Explanatory satisfaction and perceived/objective learning - Jan. 2021 (#56650)

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1) Have any data been collected for this study already?
No, no data have been collected for this study yet.

2) What's the main question being asked or hypothesis being tested in this study?
A. (Explanatorily relevant) perceived learning moderates the effect of irrelevant reductive information on explanatory satisfaction.
B. Objective learning is associated with satisfaction across a range of good/bad explanations.
C. Objective learning is not caused by satisfaction (i.e., objective learning is not better with irrelevant reductive information).

3) Describe the key dependent variable(s) specifying how they will be measured.
Measured for six explanations (first two explanations are to anchor participants to good/bad explanations and will not be analyzed):
A. Explanatory satisfaction: self-report, measured on a seven-point scale
B. Perceived (general) learning: self-report, measured on a seven-point scale
C. Perceived (explanatorily relevant) learning: self-report, measured on a seven-point scale

Measured for three explanations (third, fourth, and fifth from initial six):
D. Objective learning: participants prompted to recall two explanations (given the question as prompt) after a short distractor task; also given option to indicate “don’t remember anything at all”.

Recalled explanations will be compared to original explanations by the following steps: 1. Preprocess both explanations (tokenize documents, add part of speech details, remove stop words, and lemmatize words, using default functions in MATLAB’s text analytics toolbox); 2. Convert explanations to sequences of word vectors (using pretrained fastText word embeddings from MATLAB’s text analytics toolbox); 3. Calculate cosine similarity between centroids of each vector sequence. This results in a measure of “Recall Fidelity” ranging from 0 to 1 for each recalled explanation.

4) How many and which conditions will participants be assigned to?
Participants will each read four explanation types. Types cross explanation quality (good/circular) with reductive information (reductive/non-reductive), leading to four types: good/reductive, good/non-reductive, circular/reductive, circular/non-reductive.

The first two explanations presented will be good/reductive (best) and circular/non-reductive (worst). This will be followed by four additional explanations, one of each type. Types will be randomly assigned to six question-answer pairs in two domains (psychology and physics), so that each participant will read only one explanation of one type for a given question-answer pair.

5) Specify exactly which analyses you will conduct to examine the main question/hypothesis.
Note: all regression analyses will include random intercepts for participant and question-answer pair, the latter nested within domain. In all regression analyses, significance of interactions and fixed effects will be tested with likelihood ratio tests.

A. Mixed-effects regression predicting satisfaction rating with explanation quality, reductive information, and interaction as predictors. Prediction: reductive explanations more satisfying than non-reductive; good explanations more satisfying than circular explanations.
B. Candidate mediators: repeat above analysis with perceived explanatorily relevant learning and perceived general learning as dependent variables. Prediction: reductive explanations and good explanations lead to higher perceived learning.
C. Mediation model (using SEM in lavaan R package), testing whether the effect of explanation quality and reductive information (separate models for each) on satisfaction is mediated by perceived explanatorily relevant learning. We will estimate standardized model parameters and bias-corrected bootstrap confidence intervals. 95% CIs excluding 0 will be taken to indicate statistical significance.
D. Multiple mediation model, testing whether the effect of explanation quality/reductive information (separate models for each) on satisfaction is mediated by perceived explanatorily relevant learning more than perceived general learning (also controlling for the covariance between the potential mediators). We will test the contrast between the two specific indirect effects.
E. Mixed-effects regression (only on non-reductive explanations) predicting satisfaction rating with recall fidelity as a predictor. Prediction: recall fidelity positively associated with satisfaction.
F. Repeat E. on full dataset with moderators, testing whether recall fidelity is differentially associated with satisfaction based on explanation quality or reductive information. Follow up significant interactions (recall fidelity x quality, recall fidelity x reductive information) with tests of recall fidelity within conditions.
G. Mixed-effects regression predicting satisfaction rating with “don’t remember anything” selection (yes/no) as a predictor. Prediction: remembering

nothing associated with lower satisfaction, compared to remembering something.
H. Mixed-effects regression predicting recall fidelity with explanation quality, reductive information, and interaction as predictors. Prediction: no effect of reductive information, or effect goes opposite satisfaction effect (e.g., better recall for non-reductive explanations). We will follow-up a non-significant effect with an equivalent Bayesian regression model (with default weakly uninformative priors provided in the R package rstanarm), allowing us to calculate Bayes factors and quantify evidence for the null hypothesis (model coefficients = 0).

6) Describe exactly how outliers will be defined and handled, and your precise rule(s) for excluding observations.
Participants will complete a memory check: select a question that they had previously rated from a list of 3 distractors. Participants also must correctly solve at least four out of a series of five simple addition problems. Participants must pass these checks to be included in analyses. (We will analyze data both with and without the second exclusion criterion, as a mental math task may index attention but also numeracy and working memory).

7) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.
We will recruit 550 participants from Prolific, with the following qualifications: approval rate >= 95%, number of tasks approved >= 100, current location = US. Our target sample size is 520 after exclusions. If >30 participants are excluded in the first round of data collection, we will collect more data in sets of 40 until we reach or exceed 520.

8) Anything else you would like to pre-register? (e.g., secondary analyses, variables collected for exploratory purposes, unusual analyses planned?)
For reductive explanations we will recalculate recall fidelity, where the recalled explanation is compared to the original explanation with reductive information removed. We will repeat all analyses with this revised measure of recall fidelity. This is to ensure that recalled explanations are not unfairly penalized for failing to include reductive information.