

Should the Festival Switch to Corn Cups? A Claim-Evidence-Reasoning Case

Learning target: I can use qualitative evidence about where a synthetic material comes from, what it does at the end of its life and where a town's waste actually goes to argue whether switching materials would help, and I can spot a claim that the evidence does not support.

Claim, evidence, reasoning

About 45 min

Individual

MS-PS1-3 · assesses

MS-ETS1-2 · practice

writing

data analysis

reading

Standards connections

MS-PS1-3 (assesses, making sense of information about a synthetic material's origin and its effects on a community and the environment): Students gather information from an audit, a reference table, town facts and a vendor flyer about two synthetic cup materials (PET from petroleum and PLA from corn), judge which claims are supported, and write an evidence-based argument about the material's impact on their town. The information is qualitative, within the assessment boundary.

MS-ETS1-2 (practice): The decision compares two competing solutions against the town's real criteria and constraints (landfill space, recycling, cost, facilities available), which is the evaluation practice this PE describes, at classroom scale.

Purpose: practice · **Time:** about 45 minutes · **Format:** individual

Answers with reasoning

The scenario

Every July the town of Cedar Hollow holds a three-day music festival on the fairgrounds. Last year the food booths handed out about 12,000 drinks in clear PET plastic cups. A town council member has proposed a rule for this year: all booths must switch to PLA cups made from corn, because 'they are biodegradable and PET is not.' A cup supplier has sent the council a flyer. Before the vote, the council asked the high school science club to review the evidence and write a recommendation. The club collected the audit from last year's cleanup crew and looked up what the two materials actually do.

Where last year's 12,000 PET cups ended up (teaching dataset)

Simulated teaching dataset: the numbers are invented to be realistic, not measured.

Where the cups were found	Number of cups	What happened to them next
Recycling bins	4100	Sent to the county sorting plant; about 1 in 5 rejected for food contamination
Trash bins	7300	Sent to the county landfill, 20 km away
On the ground or in the creek	600	Picked up by volunteers and sent to the landfill

Simulated cleanup audit. The crew counted cups in each kind of bin and on the ground at the end of each night.

What the two cup materials actually do (reference facts)

	PET cup	PLA cup
Natural resource it comes from	petroleum (nonrenewable; drilling and refining can pollute)	corn starch (renewable crop; growing it uses farmland, water and fertilizer)
How it is made	petroleum-derived molecules are reacted and joined into long PET chains	glucose from corn starch is fermented to lactic acid, which is joined into long PLA chains
In an industrial composter (about 58 °C, moist, aerated)	does not break down	breaks down over weeks to months; the common standard is 90 percent within 180 days
In a landfill, a backyard pile, a creek or on the ground	lasts for decades or longer	lasts for years; no useful breakdown
In the recycling stream	recyclable where accepted; sorted and melted into new products	not recyclable with PET; looks like PET, and even a small amount can spoil a melted batch of PET

Cedar Hollow facts (from the town public works office; teaching scenario) — 1. All festival trash goes to the county landfill. 2. The county recycling plant accepts PET cups but rejects any load found to contain PLA. 3. The nearest industrial composting facility is 140 km away. A hauler quoted \$900 to collect festival food waste and cups in separate bins and deliver them there, and the booths would need a volunteer at every bin to keep PET and trash out. 4. Cost per cup: PET 4 cents, PLA 6 cents. 5. The fairgrounds has no dishwashing facility.

The supplier's flyer (fictional advertisement, printed exactly as received) — GreenLeaf cups are made from corn, so they are 100 percent natural. Toss one anywhere and it vanishes in 45 days. Zero impact on the planet. Switch today and never think about plastic waste again.

Warm-up: organize the evidence

1. From the audit, calculate the percent of cups that reached the recycling bins and the percent that went to the landfill (trash bins plus ground). Show your work.

Answer: Recycling bins: $4,100 \div 12,000 = 0.342$, about 34 percent. Landfill: $(7,300 + 600) \div 12,000 = 7,900 \div 12,000 = 0.658$, about 66 percent.

Why: Trash and ground both end at the landfill per the audit's last column. The two percentages sum to 100.

Also acceptable: Accept 34 and 66 percent, or 34 and 61 percent if the student counted only trash bins as landfill and said so.

2. Suppose this year's cups are PLA and people throw them away exactly as they did last year. Using the reference table and the town facts, describe what happens to a PLA cup that lands in (a) a recycling bin, (b) a trash bin, and (c) the creek.

Answer: (a) Recycling bin: the county plant rejects any load containing PLA, so the PLA cup and the PET bottles around it could all be rejected and sent to the landfill; PLA is not recycled with PET. (b) Trash bin: the cup goes to the county landfill, where PLA lasts for years with no useful breakdown, almost like PET. (c) Creek: it stays in the creek for years; PLA does not break down in water or on the ground. In Cedar Hollow, none of the three paths leads to an industrial composter.

Why: This question makes students connect the material's properties to the town's actual waste paths before they write the CER.

Also acceptable: Accept 'it gets pulled out and landfilled' for (a).

- All three destinations traced using the town facts
- States that PLA does not break down in the landfill or the creek
- Notes that PLA in the recycling bin spoils the load

3. The flyer makes four claims. Pick the two you think are least supported and, for each, write the evidence from this sheet that contradicts it. Then name one claim in the flyer that is at least partly true.

Answer: Least supported: 'Toss one anywhere and it vanishes in 45 days' contradicts the reference table, which says PLA breaks down only in an industrial composter over weeks to months (90 percent in 180 days is the standard) and lasts for years in a landfill, a backyard pile, a creek or on the ground. 'Zero impact on the planet' contradicts the fact that PLA is made from a crop that uses farmland and water, that it lasts for years outside a composter, and that it spoils PET recycling. '100 percent natural' is also unsupported: PLA is a synthetic material made by chemical processes (fermentation and polymerization) from corn starch. Partly true: 'made from corn' is accurate; the natural resource is corn starch.

Why: Students should name specific contradicting evidence, not just say the flyer is an advertisement. The 'made from corn' claim is true, which keeps the evaluation fair.

Also acceptable: Any two unsupported claims with correct evidence earn full credit, including 'never think about plastic waste again', which the landfill and recycling facts contradict.

- Two unsupported claims each matched to contradicting evidence from the sheet
- One claim identified as at least partly true

Your recommendation

Answer: Model response. Claim: The festival should not switch to PLA cups this year unless the town sets up separate collection and pays to haul the cups to the industrial composter; without that, PLA cups would be worse for Cedar Hollow than PET. Evidence: (1) Last year about 66 percent of cups (7,900 of 12,000) went to the landfill, where the reference table says PLA lasts for years with no useful breakdown, so two thirds of PLA cups would sit in the landfill just as PET does. (2) About 34 percent of cups (4,100) reached recycling bins; PET cups there are recycled, but PLA is not recyclable with PET, and the county plant rejects any load containing it, so switching could turn the one path that currently works into landfill too. (3) PLA breaks down only in an industrial composter at about 58 °C; the nearest one is 140 km away and would cost \$900 plus a volunteer at every bin. (4) PLA costs 6 cents per cup against 4 cents, about \$720 instead of \$480 for 12,000 cups. (5) In favor of PLA: it comes from corn, a renewable crop, while PET comes from petroleum, a nonrenewable resource, and in a composter PLA would be 90 percent gone in 180 days. Reasoning: 'Biodegradable' is not a property a cup carries with it; it describes what microbes can do to the material under the right heat, moisture and air. Cedar Hollow's waste paths (landfill, a recycling plant that rejects PLA, a creek) provide none of those conditions, so in this town the PLA cup's benefit never happens while its costs do: more money, a spoiled recycling stream and the same landfill pile. PLA's real advantage, a renewable source, would matter if the cups could reach a composter; that is why the claim is conditional. If the council pays for separate collection and hauling and staffs the bins, the balance flips, because then the cups would actually break down and the renewable source would be a gain rather than a wash.

Why: This is one solved response. Full credit requires a clear claim that follows from the evidence, at least four evidence items with numbers, at least one item on each side, and reasoning that explains the conditions dependence of biodegradability and weighs source against ending. A student who claims 'yes, switch' can earn full credit only if the evidence and reasoning honestly address the landfill and recycling facts (for example, by arguing that the renewable source is worth the costs, or by proposing the hauling condition).

Also acceptable: Strong alternative claims: 'Yes, if the town funds hauling to the composter and staffs the bins' (same evidence, condition stated); 'No, and the town should instead improve recycling collection, since only 34 percent of PET cups reached the bins' (uses the audit to redirect the decision). A 'yes, switch' claim that ignores the landfill and recycling evidence earns partial credit for evidence organization but not for reasoning.

- Claim is clear and conditional or unconditional with reasons
- At least four evidence items with numbers or specific facts
- At least one fact favoring PLA and one favoring PET
- Reasoning explains that biodegradability depends on conditions and applies it to where Cedar Hollow's cups go
- Reasoning weighs the renewable source against the costs

4. The council member's argument was 'PLA is biodegradable and PET is not.' Rewrite that sentence so that it is accurate for Cedar Hollow. Then name one change the town could make that would most change your claim, and explain why.

Answer: Accurate rewrite: 'PLA is biodegradable in an industrial composter, and Cedar Hollow's cups go to a landfill, where neither PLA nor PET breaks down.' Change that would most alter the claim: giving the festival a real path to industrial composting (paying the hauler and staffing separate bins), because then PLA cups would actually break down and its renewable source would count as a gain; alternatively, a reuse-and-deposit system that removes most single-use cups, which would make the PET-versus-PLA question less important.

Why: The rewrite must tie biodegradability to conditions and to the town's actual waste path. The change named must be one that alters where the cups end up.

Also acceptable: Accept 'if the county recycling plant could sort out PLA' as a change, with the explanation that it would protect recycling but still would not make PLA break down.

- Rewrite names the composter condition and the landfill reality
- A change that alters the cups' destination, with a reason

Scoring rubric

Criterion	4 • Exemplary	3 • Proficient	2 • Developing	1 • Beginning
Claim	One clear sentence that answers the question and, if conditional, names the specific condition; it follows from the evidence.	Clear claim that answers the question; the condition is vague or the claim slightly overreaches the evidence.	A claim is present but is hedged on both sides or does not actually answer whether to switch.	No claim, or a claim that contradicts the student's own evidence.
Evidence	Four or more specific items from at least three of the sources (audit, reference table, town facts, flyer), with numbers where available, including at least one fact on each side.	Four items, but one lacks a number or specific fact, or all items favor one side.	Two or three items, or items copied without connecting them to the town.	Evidence missing, invented, or taken from the flyer as if it were fact.
Reasoning	Explains that biodegradability depends on conditions, traces where Cedar Hollow's cups actually go, and weighs the renewable source against the local costs to reach the claim.	Explains conditions dependence and connects it to the town, but does not weigh the renewable benefit or treats one side as obvious.	Restates the evidence or asserts a general rule (natural is better, plastic is bad) without applying it to the town's waste paths.	No reasoning, or reasoning that treats the flyer's claims as true.
Fairness and accuracy	Uses synthetic, biodegradable, renewable and recyclable correctly; gives PET and PLA each a real benefit and a real cost; no scientific errors.	Terms mostly correct; one side gets only a token benefit or cost.	Several terms used loosely (biodegradable as 'disappears', natural as 'safe'); one material treated as all good or all bad.	Scientific language absent or consistently wrong.

Teacher notes

The audit, the town facts and the flyer are a teaching scenario and are labeled as such; the reference table is accurate: PLA composts in industrial facilities (about 58 °C) over weeks to months with a 180-day, 90

percent standard, does not break down in landfills, backyard piles or water on any useful timescale, and contaminates PET recycling; PET does not biodegrade and is recyclable where accepted. The sheet is designed so that the evidence points toward 'not unless composting access is arranged,' but the renewable-source fact and the hauling option keep a conditional yes fully defensible; grade the reasoning, not the verdict. Watch for two shortcuts: treating the flyer as evidence, and treating 'made from corn' as if it meant 'breaks down anywhere.' If students raise methane from landfill breakdown, that is a bonus point in PET's favor (nothing breaking down means no landfill methane from the cups) and worth a brief discussion, but it is not required.

Scaffold offered to students: Follow the cup

Before writing, draw three arrows on scrap paper, one for each place a cup can land (recycling bin, trash bin, ground). At the end of each arrow write where that cup goes in Cedar Hollow and what the reference table says PET and PLA do there. The arrow that catches the most cups (use the audit numbers) is the one your reasoning should spend the most words on. Sentence frame for the claim: 'The festival should _____ because, in Cedar Hollow, most cups end up _____, where PLA _____.'

Extension: A third option

The council also received a proposal for a deposit system: festival-goers pay \$2 for a sturdy reusable polypropylene cup, refill it all weekend and get the \$2 back when they return it, after which the cups are washed in town and stored for next year. Using W5's break-even idea (a reusable plastic cup takes roughly 30 times the energy of a single-use cup to make), write a second CER on whether this option beats both PET and PLA for Cedar Hollow. Name the two pieces of evidence you would need that this sheet does not give you, such as the return rate and the number of years the cups would last.