Threats to Internal Validity

- **History**
  When an event occurs at the same time as treatment and changes participants' behavior, this event becomes an alternative explanation for the changes in participants' behavior (rather than treatment); thus, participants' "history" includes events other than treatment.

- **Maturation**
  Participants naturally change over time; these maturational changes, not treatment, may explain any changes in participants during the experiment.

- **Testing**
  Taking a test generally affects subsequent testing; thus, participants' performance on a measure at the end of the study may differ from an initial testing, not because of treatment but because they are familiar with the measure.

- **Instrumentation**
  Instruments used to measure participants' performance may change over time (e.g., observers may become bored or tired); thus, changes in participants' performance may not be due to treatment but to changes in the instruments used to measure performance.

- **Regression**
  Participants sometimes perform very well or very poorly on a measure because of chance factors (e.g., luck). These chance factors are not likely to be present in a second testing, so their scores will not be so extreme — the scores "regress to the mean." These regression effects, not the effect of treatment, may account for changes in participants' performance over time.

  Test score = true score + error (chance factors, etc.)
  One definition of an *unreliable* test or measure is that it measures with a lot of error. If people score very high or low on the test, it's possible that chance factors produced the extreme score. On a second testing, those chance factors are less likely to be present (otherwise they wouldn't be *chance*).

- **Selection**
  When differences exist between individuals in treatment and control groups at the start of the study, these differences become alternative explanations for any differences observed at the end of the study (rather than treatment).

- **Subject Attrition (Mortality)**
  When participants are lost from the study (attrition), the group equivalence formed at the start of the study may be destroyed; thus, differences between treatment and control groups at the end of the study may be due to differences in those who remained in each group rather than to the effects of treatment.

Threats to Internal Validity Important Points to Remember

- When there is no comparison group in the study, the following threats to internal validity must be considered:
    - history, maturation, testing, instrumentation, regression, subject mortality, selection

- When a comparison group is added, the following threats to internal validity must be considered:
    - selection, additive effects with selection

- Threats to internal validity that true experiments may not eliminate:
    - Contamination,
    - Experimenter expectancy effects, and
    - Novelty effects (including Hawthorne effect)

- Threats to **external** validity occur when treatment effects may not be generalized beyond the particular people, setting, treatment, and outcome of the experiment.
    - The best way to assess the external validity of findings is to replicate the experiment.