

EXPLORING CONNECTIONS BETWEEN STORY PROBLEM TOPICS AND PROBLEM SOLVING: IS WORK HARD AND SOCIALIZING EASY?

Virginia Clinton
Univ. of Wisconsin-Madison
[e-mail](#)

Candace Walkington
Southern Methodist University
cwalkington@smu.edu

Elizabeth Howell
Southern Methodist University
ehowell@smu.edu

A mathematics story problem's topic may influence how difficult it is to solve. For example, a student is more likely to accurately solve a story problem with a topic relevant his or her interests (e.g., a "personalized" scenario on playing video games) than a matched story problem that is not (Walkington, in press). Nathan, Kintch, and Young (1992) proposed a model of story problem solving where learners construct a mental representation of the actions and relationships in the problem, a *situation model*, which is then connected with formal mathematical operations. Problems with relevant and familiar topics, like personalized stories, may promote situation model construction by allowing new mathematics concepts to be connected to prior experience, with key concepts becoming more *grounded* (Goldstone & Son, 2005). Problems with relevant topics may also elicit *interest* in the content to be learned (Walkington, in press). However, individual-level personalization may not be feasible for a heterogeneous classroom (Hidi, 1990). Therefore, we identify topics that support problem-solving across a diverse sample of students.

We used LIWC, a dictionary-based computerized text analysis program that counts words in many categories. LIWC measured problem topic by determining the percentage of the words in a story problem that belong to different categories (e.g., social processes and work). We analyzed a dataset from a diverse array of secondary students ($N = 3394$) solving 282 traditional story problems on linear functions in Cognitive Tutor Algebra (CTA). CTA is an intelligent tutoring system that provides adaptive hints and logs student answers (Morgan & Ritter, 2002). After controlling for aspects of the problem's mathematical structure, we tested for associations between the topic of the story problem, accuracy, and hints requested. Words related to social processes (e.g., talk, husband, friend) were positively associated with correct answers ($\beta = .29, p < .001$) and negatively associated with hint-seeking ($\beta = -.04, p = .03$). In contrast, words related to work (e.g., job, business, profit) were negatively associated with correct answers ($\beta = -.26, p < .001$) and positively associated with hint seeking ($\beta = .29, p < .001$). Also, words related to food (e.g., restaurant, pizza, cook) were negatively associated with hint-seeking ($\beta = -0.10, p = .03$). Students' situation models appeared to be facilitated if the problem was about social processes and food and hindered if the problem was about work. Future research may illuminate whether this effect is due to increased familiarity with the topic or activated interest in the story problem.

References

- Goldstone, R., & Son, J. (2005). The transfer of scientific principles using concrete and idealized simulations. *Journal of the Learning Sciences, 14*(1), 69-110.
- Hidi, S. (1990). Interest and its contribution as a mental resource for learning. *Review of Educational Research, 60*(4), 549-571.
- Hidi, S., & Renninger, K. (2006). The four-phase model of interest development. *Educational Psychologist, 41*(2), 111-127.
- Morgan, P., & Ritter, S. (2002). *An experimental study of the effects of Cognitive Tutor Algebra I on student knowledge and attitude*. Pittsburgh, PA: Carnegie Learning, Inc.
- Nathan, M., Kintsch, W., & Young, E. (1992). A theory of algebra-word-problem comprehension and its implications for the design of learning environments. *Cognition and Instruction, 9*(4), 329-389.
- Walkington, C. (in press). Using learning technologies to personalize instruction to student interests: The impact of relevant contexts on performance and learning outcomes. *Journal of Educational Psychology*.