Home Design/ Insulation Challenge:

Adapted from:

FOSS Insulation & Home Design

https://www.fossweb.com/resources-by-investigation?folioID=G4611751&parentID=G4628008

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Engineering Design Process

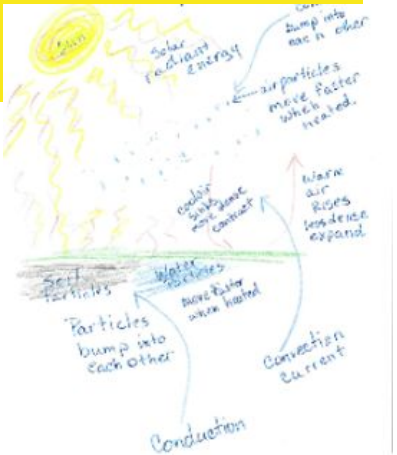
Identify the problem:

How can we design a more efficient way to decrease energy transfer between a model home and the environment?"

We located the best spot on the blacktop to heat up the model houses by walking around without flip flops to find the location of the direct sun. We discussed energy transfer by actually transferring the heat directly from the blacktop to their feet. We discussed radiation by identifying where the heat originates from (the sun). Then we found the hottest spot on the ground and discussed conduction- direct transfer of heat energy. We discussed which way hotter air travels inside a closed system like a house- convection. Then we discussed how we could reduce the energy transfer to our feet from the blacktop. Ideas of stepping on towels and putting on flip flops (or even heading down to the lake) to reduce the energy transfer from the hot blacktop to their feet.

Brainstorm:

Interactive discussion instead of using a written notebook since it was a hot day with lots of activities going on around us. We went on a walk to see different houses and think of ways to keep the energy from transferring out of the house in the winter and how to keep the energy from transferring into the house in the summer.

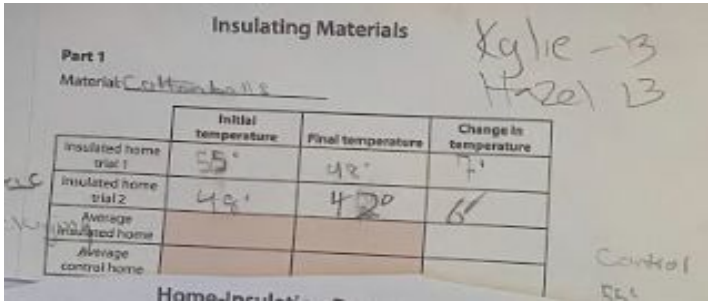


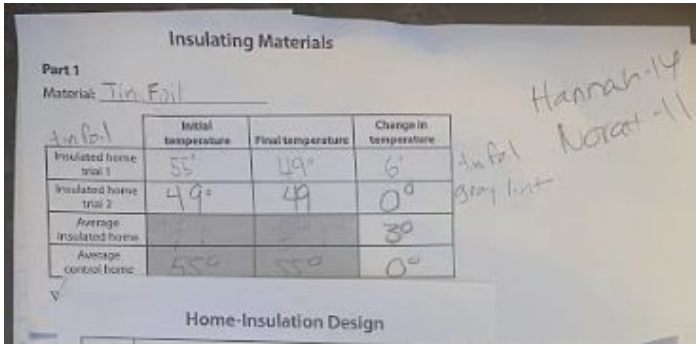
Ideas they shared:

Roofs to block the sun
Pink cotton candy material in the walls (answer from 14 year old)
Insulation (answer from 9 year old)
Thick walls
Fans to circulate heat
Air conditioning
Shingles
Black or white to reflect or absorb heat

Testing Insulation:

Tested different Insulation Materials and compared to a control once we found the best spot for Radiation Energy Transfer: .

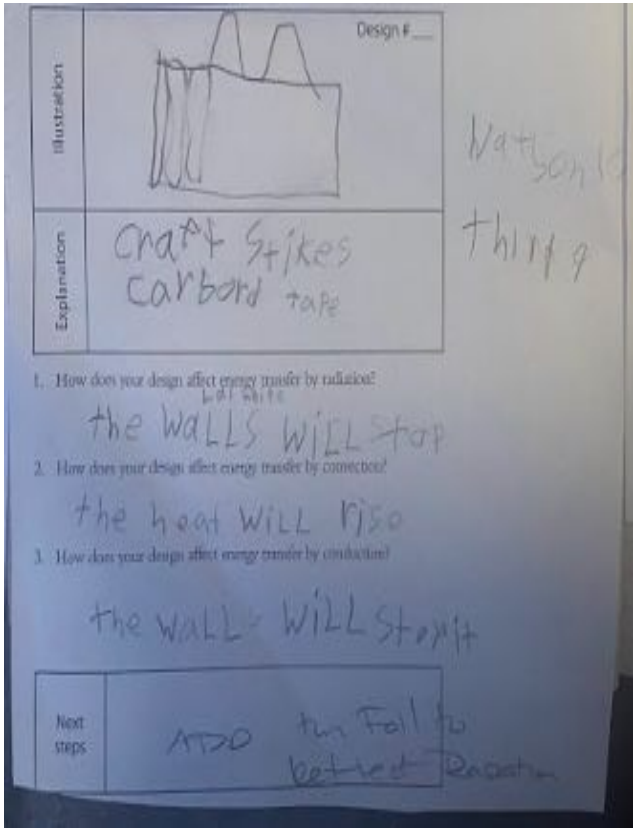


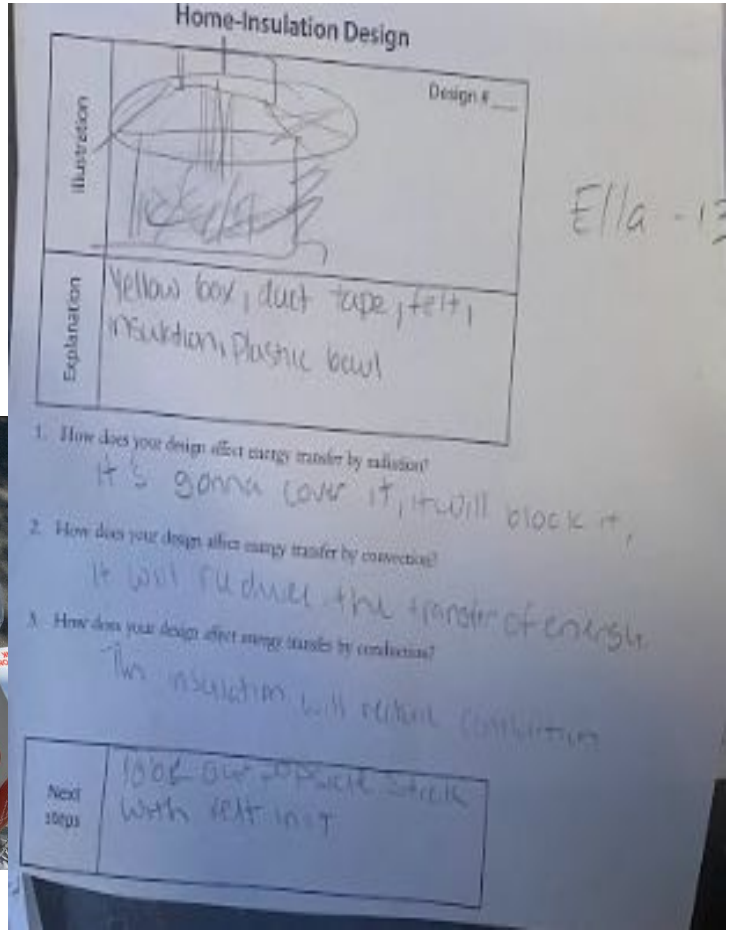


***Discussed the different types and compared results. Then they tested with another type of insulation material to see if they could find the one that keeps the heat out of the house the best. We discussed/ brainstormed the different types of insulation materials, where it is installed in a house and the fact that yes it does look like pink cotton candy!

Design:

Samples from the conceptual models with the materials available:



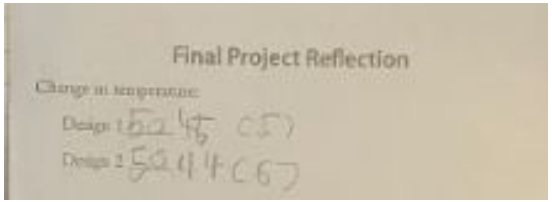


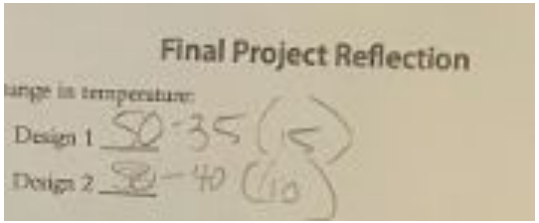
Build:

Samples of the designs built

Test and Evaluate:

The children took initial readings and then 6 minutes later. They calculated the temperature changes and discussed their results before deciding what to change for the next step. Proper reading of thermometers and the intervals to read the measurements and even how the thermometer works was questioned and discussed.

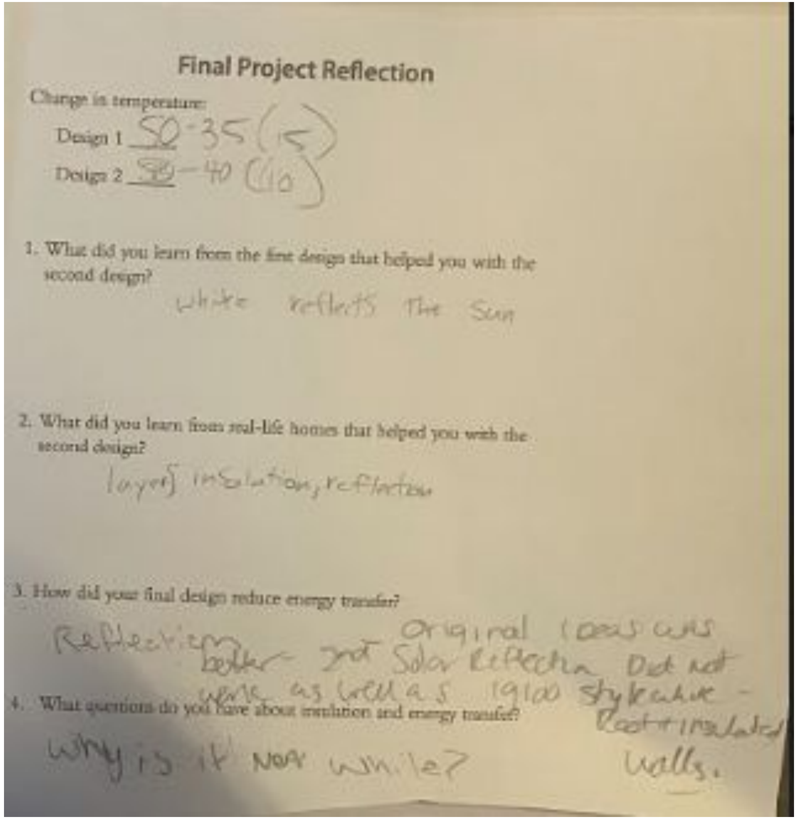




Redesign:

The children went back to the drawing board after they tested to see if their designs kept the heat out. The temperatures dropped in all the designs from 4 to 15 degrees. The igloo style design was amazing! The children made sure to see if there was a difference in the control while they were testing and compared their initial to the final after 6 minutes, making sure to control the variables the best they could.

Share the Solution:



Final Project Reflection

Change in temperature:

Design 1 50 - 35 (15)

Design 2 50 - 40 (10)

1. What did you learn from the first design that helped you with the second design?

White reflects the Sun

2. What did you learn from real-life homes that helped you with the second design?

layers insulation, reflection

3. How did your final design reduce energy transfer?

Reflection original ideas was better - 2nd Solar Reflection Did not work as well as 1900 style white - Roof + insulated walls.

4. What questions do you have about insulation and energy transfer?

Why is it not white?

The winning design- reduced the energy transfer by 25 degrees,

The children reflected on their models and how they reduced energy transfer by radiation, conduction , and convection. Their designs helped reduce convection inside their model homes. We ended the challenge with ice cream before there was too much energy transfer inside my cooler. Then they all ran down to the lake to transfer their energy some more!