find links to different visual representations of this process. While there may be slight differences, all these representations include core the steps listed above.

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Mini Design Challenges

What are Mini Design Challenges?

Mini Design Challenges are great ways to introduce your students to the Engineering Design Process and encourage teamwork in your classroom. These challenges can be completed in a short amount of time as an introductory activity and are a great way to prepare your students for completing a Content Driven Design Challenge. Here are two detailed Mini Design Challenges that prompt students to use the Engineering Design Process, and encourage students to communicate and work as a team.

The Marshmallow Challenge:

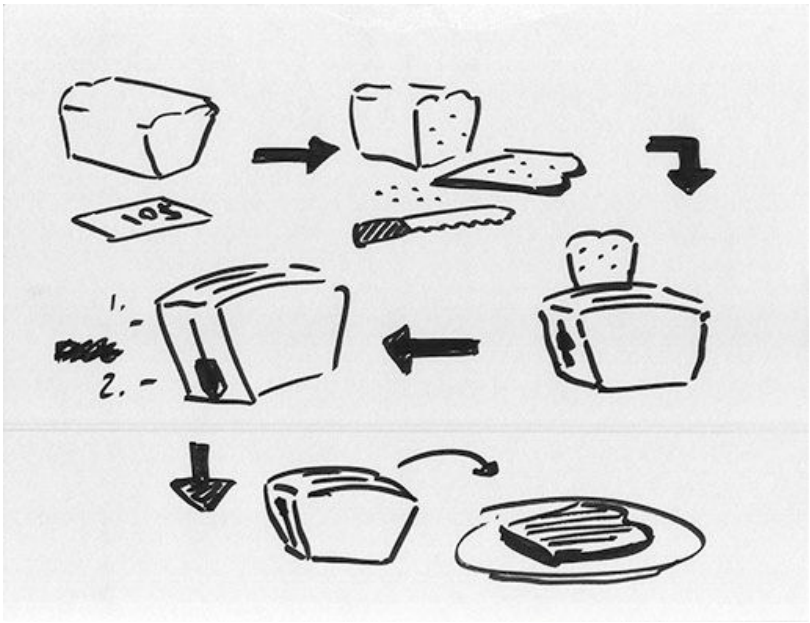
The Marshmallow Challenge is a quick and engaging activity that encourages students to collaborate and solve a seemingly simply problem. Directions for the challenge, as well as a summary video can be downloaded from this site;

http://www.tomwujec.com/design-projects/marshmallow-challenge/

The Marshmallow Challenge presents students with a simple challenge, create the tallest freestanding structure using the provided materials in the allotted time. Students work in teams of four, and engage in the Engineering Design Process without even realizing it. To complete this challenge as an introductory activity to a CDDC, implement the

challenge using the directions from the site, then present the video and discuss teams' successes and processes. Finally, introduce the Engineering Design Process and your planned CDDC. This Mini Design Challenge encourages students to work together and introduces them to the Engineering Design Process through a discovery activity.

Draw Toast:



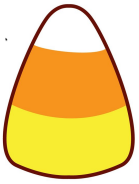
The Draw Toast Challenge requires students to explain a simple process using only pictures. Students are challenged to draw the process of making toast using only pictures (no words allowed). This challenges students to think about steps systematically and requires students to sketch out a common process. Directions for the challenge, as well as a summary video can be downloaded from this site; http://www.tomwujec.com/design-projects/draw-toast/

To complete this challenge as an introductory activity to a CDDC, implement the challenge using the directions from the site, then present the video and discuss teams' successes and processes. Finally, introduce the Engineering Design Process and your planned CDDC. This Mini Design

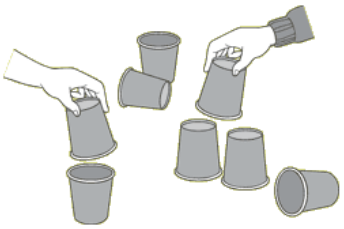
Challenge encourages students to think about procedures, details, and sketching as a form of communication.

Additional Mini Design Challenges for Middle School Students that Encourage Students to Use/Discover the Engineering Design Process:

(click the pictures and blue links to learn more about these challenges)





These challenges introduce students to the Engineering Design Process through discovery based collaborative tasks.

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Content Driven Design Challenge (CDDC)

Creating a CDDC

A Content Driven Design Challenge or CDDC is the name for the Inclusive iSTeM activity you will have your students complete. In completing a CDDC it is important to understand the necessary components and how to guide students through the process of completing the challenge. In creating a CDDC, teacher should plan the following critical components:

Problem Statement

What problem or challenge are your students trying to solve? This should be created by the teacher and present the challenge to the students by explaining the problem or question that needs a solution. The problem statement should relate to a real life problem and should not be a problem with one solution. The problem statement is designed to encourage students to think about the question being asked and explain the challenge in a clear and concise manner. For more information and examples visit, [*http://www.technologystudent.com/designpro/problem1.htm*](http://www.technologystudent.com/designpro/problem1.htm)

Interdisciplinary Connections

How does this challenge relate to other disciplines? Connecting your challenge to the discipline you teach is easy because you are an expert in your field. When it comes to connecting your challenge to other disciplines you may need more assistance. A good challenge encompasses multiple disciplines, connects to technology, and implements the Engineering Design Process. To connect the challenge to other disciplines reach out to teachers who teach those disciplines. Being able to connect the material to

multiple disciplines and incorporating multiple content specific topics creates a more meaningful and complex challenge for the students to solve.

Project Constraints or Criteria

What restrictions and requirements must students adhere to in completing the challenge? It is important to be clear and explicit in explaining the requirements and constraints for the challenge. Do students need to keep a log or inventor's notebook? Can they only work in class? What materials are they allowed to use? Does the challenge require that they present their findings in a specific manner? Be specific and clearly define any constraints or criteria after introducing the problem statement. While you don't want too many constraints on a challenge, it is important to define any necessary restrictions and requirements at the start of the challenge to guide your students through this process and ensure they complete the challenge.

For more information about important iSTeM lesson components visit, http://www.edweek.org/tm/articles/2014/06/17/ctq_jolly_stem.html

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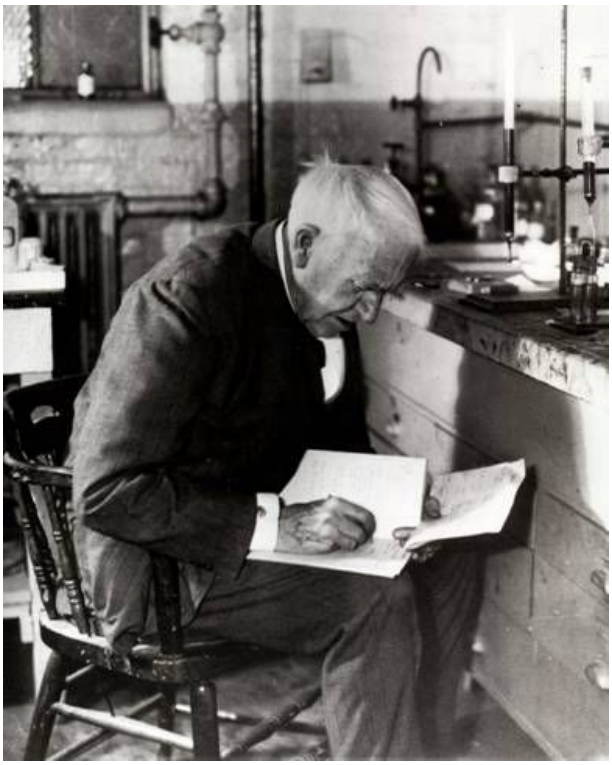
Inventor's Notebook

What is an Inventor's Notebook?



Many inventors keep a notebook/log/journal of their ideas, successes, and failures. An inventor's notebook, is a tool that students can use in completing a challenge. In an inventor's notebook students can document their ideas, questions, solutions, failures, and successes. Requiring students to keep an inventor's notebook documents their thought process throughout the challenge and gives teachers an opportunity to see their understanding in a clear and guided manner. The use of an inventor's notebook can also help students stay on task because the notebook should outline what students need to complete and when it must be completed. This tool can aid students, keeping them organized and ensuring that they document all their ideas and processes.

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Inventor's Notebook

How do I Create an Inventor's Notebook?

There are different ways to create an inventor's notebook. The inventor's notebook can be an actually hard copy notebook or packet for students to complete throughout the challenge. It could also be a digital document that students complete and collaborate within. Both Google Slides and Google Docs allow for students to share a document within their group to collaborate and edit individually or collectively. When using an online resource make sure that the students also share the slides or document with you. In creating an inventor's notebook it is important to keep in mind your specific challenge and incorporate components that will aid your students in completing the task. The inventor's notebook will vary based on your specific challenge. Here are some components to consider including within the notebook, a brainstorming section, a sketch of the solution, team roles list, challenge constraints and criteria.

Here is a link to a sample and downloadable inventor's notebook template

https://www.teacherspayteachers.com/Product/Free-STEM-Challenge-Mini-Journal-1807836

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Additional Resources

FREE Resources, Websites, and Videos!

Listed below are additional resources to help you incorporate inclusive iSTeM in your classroom.

Websites:

http://inclusive-istem.com/

http://www.stemedcoalition.org/

http://www.ed.gov/stem

http://www.pbs.org/teachers/stem/

http://pbskids.org/designsquad

Teacherspayteachers Freebies:

https://www.teacherspayteachers.com/FreeDownload/STEM-Engineering-Challenge-Projects-FREE-Student-Role-Sheets-040679300-1373438030

https://www.teacherspayteachers.com/Product/STEM-Challenge-Lab-Sheet-FREEBIE-1288783

https://www.teacherspayteachers.com/Product/STEM-Essentials-The-Nitty-Gritty-of-Teaching-STEM-1344370

https://www.teacherspayteachers.com/Product/STEM-Design-Cycle-FREE-Graphic-Organizer-970762

Videos:

https://www.youtube.com/watch?v=750kexRzWMk

https://www.youtube.com/watch?v=0wHF9iLyxic&list=PLhz12vamHOnZ4ZDCodS6C9HRN5Qrm0jHO

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