

2027-03-02 · 80 minutes

Research design ticket

Your goal: Submit a research design ticket that critiques a study and proposes a sound physiology design.

One product: Problem 2 research design ticket: study critique identifying variable/control/limitation flaws, plus a proposed sound design with hypothesis, variables, and planned measurements.

Question: Which exact study detail weakens a conclusion, and how will your own design address it?

Start the work

Prior variables work may help, but S1 and S2 supply a recovery route without assuming it is finished.

1. Read S1, the provided fictional physiology study summary.
2. Critique its variables, controls, measurement and limitations using E1/E2/R1.
3. Propose your own study using supported prior work or S2, and connect its rules to S1 flaws.
4. State a testable hypothesis, variables and planned measurements with honest protocol holds.
5. Submit the same research design ticket through the confirmed route and name its strongest improvement.

If the assignment is unavailable, save the record and ask for the route. Do not mark the weekly packet, prior work or official Project 2.1.1 complete because this original record is saved.

Words you will use

physiology

Study of how the body functions.

study design

The plan for a question, comparison, measurements and interpretation.

independent variable (IV)

The factor deliberately changed or compared.

dependent variable (DV)

The outcome observed or measured, whether or not it changes.

controlled variable

A condition intended to remain consistent across comparisons.

comparison group

The group used as a reference for another condition.

hypothesis

A tentative answer that can be tested with observations.

prediction

The pattern expected if an idea is supported.

limitation

A boundary on what a design or evidence can establish.

confounding

Two possible explanations varying together so their effects cannot be separated by that comparison.

sample size

The number of people or other independent units included in a study.

volunteer sample

People who choose to take part; they need not represent everyone.

order effect

A difference related to which condition comes first, rather than only the intended comparison.

measurement timing

When a reading is taken relative to the condition being compared.

heart rate / pulse

How fast the heart beats, expressed here in beats per minute.

posture

Body position, such as seated or standing.

protocol

The specified measurement procedure and study conditions.

reliability

Consistency of measurements when the same conditions are repeated.

critique

An evidence-based evaluation of strengths, weaknesses and limits.

causal conclusion

A claim that changing one factor produced an outcome.

generalization

Applying a finding beyond the people or conditions actually studied.

E1: variable and control criteria

Science Buddies distinguishes the compared factor, the measured outcome and conditions intended to stay consistent. These are IV, DV and controlled variables. Use a clear comparison and a defined unit.

If multiple factors differ between conditions, more than one explanation may fit a result. Honest measurements alone do not separate those explanations. A critique names the exact design detail, what it weakens and a way to fix it.

Controls can make results easier to interpret without making a study perfect. A larger sample cannot repair two conditions that were measured in different units. Count people separately from repeated readings on those same people.

E2: testability and physiology background

Science Buddies describes a hypothesis as a tentative, testable answer. Predictions connect a comparison to an outcome. A result could support or fail to support a prediction; a prediction is not a measured result.

MedlinePlus describes pulse as how fast the heart beats. Its overview identifies activity and sitting or standing among factors related to heart rate. This supports considering posture and recent activity in a design.

These sources give no music effect, caffeine effect or safe human protocol for this lesson. They do not supply a predicted numerical heart rate. Today is paper planning and critique only.

S1: fictional music and heart-rate study summary

Original fictional study for critique. No people were recruited and no measurements occurred. This is not a published study. Its procedural details are story facts, not instructions to follow.

Question: does listening to music lower heart rate compared with quiet? The fictional team describes eight volunteers from one club, with four in each group. Volunteers choose which group to join.

The music group is scheduled in the afternoon immediately after stair climbing. The quiet group is scheduled in the morning after seated rest. No common pre-measurement activity routine is specified.

The music group would have beats counted for 10 seconds. The quiet group would have beats counted for 60 seconds. The planned report compares those raw counts directly, without converting them to a common rate.

The team calls heart rate its independent variable because it would be measured. It proposes reporting that music lowers heart rate for everyone if the music group has a smaller count.

No counts, individual values, repeat readings, uncertainty estimates or completed results are supplied. Your task is to evaluate this design and proposed conclusion. Do not supply a missing result or decide that music works.

R1: annotate, critique and repair

First mark S1's intended comparison and outcome. Then underline a detail about controls and a detail limiting interpretation. Use four headings: variables, controls, measurement and scope.

For each critique, name an S1 detail and explain what it prevents you from concluding. Turn the flaw into a rule for your own plan. For example, if a condition differs between groups in a way that could explain the outcome, write a rule that holds it the same.

Look for what the summary cannot show. Ask who took part and how they were chosen, and whether any reading was repeated, then say what that allows you to conclude. Do not invent a required sample size or claim a particular bias direction.

Check the team's labels against E1: which factor is compared and which outcome is measured? Then list every way the two groups differ besides the intended comparison. Neither a lower count nor honesty can isolate a cause while other differences remain.

S2: your own physiology design route

Use your prior proposal if it has a defined measure and a supplied method. If it is missing, use this complete paper route: compare seated versus standing posture, with heart rate in beats per minute as the outcome.

Write your own testable prediction, including a difference or no detectable difference. Explain using E2 why posture is a reasonable question. No direction or numerical result is required.

Plan to compare the same people in this paper plan in both conditions, rather than different self-selected groups. This reduces differences between people in the comparison but does not remove timing or order issues.

Keep the counting method and a 60-second counting window the same. A count over one minute is expressed in beats per minute. Keep recent activity and setting consistent in the proposed plan.

List planned fields: coded participant, condition, condition order, reading window, beats per minute and protocol deviations. Use these as blank column labels only. Do not enter names, health histories or invented readings.

Have the teacher set the actual pulse technique, timing after each posture change, repeats, sample size and participation conditions. Explain the purpose of each unresolved choice; do not invent an approved stabilization interval.

Identify an order issue if everyone sits first. Propose varying which posture comes first across the people in this paper plan, subject to teacher review. That proposal does not by itself eliminate all order effects.

Link two of your own design rules to specific S1 flaws. Keep one limit that remains. Your proposal can be complete as a planning ticket while clearly naming details that still need approval. No human study may begin from this paper.

Recovery and optional extension

If absent or stuck, identify one uncontrolled S1 factor, explain one conclusion it weakens, and write one rule to fix it. Submit that clearly labeled recovery critique and rule through the confirmed route.

The recovery scaffold does not secretly replace the full ticket. Continue to the own hypothesis, variable and planned-measurement fields when able; otherwise label those portions unfinished for teacher recovery.

Optional extension: choose one S1 flaw from your own critique. Explain how the apparent conclusion might disappear or reverse after a fair comparison, without claiming a result.

Work through the reasoning step by step before explaining it. No values are supplied, so reversal is a possibility to test, not a demonstrated finding.

Warmups and conceptual self-check

Warmup one: name an S1 feature that could mislead a heart-rate conclusion even if nobody cheated.

Warmup two: explain why testing groups at different times creates another possible explanation. It does not automatically make every result false.

Conceptual self-check: a fictional claim says a supplement raised “energy,” but everyone took it just after lunch. The summary gives no separate comparison and no definition of energy. No actual published result is supplied.

Lunch and supplement exposure were not tested separately, so the summary cannot identify which factor explains an outcome. It does not establish that the sandwich caused it either. Define the outcome before planning measurements. Do not consume, give or withhold anything.

Original and official work checks

This record supplies S1 and a complete original planning route. It does not establish completion of a prior proposal, ER walkthrough, partner feedback or design revision. Retain those actual unit products and record any missing input.

If your teacher assigns the unit's peer-design critique, use an actual supplied design. If none is available, self-check with R1 and label that practice; do not invent a classmate's work or feedback.

Official Project 2.1.1 Scientific Research is the course activity behind this ticket. Its design-comparison resources, response sheet, association research and partner critique are broader than this original ticket.

The teacher must identify the assigned March 2 segment, critique format and stopping point. The weekly Study critique packet is not supplied here. Ask for what you need before completing these tasks.

Today is Tuesday, March 2, 2027. Follow the date and format on the linked assignment; no homework is due before this class.

No human intervention, exercise, pulse collection or substance use is authorized. Actual equipment, protocol, participation and privacy arrangements require teacher direction. A good paper critique does not approve a study.

M1: different-question model, paper-plane design

Original fictional planning model, with no flights or results. A team asks whether a wider paper wing changes flight distance. It plans wide wings indoors with one thrower and narrow wings outdoors with another.

Critique: wind exposure and thrower change with wing width. A longer flight would not isolate wing width. The dependent measure would be distance in metres, while wing width is the intended independent factor.

Repair: plan both wing conditions in the same setting with the same paper and release procedure. Use the same distance unit and repeat both conditions. Record weather changes instead of pretending they cannot occur.

Testable prediction: under those specified conditions, wider wings will travel farther. The prediction could fail if the comparison does not show that pattern. This is an untested plan, not a claim about actual flights.

Transfer the critique-detail → effect on the claim → design-rule structure to S1 and your own physiology proposal. The plane example supplies reasoning structure, not evidence about heart rate.

Try the decision

Using S1 and E1, which statement addresses the study's actual evidence limit?

- Check whether S1's conditions and counting windows match before linking a raw-count difference to music; repair any mismatch before explaining it.
- Honesty would make the smaller raw count proof that music lowers heart rate.

- Stair climbing caused every possible count difference, as proved by the activity difference alone.

Explain your choice using the reading. Discuss it or say it to yourself. This practice does not add another submission.

Your 80-minute flow

0–10 minutes	Answer both warmups and identify roles.
10–30 minutes	Annotate the fictional study and compare the different model.
30–50 minutes	Write the study-specific critique; use recovery scaffold if needed.
50–65 minutes	Draft own hypothesis, variables and planned measurements.
65–77 minutes	Check both ticket parts and submit/save the record.
77–80 minutes	Name the strongest design improvement on the same record.

Your response record

Use these labels on paper or in your document. The space below also works when this page is printed.

Warmup and study annotations

Answer both warmups using S1. Mark the intended comparison, outcome, one control issue and one scope limit in the summary.

Use the printed fictional details. Do not invent participant readings or a successful result.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.

Study-specific critique

Use variables, controls, measurement and scope as headings. For each, cite an S1 detail, explain what it weakens and write a rule to fix it.

Begin with what was compared versus measured. Recovery may start with one factor, one weakened conclusion and one rule; label unfinished parts.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.

Own hypothesis and variables

State your own physiology question and testable hypothesis. Label IV conditions, DV with unit and at least two controlled variables. Link two design rules to S1 flaws.

Use your prior supported proposal or the supplied S2 posture route. A difference or no-difference prediction is acceptable.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.

Planned measurements and limit that remains

Specify what would be recorded, its unit and common method/window. List blank recording columns, identify protocol decisions that need teacher review and explain one limit that remains.

Use S2 without collecting data. State why timing, repeats and participation choices need teacher review.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.

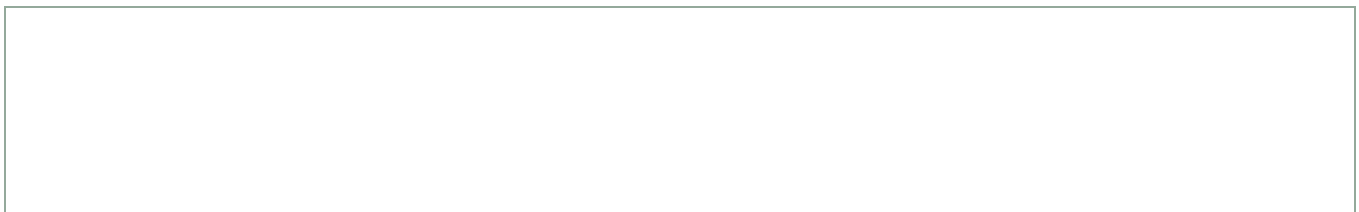


Check, submit and exit improvement

Check that both critique and own design are present. Complete the supplement/lunch self-check and name the most important improvement in your proposal. Keep all parts in the same ticket.

Save or submit through the confirmed route. Ask for missing official inputs; the practice decision is not a second submission.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.



Check your product

- My critique cites specific S1 design details rather than guessing the result.
- My own proposal states a hypothesis, IV, DV, controls and planned measurements.
- Two design rules respond to identified flaws, and a limit that remains is explicit.
- I keep fictional examples, actual prior work and official tasks still to do distinct.

Keep the limit: S1 and M1 are fictional teaching scenarios with no observations. A critique identifies design limits; it cannot establish a music or supplement effect, a safe human protocol or official completion.

Turn in your work

Submit the study critique and your own design as one Research design ticket through the linked BI assignment. Follow its format and deadline. Keep any recovery-only submission clearly labeled. After uploading, check that Schoology shows Submitted.

If the assignment is unavailable, save the record and ask for the route. Do not mark the weekly packet, prior work or official Project 2.1.1 complete because this original record is saved.

[Open this assignment in Schoology.](#)

Carry forward

Name the study detail, explain what it weakens, then turn it into a design rule.

Keep the critique and proposal together for the teacher-confirmed next task. Actual protocol and official resources remain separate. Which design change would address the limitation your critique identified?

Sources and resources

[Open today's page](#)

SB-VARS · What are Variables?

Science Buddies, original educational guide; inspected September 11, 2026

<https://www.sciencebuddies.org/science-fair-projects/science-fair/variables>

SB-HYP · Writing a Hypothesis for Your Science Fair Project

Science Buddies, original educational guide; inspected September 11, 2026

<https://www.sciencebuddies.org/science-fair-projects/science-fair/writing-a-hypothesis>

MED-VITAL · Vital Signs

MedlinePlus, National Library of Medicine; public summary inspected September 11, 2026

<https://medlineplus.gov/vitalsigns.html>