When teaching a novel concept or category, educators often use examples. Examples can be positive – something that belongs to the category – or negative – something that doesn’t belong to the category. Positive examples are commonly used, negative examples only rarely. Can use of negative examples improve learning?

Extant research is inconsistent, e.g.,
- Hammer, Hertz, Hochstein, & Weinshall (2009) found negative examples hinder learning.
- Namy & Clepper (2010) found no effect.

Limitations of previous research:
- Types of categories used and learning procedures have been highly variable.
- Studies rarely make an effort to approximate category learning in the classroom.
- Data analysis has not distinguished between sensitivity and bias.
- Theoretical accounts in many studies are only applicable for the specific type of category used in that study.
- Result is little useful guidance to educators.

To address previous limitations, we...
- Used educationally relevant categories.
- More realistic learning task.
- Examined sensitivity and bias separately.
- Interpreted results in terms of general-purpose models of category learning.

Positive Only
- Positive only = 6 examples from target category
- Positive dominant = 4 target examples, 2 non-target
- Negative dominant = 2 target examples, 4 non-target
- All learning examples labeled as target/non-target

Positive Dominant
- Positive dominant = 4 target examples, 2 non-target
- Negative dominant = 2 target examples, 4 non-target

Negative Dominant
- Positive only = 6 examples from target category
- Positive dominant = 4 target examples, 2 non-target
- Negative dominant = 2 target examples, 4 non-target

Participants:
- WWU students, N=53 to 111 per domain

Materials:
- Examples of several different categories from 6 subject domains:
  - Musical style
  - Writing style
  - Graphs of functions
  - Psychology concepts
  - Evergreen trees
  - Microorganisms

Procedure:
- One category from the domain chosen as “target”
- Learning phase:
  - 6 example items are shown.
  - Short discussion amongst participants about characteristics of target category.
  - 6 examples shown again.
- Testing phase:
  - 12 new examples shown (4 target).
  - Participants classify as target/non-target.

Discussion
- Effects of negative examples on sensitivity were inconsistent and small (significant for 3 out of 6 domains, overall $\eta^2=.032$).
- Effects of negative examples on bias were both more consistent and larger (significant for 5 out of 6 domains, overall $\eta^2=.086$).
- Helps to explain why previous studies only examining accuracy had conflicting results.
- Computer simulations using both an induction model of category learning and a prototype model also predict mostly bias effects.
- For educational purposes, negative examples may be most useful for influencing the ratio of misses to false positives.

References