Lemelson-MIT Program Overview

National Awards

- Lemelson-MIT Prize
- Lemelson-MIT Program
- Lemelson-MIT Student Prize
- EurekaFest
- JV InvenTeams
- InvenTeams

Invention Education

- • **15 years of experience**
- • **228 high school teams**
- • **7 U.S. patents**

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Celebrating invention, inspiring youth

Presenters: Leon and Vickie Grant

- Pre-Engineering Teacher at Marietta High School (Leon)
  - Director of the MCS Engineering Pipeline (2014)
  - WEPAN Leader in Engineering Education Award (2017)
  - ACTE Carl Perkins Community Service Award (2017)
  - DiscoverE Educator Award (2015)
  - 10 years experience in manufacturing engineering
- Physical Science Teacher in STEM Magnet Program at Marietta Middle School, GA (Vickie)
  - Doctoral candidate at Piedmont College in Curriculum & Instruction, Dissertation: Middle School Science Teachers' Efficacy in Teaching Engineering in the Science Classroom

Invention Education Experience

- Haiti Container Building Project (Both)

- Lemelson-MIT InvenTeam (Leon)

- REAL World Design Challenge (Both)

- Intel ISEF (Both)

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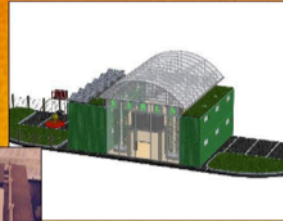*Celebrating invention, inspiring youth*
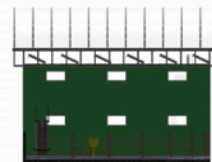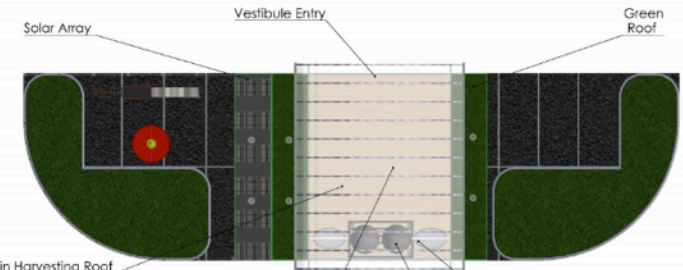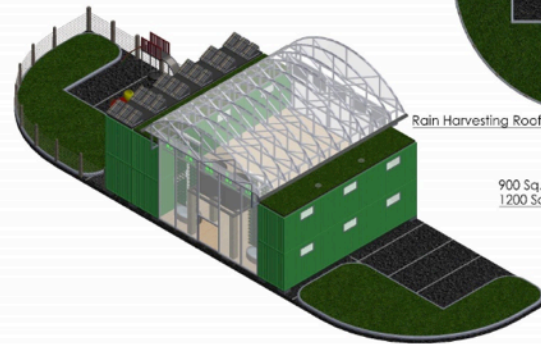
Haiti Container Building Project
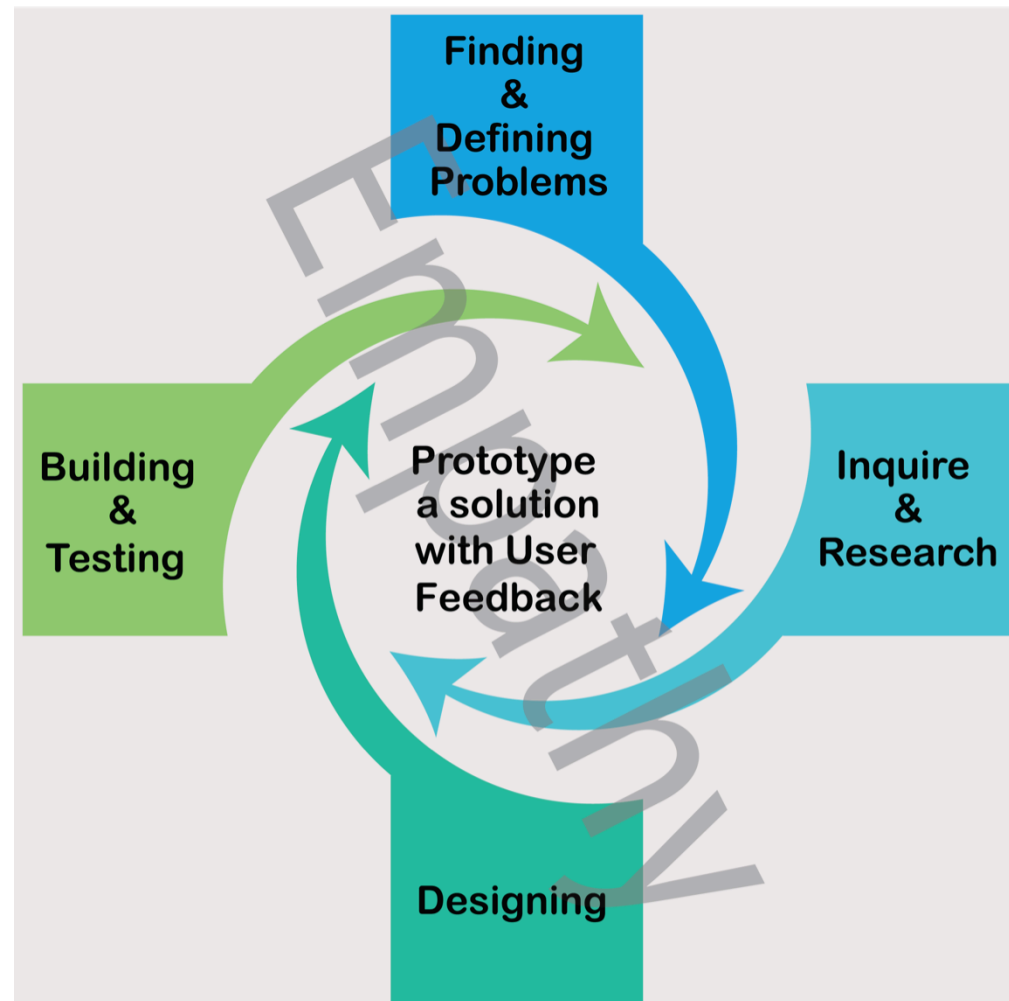
Invention Cycle

Technical inventions are

- Useful

- Unique

- Reduced to practice

Design Empathy:

gain an empathic understanding of the people you're designing for and the problem you are trying to solve

Different Types of Empathy

- Deep emotional understanding of users' needs to inspire inventors for solutions and creativity

Affective Experiences

Empathic Distress
Experiencing distress as a result of feeling for another

Empathic Concern
Feeling concerned or happy for another

Self-Oriented ← → **Other-Oriented**

Imagine-Self Perspective Taking
Imagining how oneself would think and feel if they were another

Imagine-Other Perspective Taking
Imagining how another thinks or feels

Cognitive Processes
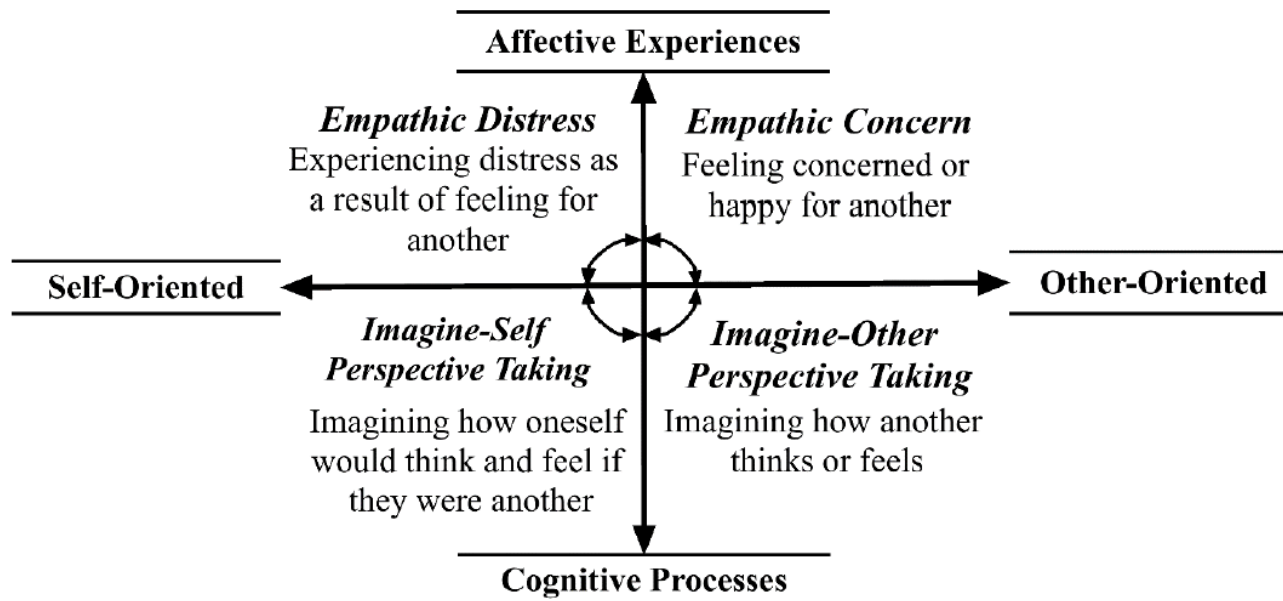
Figure 1. Conceptualizing empathy and the interrelationship between empathy types

Reference: Hess, J. L., & Fila, N. D. (2016). The development and growth of empathy among engineering students. American Society for Engineering Education.

DIY Girls: Design with Empathy

DIY Girls InvenTeam (2017) invented a portable tent featuring solar-powered LEDs, a cell phone charger, and UVC LED sanitation features for mothers who are homeless in LA.

"My family is only one pay check away from the sidewalk..."

Developing Empathy Among Students

- Ask What-How-Why

- Assume a beginner's mindset

- Build empathy with analogies

- Use photo and video user-based studies

- Story share-and-capture

The Problem Statement
seeks to understand the problem

"If I had an hour to solve a problem I'd spend 55 minutes thinking about the problem and 5 minutes thinking about solutions."

— Albert Einstein
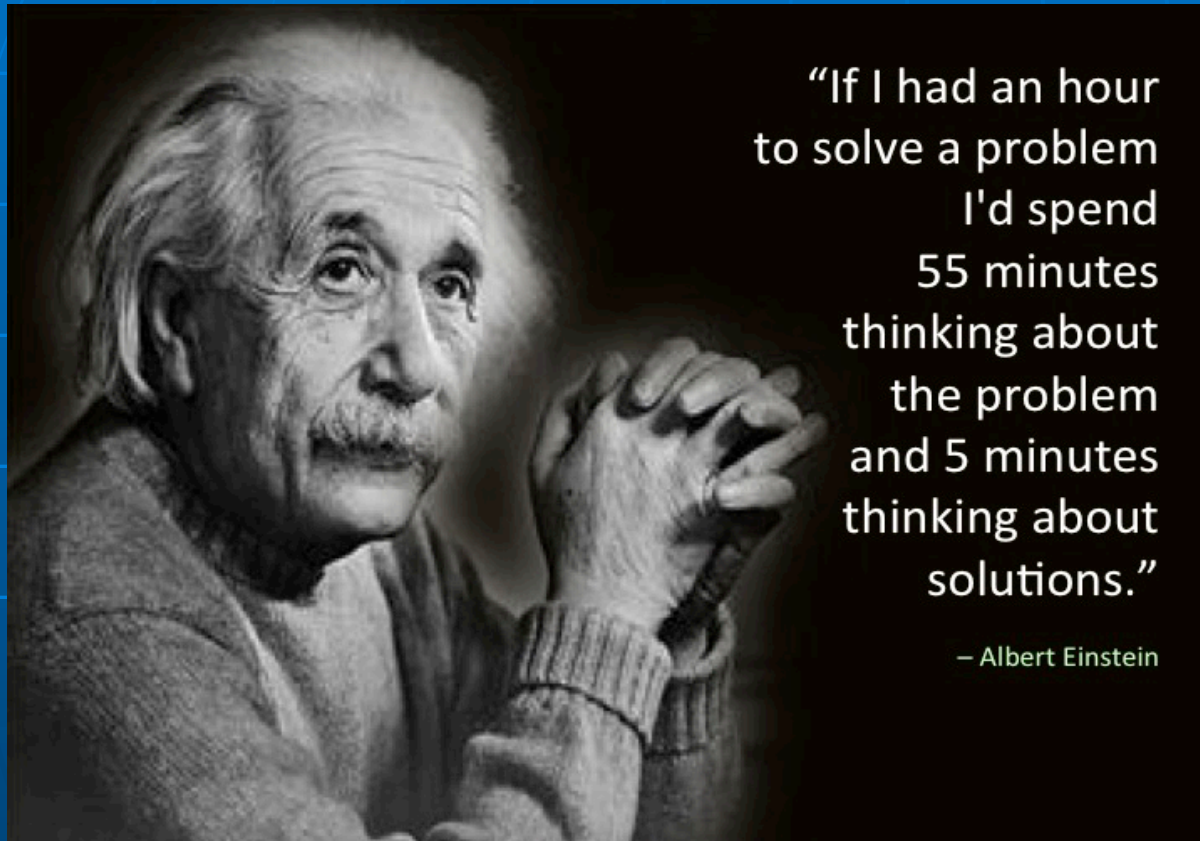
- Who?
- What?
- When?
- Where?
- Why?
- How?

Figure 1. Conceptualizing empathy and the interrelationship between empathy types

Haiti Container Building Project

Haiti
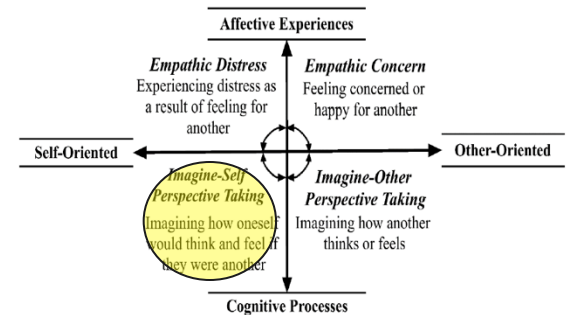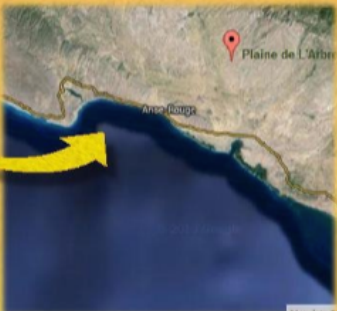- Total Population: 10,317,000
- Per Capita Income: $1,300
- 77% live on less than $2 per day

L'Arbre
- Located in Northwest Haiti
- 40 Villages and Localities
- Population-20,000
- Semi-Arid Area
- 97% Deforestation

THE PROBLEMS

TRANSPORTATION
Most roads are gravel and dirt. Which frequently washout. The lack of access difficulty transporting goods hinders economic development.

ELECTRICITY
Less than 30% of Haitians have access to electricity. No infrastructure exist in rural areas.

WATER & SANITATION
Haiti has the lowest rates of access to improved water and sanitation infrastructure in the western hemisphere. Over 8000 Haitians have died from Cholera since 2010. (Gelting et.al., 2013)

EDUCATION
The Plaines de l'Arbre area has one undersized national school for 1200 children. The majority of parents can't afford to buy books and the majority of students are malnourished because their parents cannot afford to feed them or provide the daily meals necessary for them to be able to concentrate in school. (Metayer, 2014)

NUTRITION
Because of the lack of daily nutrients, nearly one-third of all children under five suffer from stunted growth and three-quarters of children 6-24 months of age are anemic. (DHS, 2005)

Food Preparation
Wood is the primary fuel sources for cooking; however 95% of Haiti is deforested. In addition to that, Haiti loses 700 hectacres of trees every year which equates to about 0.60% per year.

Assume a Beginner's Mindset

- Where is l'Abre, Haiti?
- What is the historical context?
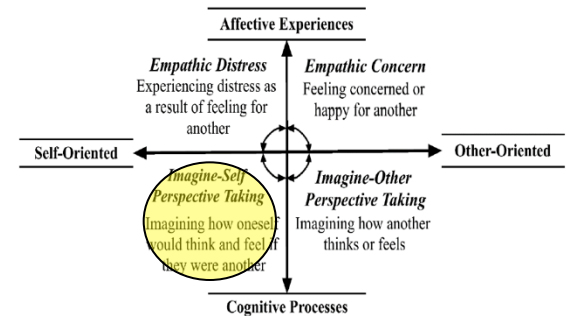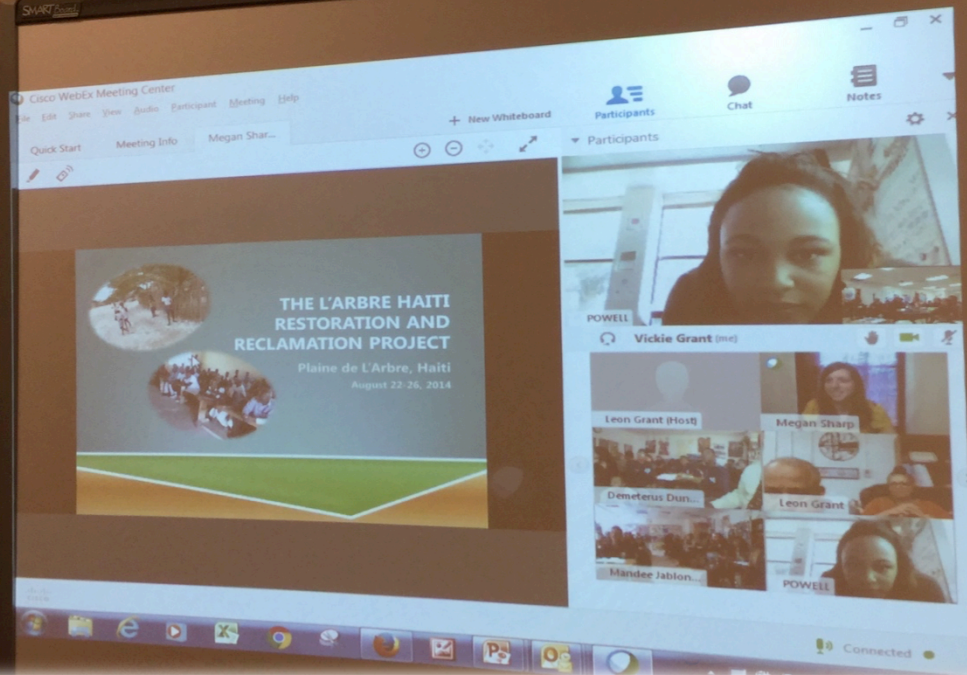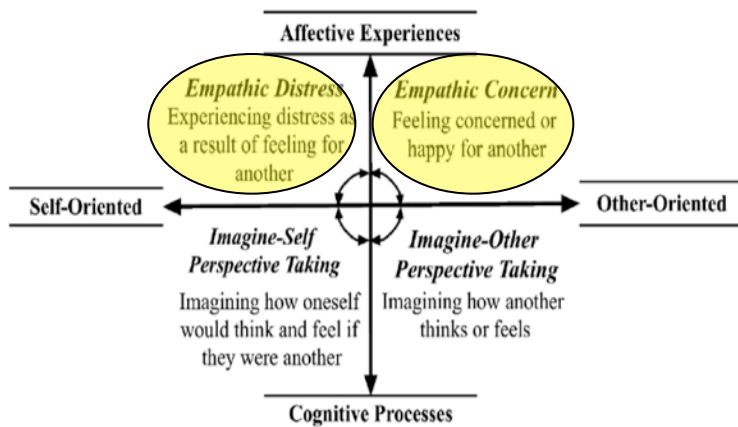- What is the socio-economic context?
- Why is there a need?

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Build Empathy with Analogies

- $2 Per Day Campaign
- School-wide clothing drive
- Fundraiser for the Haiti Container Building Project

Story Share-and-Capture

WORLD

Haiti's 'Bayakou': Hauling Away Human Excrement By Hand

July 30, 2017 · 8:00 AM ET
Heard on Weekend Edition Sunday

REBECCA HERSHER

5:52

+ Queue
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Embed
Transcript

Haiti's capital city doesn't have a sewer system. Instead, so-called nightsoil, or human excrement, is largely removed by hand by workers who toil at night under cover of darkness.

Transcript

LULU GARCIA-NAVARRO, HOST:

Port-au-Prince, Haiti, is one of the largest cities in the world without a central se[wer] system. Most of the more than 3 million residents use outhouses and rely on wo[rkers] with some of the worst jobs in the world, hauling away human excrement by han[d,] bucket at a time. The men are called bayakou, and they work in the dark by candlelight. Rebecca Hersher spent a night with a group of them.

REBECCA HERSHER, BYLINE: As soon as we arrive, you can smell it. It's a hea[vy,] earthy stench, like rotten eggs and grosser things.

Bonsoir.

An estimated 1 in 5 Haitians don't have access to any kind of latrine. Those who [only] have outhouses generally hire a bayakou to clean them out. Tonight, a team of fo[ur] bayakou are emptying one outhouse. One of the guys, Gabriel Toto, is sitting on [the] edge of the hole, his bare feet in the brown soup below, holding a big stick.

Affective Experiences

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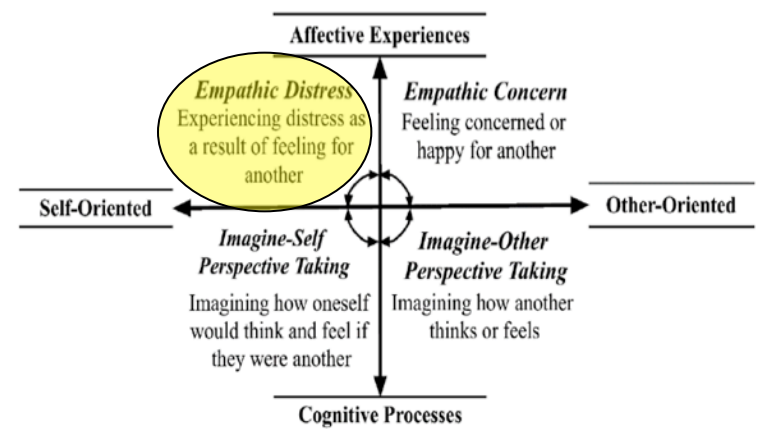
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Other Ways to Develop Empathy?

- Conduct interviews

- Bodystorm

Please add your methods!

Lemelson-MIT Resources

- Lemelson-MIT Program
http://lemelson.mit.edu/

- InvenTeams National Grants Initiative
http://lemelson.mit.edu/inventeams

- JV InvenTeams Curriculum Materials
http://lemelson.mit.edu/jv-inventeams

- Inventor Archive
http://lemelson.mit.edu/search-inventors

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Other Resources

- [MIT's D-Lab](): Development through Discovery, Design, and Dissemination
- [Dr. Ashok Gadgil]() and the Darfur Stove
- [Ashoka's Start Empathy]()
- [EdWeek article on Building Empathy in Classrooms and Schools]() (recommends introducing design thinking in STEM classes)
- [Design for the Other 90%]()
- [Getting Started with Empathy- Interaction Design Foundation]()
- [Stanford d.School Bootcamp Bootleg, 2013]()
- [Marietta City Schools Engineering Pipeline]()

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Q & A

Q: Can you talk a bit more about the importance of using a problem statement? How can you use a problem statement to support the development of empathy?

Asking students to use *a problem statement*, instead of *a solution statement* is particularly useful for prompting them to develop a deep understanding of the problem and the needs of beneficiaries. Teachers can ask students to first specify answers to the Who, What, When, Where, Why questions, then think about solutions to the problems. For example, in a project of designing a chair, the teacher can ask students to think through issues such as:

"Is the chair designed for a senior citizen or a toddler?"

"Will the user sit on the chair while studying or watching TV?"

"When will the chair be used - in the summer or in winter?"

"Where will the chair be placed, indoor or on the patio outside?"

Also, the teacher can ask students to think about alternative solutions to the problem.

"Does the problem have to be solved by a chair?"

"What might other solutions be?"

By diving deep into the problem, students will develop comprehensive understanding of the users and develop empathy for them. Remember the Einstein quote and ask students to spend more time on fully understanding the problem – from the user's standpoint!

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Q & A

Q: Have you ever used the bodystorming technique at the middle school level?

So far, we haven't find the bodystorming technique widely used in middle school invention projects. However, students often use other techniques such as conducting interviews to develop empathy. As an example, the middle school students observed and interviewed Vickie and another teacher to understand their needs in the chair design project and asked them to provide feedback on the prototypes.

We found that the bodystorming technique was used in high school engineering projects. In an invention project for users of wheelchairs, Leon's students borrowed a wheelchair from a local hospital. Every student on the team used the wheelchair to complete a series of tasks such as getting a book from the bookshelf, climbing on stairs, and travelling across the campus. The bodystorming technique enabled students to experience the challenges that users of wheelchairs face. Empathy for the user – based on real experiences – inspired the students' inventions.

THANK YOU!

**Contact Us at
PD-lemelson@mit.edu**

Invention Education
Webinar Series