

## Engineering Laboratory Report Writing Project Advanced-1: Logical appeals (Claim-Data-Warrant)

### Learning Objectives

After completing this module, engineering instructors can develop teaching materials so that students should be able to

1. Describe why engineers' appeals should be logical (logos) and ethical (ethos).
2. Define the three parts of a logical appeal: claim, evidence, and warrant (reasoning).
3. Use the logical appeal when analyzing and interpreting lab data.

### Why should students care about rhetorical strategies when writing engineering lab reports?

Typically, the audience aims to learn a student's thoughts through reading lab data analysis and interpretation results. They want to read the student's main ideas or how the student applies technical meaning to the lab data. Therefore, lab report writers need to make their own points or claims based on the factual lab data as the primary source and supported by secondary sources (outside references).

### Opinion vs. Claim in engineering lab reports

- **No personal opinions:** The lab report audience is not interested in students' personal opinions about lab data. Opinions, which can be defined as views or judgments formed about something, are not necessarily based on "fact" or "knowledge." The following sentences from lab reports can be opinions, which technical audience is difficult to agree: "This lab was unsuccessful." "I think the lab data are reasonable." "In my understanding, sample A is better than sample B."
- **Make claims based on lab data-factual evidences:** In contrast, claims can "convince" your points or deliverables to the lab report audience who may or may not agree. Claims are statements about what is true or about what should be done. Therefore, good claims provide the main argument of a lab report. A claim must be specific and convincing; therefore, the writers' claims should be supported by evidence (lab data, existing theories, data/knowledge from outside sources, engineering principles, etc.), which the audience can trust. The following sentences from lab reports can be sound claims: "A 1045 steel sample is stronger than a 1020 steel sample because of its 20% higher yield strength and 15% higher ultimate tensile strength."

### Out of the three (logical, ethical, and emotional) appeals of argument, which one do engineers mostly use in report?

- **Use logical appeals:** Strong arguments have a balance of all three argumentative appeals: logical(logos), ethical(ethos), and emotional(pathos). However, engineers, typically, do not value emotional appeals because lab reports aim to deliver factual, credible, but impersonal technical information to the audience.

### Claim-Evidence-Warrant: three part of a logical appeal:

|                  | Claim  | Data (Evidence)   | Warrant (Reasoning)   |
|------------------|--|---|---|
| Definition       | An answer (or a finding) to the problem you defined or investigated.                   | Lab data used to support the claim.   | Connecting the claim (the writer's point) and the evidence (the lab data) logically using engineering principles.   |
| Example sentence | 1045 medium carbon steel is harder than 1008 low carbon steel at the room temperature. | The lab data from Table 1 show the average hardness of 1008 steel coupons is 85 HRB while that of 1045 steel is 99 HRB. | Addition of carbon as an alloying element in ferrous alloys can create local nonuniformity in the lattice, which makes plastic deformation more difficult by impeding dislocation motion [1]. |
| Differences      | The writer's understanding (or main idea) to present to the audience.                  | Original lab data as the primary sources, which you need to rely on when claiming.                                      | Logical connection between the claim and the evidence. Often, the secondary sources (other's data, ideas, and scholarship) can be used.   |

### Common mistakes by students

- Show student's feeling to strengthen the claims: "This lab is unsuccessful." "I am glad the system works!" "Data make sense." Note that engineers rarely use emotional appeals.
- Make claims without relevant evidence.
- Use of extreme (and subjective) adjectives to strengthen the claims: very, extremely, significantly, etc. Instead, use quantities to strengthen the claims ("the value was increased by 200%." "the average decreased more than half.")