



CHANGING THE WAY WE LIVE

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- In order to solve story problems, learners must comprehend problem text (Kintsch & Greeno, 1985)
- Successful problem-solvers coordinate:
  - **Surface model:** Literal text
  - **Textbase:** Info arranged in propositional form
  - **Situation model:** Understanding of actions and relationships
  - **Problem model:** Formal equations and operands
- The *readability level* and *topic* of problems may interact with cognitive and non-cognitive factors













# Readability: Coh-Metrix

- Provides 108 quantitative measures of (McNamara et al., in-press):
  - **Surface code**: Difficulty of words and syntax
  - **Textbase**: Ease

# Topic Incidence - LiWC

- Dictionary-based text analysis program (Pennebaker, Chung, Ireland, Gonzales, & Booth, 2007)
- The topic of a story problem was determined by whether it had at







# Study 1: Results

- **Moving from 3 to 4 sentences** reduced corrects by an estimated 4.4% ( $p < .01$ ), increased incorrects by an estimated 2.75% ( $p < .05$ ) and increased hints by an estimated 1.4% ( $p < .01$ )
  - Other measures of length (DESWC, DESSL) sometimes significant as well.
- **Third person singular pronouns** (3PS; he/she/it) associated with more correct answers ( $p < .05$ ) and fewer hints ( $p < .01$ )
  - Changing a problem with no 3PS to a problem that has 10% of its words as 3PS should increase correct answers by an estimated 3.6%
- Increasing the **standard deviation of the amount of semantic overlap between sentences** significantly decreased correct answers
  - Moving from SD = 0 to SD = 0.3 would decrease corrects by 4%
- Using **concrete words** significantly reduced hints (*low schools only*)
- Using **words with multiple meanings** (word polysemy) significantly decreased corrects and increased incorrects (*expression-writing only*)
  - Each additional meaning decreases corrects by 4.6% and increases incorrects by 4.6%



# Study 1: Results

- Words involving **social processes** decrease incorrect answers ( $p < .05$ ) by an estimated 2.09%





# Study 1: Replication

- Eighth grade students solving  $N = 60$  MATHia problems on linear functions
- Coh-Metrix:
  - Results replicate, except **length** (limited problem set) and **word polysemy**
- LIWC:
  - Not enough non























