Engineering with Preschoolers

Learning from the Engineering and Empathy and Head Start on Engineering / Ingeniería y Head Start projects
Who are we?

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Today’s agenda

1. Project Overviews
2. Activity Showcase!
3. Reflection
4. Q&A, Evaluations
Today you will...

1. Gain more familiarity with engineering and its application in early childhood learning experiences
2. Engage with research-based engineering activities
3. Understand key considerations from two different projects and reflect on how your own context may inflect engineering activities for young children
Engineering and Empathy
PRE-KINDERGARTEN AND KINDERGARTEN
What will the future look like if we give young children more opportunities to practice being empathic innovators and problem solvers?
Key ideas influencing this project:

- At its core, engineering is one way that humans design things and solve problems.
- Being able to exhibit empathy—to take the perspective of another or put yourself in their shoes—is an important facet of engineering.
- Between the ages of 4 and 6, young children are also beginning to build the foundations for exhibiting empathy.
- They are beginning to understand why another child might want a turn with a toy, or how their actions could make someone happy or sad.

What if we introduce engineering and empathy in parallel, at this very young age?
What we heard

- the integration of engineering and empathy was new to teachers
- reading the lessons (for the curriculum review) and implementing the lessons (for the formative testing) helped them see the value of pairing the topics
- pre-K formative testing teachers commented that – at first – they did not understand the connection between engineering and empathy and said they were skeptical that the pairing of these topics would support student learning. They noted the PD as instrumental in building their understanding of the link between engineering and empathy
- they felt the activities resulted in children demonstrating and talking about empathy both during and outside the activities

“I like the way this lesson connects the concept of empathy with engineering and the role people and collaboration plays in finding solutions for everyone. I think it is a beautiful way to engage students and connect the science with everyday life issues.”
-Pre-K teacher

“I have done many of these same lessons with my students but I like the idea of incorporating the engineering aspect into it.”
-Kindergarten teacher
Integrating empathy
<table>
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<th>Research Questions</th>
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<td><strong>RQ1.</strong> What contextual factors mediate how pre-K and K educators are able to incorporate integrated engineering and empathy into teaching and learning?</td>
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<td><strong>RQ2.</strong> What pre-K and K educators view as important design considerations for developing high-quality integrated engineering and empathy resources for pre-K and K classrooms?</td>
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<td><strong>RQ3.</strong> What tools and supports can build on and enhance teachers’ existing knowledge and practices in order to help them successfully deliver integrated engineering and empathy activities in early childhood settings?</td>
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Formative Findings

Mediating Factors

- Teachers may be skeptical about value of pairing engineering and empathy
- Teachers may lack of confidence in their understanding of engineering concepts and how to engage children in engineering activities.
- Teachers tend to support empathy development situationally (vs. following a curriculum)
- Empathy development may be mediated by cultural differences in how families talk about and express emotions
Design Implications

Activity Characteristics
- Collaborative and play-based
- Multi-sensory
- Opportunities to explore different materials
- Adaptable for students at different levels in their development

Pre-Intervention Professional Development Workshop
- Demonstrate the rationale and value of pairing engineering and empathy
- Build on teachers’ existing practices and knowledge of empathy
  - Provide trajectory of empathy development and how they can support children along the trajectory
- Build on teacher conceptions of engineering and what engineers do
Elements of Lesson Plans

- Adaptability
  - Provide ideas for how teachers might adapt the lesson for different types of learners

- Make explicit which elements of empathy development an activity supports (and how) and how that relates to better designs

- Call out examples of:
  - Engineering concept/skill/practice that each activity targets (and where)
  - Different components of empathy
  - The mutually-beneficial link between engineering and empathy.
Teachers see the value of integrated engineering and empathy activities
- Build on the skills that pre-K/K educators prioritize
- Fit into the regular routines of pre-K/K classrooms

Perceptions of children’s engineering and empathy skills increased between the start and end of the intervention

The professional development and educative elements of the lesson plans were instrumental in building teacher understanding of the link between engineering and empathy

Key Findings (so far)

I like the way this lesson connects the concept of empathy with engineering and the role people and collaboration plays in finding solutions for everyone.
I think it is a beautiful way to engage students and connect the science with everyday life issues.

--Pre-K teacher
HSE is an ongoing initiative focused on **empowering families** to use engineering to help their children thrive. We aspire to **collaborate as equal partners** with the communities we serve and **inform a more equitable vision for engineering education** in our society.

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Head Start on Engineering / Ingeniería y Head Start

THE 2021–2022 HEAD START ON ENGINEERING PROGRAM
EL PROGRAMA DE INGENIERÍA Y HEAD START 2021–2022

WELCOME MEETING
REUNIÓN DE BIENVENIDA

1

2

VIRTUAL FAMILY ENGINEERING WORKSHOPS
TALLERES VIRTUALES DE INGENIERÍA EN FAMILIA

3

BABY CHICKS ARE SINGING
LOS POLLITOS DICEN

4

PARENT MEETINGS
REUNIONES DE PADRES

5

Activity Videos
Videos de las actividades

6

TACO FIESTA
FIESTA DE TACOS

Program Website
Página web del programa

FORT BUILDING
EL FUERTECITO

Programa OMSI
Familiares de OMSI
Families bring their own goals to the program:

- Trying new things
- Fostering sibling relationships
- Spending quality time together
- Practicing problem solving
- Building skills and knowledge
Family Goal: Fostering Sibling Relationships:

“First she built a house with her brother. Then they made a second house. They made it bigger and taller for the chickens to fit better.”

Al principio ella construyó una casa con su hermano. Luego hicieron otra casa. La hicieron más grande y más alta para que cupieran mejor los pollitos.
Family Goal: Building Skills & Knowledge

I think that all the resources, the materials that the program offers are helping us prepare for the future. It is helping her in many ways, it provides her the opportunity to use her own ideas, her brain and start creating things. I think the activity helps and it's just the beginning.
Family Goal: Practicing Problem Solving

[The activities] help her problem solve and deal with situations where she might feel stuck or overwhelmed over a subject and have the ability to work through it. I'm focused on that right now. We work through it on different subjects.

[Las actividades] le ayudan a resolver problemas y lidiar con situaciones en las que podría sentirse atascada o abrumada por algo, y le da la capacidad de resolver ese problema. Me estoy enfocando en eso ahora. Tratamos de resolver diferentes temas.
Family Goal: Spending Time Together

I don't know if you know, but we recently adopted them. There was a lot of distraction and trauma involved in the process of adoption. This [program] has helped remove that... It's been a healing experience not just educational. We are learning things about each other and other areas we need to work on as a family.”

No sé si lo sabía, pero hace poco los adoptamos. Ha habido mucha distracción y trauma en este proceso. Pero esta experiencia nos ha ayudado a eliminar eso... Ha sido una experiencia sanativa, no solo educativa. Estamos aprendiendo cosas sobre nosotros y otras áreas en que necesitamos trabajar juntos en familia.
Family Goal: Trying New Things

"We were able to do it. It was nice. We didn't have activities to do before. The only family bonding time we had before was movie night. The engineering program gave us something to work on."

Pudimos hacerlo. Fue bonito. No teníamos otras actividades antes. El único tiempo familiar que teníamos antes era nuestra noche de cine. El programa de ingeniería nos dio algo que hacer.
Head Start on Engineering / Ingeniería y Head Start
Collaborating as Equal Partners &
Informing an Equitable Vision of Engineering Education

Two equity-based commitments emerged in collaboration with the project team, partners, and families:

- Finding new ways to work together
- Broadening ways for us to understand engineering (What counts as STEM?!)
Equity Commitment: finding new ways to work together

- Positioning educators, researchers, and families to work together
  - Creating professional development opportunities for HS staff
  - Empowering Spanish- (and now Arabic!) speaking staff in HS
  - Elevating family voice and perspective through collaborative communication design

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**Equity Commitment: finding new ways to work together**

HS staff reflected on and co-designed professional development trainings:

- These were good ideas for children. But they're also helpful for adults, such as thinking about engineering in our everyday lives.

- Having everyone together in the classroom makes us accountable to focus and listen. Make sure to clarify expectations before the training, such as that we will be working in our classroom teams.

- Provide questions for aides and assistants in their preferred language in advance to give them time to reflect. Make these printed, not emailed. Aides and assistants don't have much access to email.

- These materials can be advanced for some children. Provide ways for teachers to adapt. For example, blocks for some children to build with? This may be a lot to ask, but another kit with blocks or simpler materials?

- More ideas on how to implement in the classroom. Maybe some small group brainstorms. Curriculum ideas that are easy to implement.

- Like the idea of doing a project together as classroom teams, all of us equal. This helps with team building. Some teams write lesson plans this way.
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Equity Commitment: broadening our understanding of engineering

- Asset-based: amplifies family strengths
- Supportive of child development and family goals
- Flexible!
Can you work together to build a safe and cozy place for the chicken family?

Follow the link for a read-aloud video.

LET’S EXPLORE!
Explore the materials together with your child.

Think about this chicken family. What do they need to stay safe and cozy? Can the chicken family in the story help you think of ideas?

Let’s Design!
Based on the story that you read (or sang) and what you imagined the chicken family needs...

Can you build a cozy shelter to protect the chicks from sun and rain?

Can you build the chicken family a tall structure to stay safe at night?

What else can you build that the chicken family needs?

Watch a video of the activity in action and get more extension ideas!

Let’s explore!
Explore the materials together with your child.

Think about this chicken family. What do they need to stay safe and cozy? Can the chicken family in the story help you think of ideas?

How would you use the materials in the box to build the chicken family a house?

What else can you build that the chicken family needs?
The engineering design process is a cycle that engineers follow to create and test solutions to a problem.

We often use this process to solve problems every day, like figuring out a good recipe or building a brick wall. Talking about the engineering design process with children and families using the steps during playful learning experiences is an great way to get children interested in engineering and help them develop problem-solving skills.

**IMAGINE**

- Ask: What is the problem you want to solve?
- Imagine: What could you do to solve the problem?
- Plan: Plan how to use your materials.
- Create: Create your solution.
- Improve: Improve your design based on what you learn.

**PRESEUNT**

- Hire: Choose the best solution and test it. What did you learn from the process?
- Imagine: Envision the problem and create a solution that works.
- Plan: Plan for the solution.
- Create: Create what you need to solve the problem.
- Improve: Improve the design based on what you learn.

**IMAGINA**

- Ask: What is the problem you want to solve?
- Imagine: What could you do to solve the problem?
- Plan: Plan how to use your materials.
- Create: Create your solution.
- Improve: Improve your design based on what you learn.

**El proceso de diseño de ingeniería es un ciclo que los ingenieros siguen para experimentar y encontrar soluciones a un problema.**

Utilizamos este proceso para resolver problemas todos los días, desde preparar una receta de cocina, hasta armar un estante de libros. Hablar sobre el proceso de diseño de ingeniería con los niños y sus familias, y utilizar los pasos durante experiencias de aprendizaje divertidas es una manera excelente de lograr que los niños se interesen en la ingeniería.

**IMAGINA**

- Asks: ¿Cuál es el problema que quieres resolver?
- Imagina: ¿Qué podrías hacer para resolverlo?
- Planifica: Planifica cómo usar tus materiales.
- Crea: Crea lo que necesitas para resolver el problema.
- Mejora: Mejora tu diseño basándolo en lo que aprendiste.

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Let’s Engineer!

Choose two of the four stations*:

- Make Way for Ducklings
- Los pollitos / The Little Chicks
- Fort Building / El fuertecito
- Taco Fiesta! / ¡Fiesta de tacos!

*No need for FOMO! Materials on all these activities (and more!) will be shared.
Reflections

- How do you already encourage and support engineering behaviors and attitudes?
- How can engineering activities amplify the strengths of your communities of learners?
- What is something that you learned today that you plan to take back with you?
What questions do you have for us?

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