STEM - High School
Leading Class Discussion on STEM Carbon Footprint

Author(s)	Avatar(s) & Environment	Suggested Learner Audience
Simulations for Secondary Science Teachers Conference Stacey Culleny Dr. Norm Herr Valecia Kelly Alicia Lane Dr. Michael McVey **Mursion** Jessica Gasparolo	**Host Avatar(s)** Nina/Michael **Simulation Avatars** Ciara, Angela, Jordan, James, Stephanie **Environment [ML3z]** 11th Grade High School Classroom	● Pre-Service Teachers ● Non-credentialed Teachers ● Novice Teachers

Delivery Mode(s) Available for Scheduling 1:1, Facilitated Group

Learner-Facing Vignette:

You are the teacher of a high school STEM class. Today is the second day of your lesson exploring the engineering design process and carbon footprints. The students understand that a Carbon Footprint is the amount of carbon dioxide and other carbon compounds emitted due to the consumption of fossil fuels by a particular person. In preparation for today's class discussion, the students have calculated their own carbon footprints and have them pre-loaded on their tablets. You intend to begin your discussion by asking the students to state their findings about their day-to-day energy consumption. You plan to encourage the students to discuss why some people's footprints have more of an impact than others, and guide the students to brainstorm possible solutions they can employ in their day-to-day lives that can reduce their carbon footprints.

Learner Outcome:

Your goal is to lead a class discussion, encouraging the students to break a large-scale problem down into smaller more manageable problems that can be solved through engineering.

Strategies/Best practices to consider:

● Ask higher-order thinking questions to engage the students critically on the topic
● Promote the analysis and interpretation of data to problem-solve
● Encourage students to make assertions stemming from evidence

Information about Intensity Level: Low
- Low intensity sessions are meant to build confidence for the learner. This setting is recommended for first time learners.
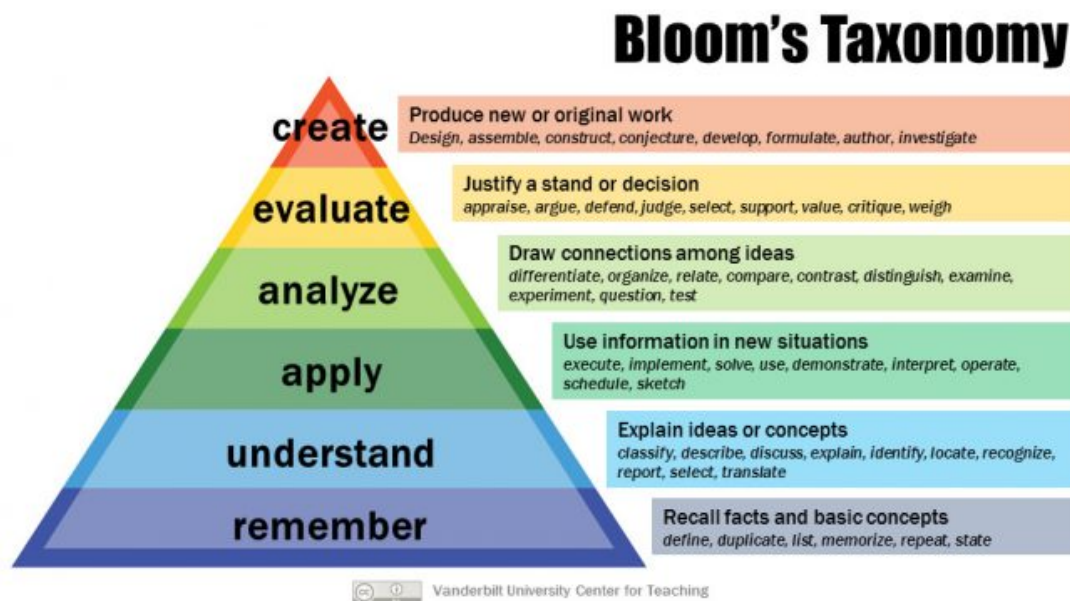
Supplemental Materials:

Students Prior Knowledge:

The definition of a carbon footprint. The students understand that a Carbon Footprint is the amount of carbon dioxide and other carbon compounds emitted due to the consumption of fossil fuels by a particular person. Outside of this the students may have limited to no prior knowledge.

**This scenario is gearing toward practicing the following of the
Next Generation Science Standards 8 Practices of Science & Engineering:[1]**

HS-ETS1-1 Engineering Design
Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-2 Engineering Design
Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Bloom's Taxonomy

create — Produce new or original work
Design, assemble, construct, conjecture, develop, formulate, author, investigate

evaluate — Justify a stand or decision
appraise, argue, defend, judge, select, support, value, critique, weigh

analyze — Draw connections among ideas
differentiate, organize, relate, compare, contrast, distinguish, examine, experiment, question, test

apply — Use information in new situations
execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch

understand — Explain ideas or concepts
classify, describe, discuss, explain, identify, locate, recognize, report, select, translate

remember — Recall facts and basic concepts
define, duplicate, list, memorize, repeat, state

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[1] NSTA, and using information from Appendix F of the Next Generation Science Standards © 2011, 2012, 2013 Achieve, Inc. "Science and Engineering Practices." *National Science Teaching Association*, 2014, https://ngss.nsta.org/practicesfull.aspx. Accessed 10 8 2021.
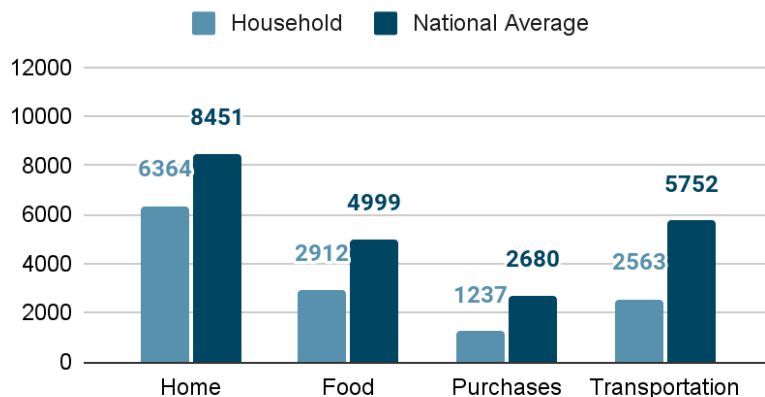
Student Work:

Graphed data is reported in kgs.

Ciara (she/her/hers)

Household details:

Lives with her parents in military base lodging. Her mother is a military chaplain and her father is a translator. She has one sibling, but he does not live with them. She has a pet betta fish.

Ciara's Carbon Footprint

Legend: Household, National Average

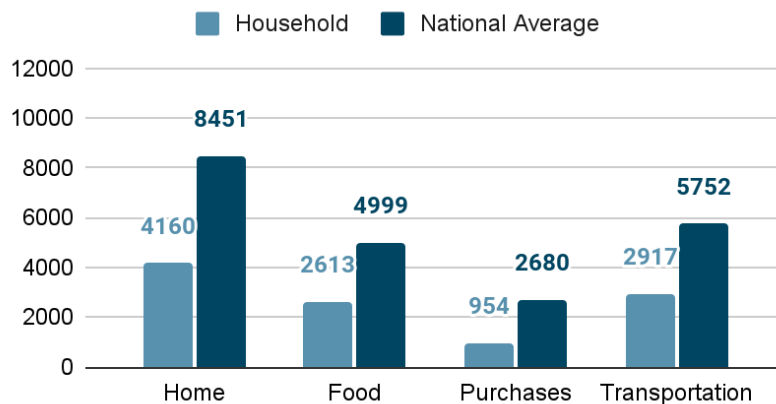| Category	Household	National Average
Home	6364	8451
Food	2912	4999
Purchases	1237	2680
Transportation	2563	5752

Angela (she/her/hers)

Household details:

Lives with her mother and step-father. Her mother is an attorney and her step-father is a stay-at-home dad. She has two siblings (one living at home & one in college) and a pet cat.

Angela's Carbon Footprint

Legend: Household, National Average

Category	Household	National Average
Home	4160	8451
Food	2613	4999
Purchases	954	2680
Transportation	2917	5752

Jordan (they/them/theirs)

Household details:

Lives with their mother. Their mother is a case manager for a community service agency. They have two siblings and a pet guinea pig.

Jordan's Carbon Footprint

Legend: Household, National Average

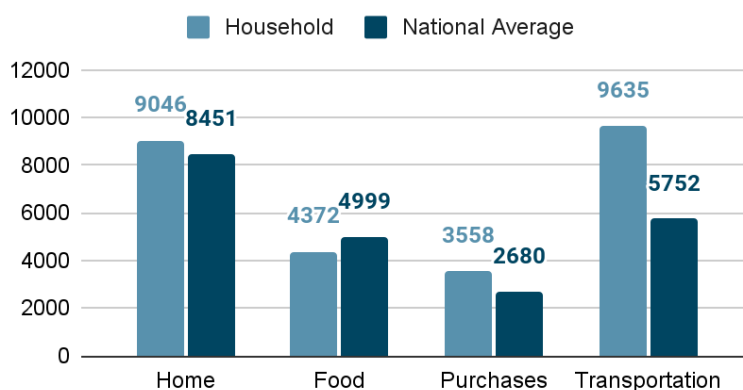| Category	Household	National Average
Home	8082	8451
Food	5709	4999
Purchases	1366	2680
Transportation	8101	5752

James (he/him/his)

Household details:

Lives with his parents. His mother is a retail manager, and his father is a long-haul trucker. No siblings. No pets.

James' Carbon Footprint

Legend: Household, National Average

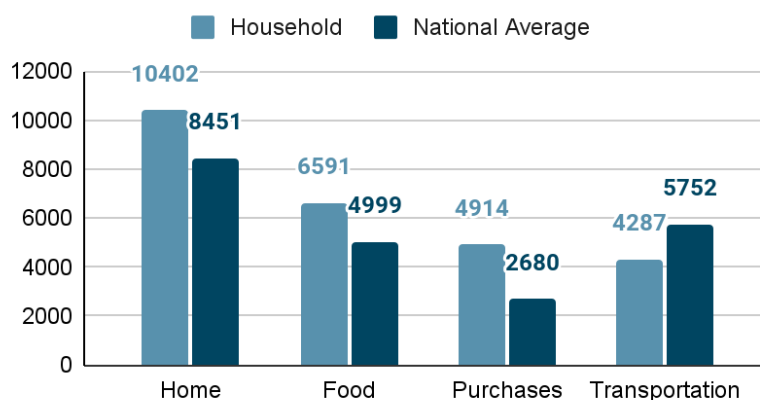| Category	Household	National Average
Home	9046	8451
Food	4372	4999
Purchases	3558	2680
Transportation	9635	5752

Stephanie (she/her/hers)

Household details:

Lives with her parents. Her father is a commercial airline pilot, and her mother manages a high-end clothing boutique. She has one sibling and a pet dog.

Stephanie's Carbon Footprint

Legend: Household, National Average

Category	Household	National Average
Home	10402	8451
Food	6591	4999
Purchases	4914	2680
Transportation	4287	5752

Background (Internal, not Learner-Facing)

Review Time	Delivery Mode(s)
Mursion Bank: Up to 15 minutes bill as "Trainee" directly to client	1:1, Facilitated Group

Scenario Specific Content
Intensity Level: • **Low:** In a low intensity, the students exhibit mostly on task behavior with a few instances of off task behavior. Most students are engaged and off-task behavior is likely a result of over-participation or excitement over the subject matter. Off-task behavior can be redirected at the first attempt by the Learner.   Host Specific Inquiries: • N/A

What is this scenario intended to address?

In this simulation, the learner will elicit student thinking related to the content. Specifically, they will pose questions that provoke students to share their thinking about the content in order to evaluate their understanding, guide instructional decisions, and surface ideas that will benefit other students.

Simulation Specialist Goal:

The goal of the Simulation Specialist is to follow the teacher's lead and, if elicited, create an open dialogue about the content between students.
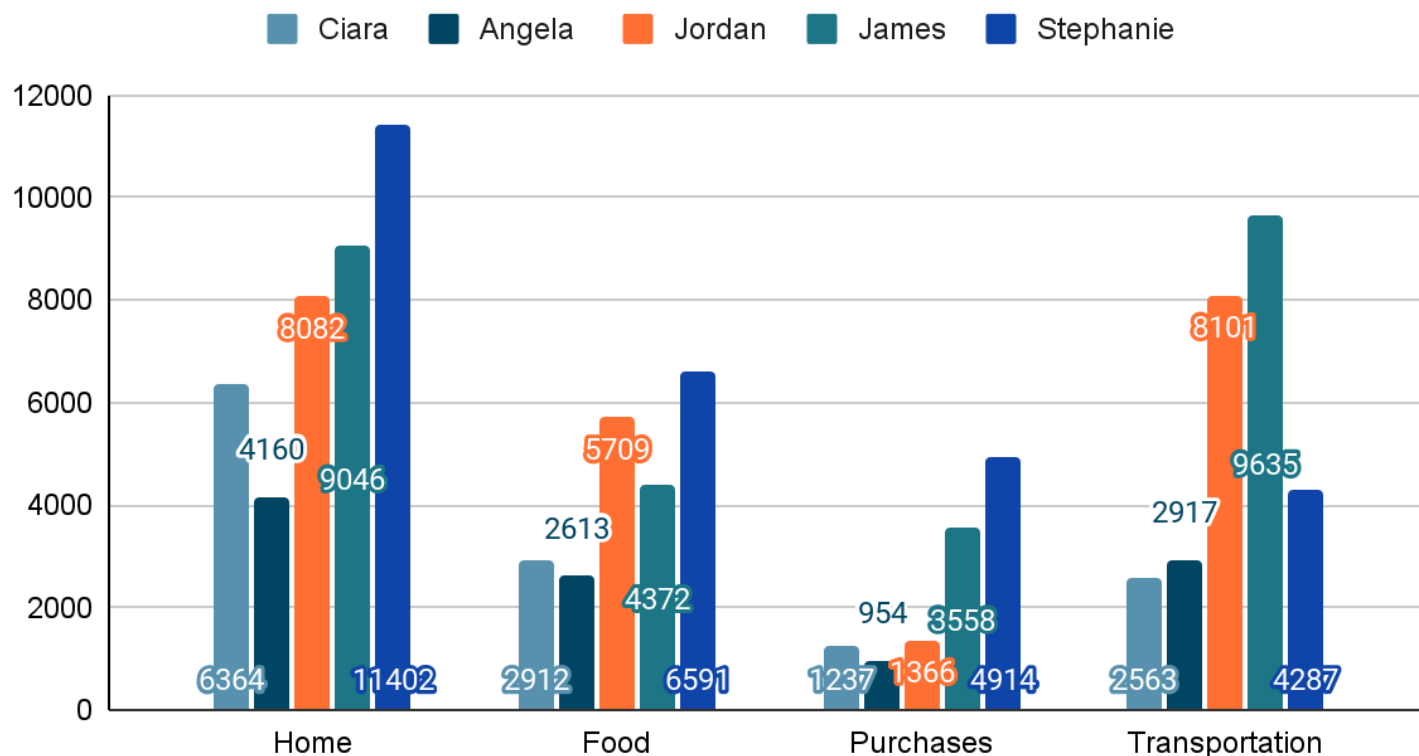
Avatar's Perspective:

Initially, the students will only have a surface level understanding of the content; the Learner will have to elicit the differing interpretations of the content through higher-order questions and further checks for context.
- If asked close-ended questions - answer with "yes" or "no" only
- If questions are unrelated to text or surface level, do not volunteer additional responses

Carbon Footprint Bar Chart:

All of the student data is combined into one bar chart on the next page for ease of reference.

Class Carbon Footprint Totals

Legend: Ciara | Angela | Jordan | James | Stephanie

Bar chart values:

Home
- Ciara: 6364
- Angela: 4160
- Jordan: 8082
- James: 9046
- Stephanie: 11402

Food
- Ciara: 2912
- Angela: 2613
- Jordan: 5709
- James: 4372
- Stephanie: 6591

Purchases
- Ciara: 1237
- Angela: 954
- Jordan: 1366
- James: 3558
- Stephanie: 4914

Transportation
- Ciara: 2563
- Angela: 2917
- Jordan: 8101
- James: 9635
- Stephanie: 4287

**Graphed data is reported in kgs.

Student Name	Possible Student Responses & Questions (If prompted by Learner)
Ciara she, her, hers	<u>Possible Student Responses</u> ● *I live at the military base, so even though my personal score isn't that high, I know where I live has a really big carbon footprint.* ● *Most everything we need is on the base, so we don't really use transportation except for special occasions or when I come to school.* <u>Possible Question</u> ● *Would growing a garden help? Or composting?*
Angela she, her, hers	<u>Possible Student Responses</u> ● *I'm vegan so I looked up what that means for my carbon footprint and found this University of Oxford study that said cutting meat and dairy from your diet could reduce your carbon footprint from food by up to 73 per cent!* ● *I wonder what the school's footprint is - we should get solar panels on all the roofs!* <u>Possible Question</u> ● *How do carbon footprints affect greenhouse gases?*

Jordan they, them, theirs	<u>Possible Student Responses</u> ● *We make sure to bring reusable bags to the grocery store.* ● *I think our footprint is bigger in the home section because we use a lot of energy doing laundry - my mom helps local unhoused families wash their clothes. Also my dad lives a couple hours away, so I know my transportation is affected by that.* <u>Possible Question</u> ● *The coffee shop I work at has a lot of imported beans - does that make a difference in my carbon footprint?*
James he, him, his	<u>Possible Student Responses</u> ● *I think we are pretty average except in the transportation section because of my dad's job.* ● *I try to make sure to turn off the water when I brush my teeth but I always forget.* <u>Possible Question</u> ● *If your job means you have to travel - like my dad does with driving trucks and Stephanie's dad with being a pilot - how can you fix how big it makes your carbon footprint?*
Stephanie she, her, hers	<u>Possible Student Responses</u> ● *I was really surprised at how high my carbon footprint is!* ● *I guess I just didn't think about how often we leave the lights on - also sometimes we'll all be doing something in a different room that uses energy. Like I'll be watching TV in one room and Mason will be playing some video game. And mom will be on the computer.* ● *Also I don't know why my food is so high.* (They eat out/order in a lot, and they eat a lot of meat). <u>Possible Question</u> ● *The carbon footprint calculator asked how often we buy electronics, but why does it matter if we buy new TVs to replace our old ones every year or so? Don't the new ones work more efficiently?*

Pushback Techniques:
● If Learner never switches students, a student may ask "Why am I the only one getting asked anything?"

Sim Specialist Information:
● **Carbon Footprint**: The amount of carbon dioxide and other carbon compounds emitted due to the consumption of fossil fuels by a particular person. This ranges from our direct energy consumption from personal household activities such as cooking or showering to our indirect energy consumption from the food we consume and how that industry operates.
● Carbon Footprint Website: <u>Basic Carbon Footprint Calculator</u>